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LIBRO DE APLICACIONES Y USABILIDAD DE LA TELEVISIÓN DIGITAL INTERACTIVA

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PREFACIO ·

PREFÁCIO ·

PREFACE ·

Las jAUTI2019 VIII Jornadas Iberoamericanas sobre Aplicaciones y Usabilidad de la Televisión Digital Interactiva, se realizaron durante WebMedia 2019 XXV Simpósio Brasilero de Sistemas Multimedia y Web, del 29 de Octubre al 1 de Noviembre en Río de Janeiro (Brasil). jAUTI2019 es la octava edición de un evento científico organizado anualmente por la RedAUTI Red Temática de Aplicaciones y Usabilidad de la Televisión Digital Interactiva, formada por más de 250 investigadores pertenecientes a 32 universidades de España, Portugal y once países latinoamericanos (Argentina, Brasil, Colombia, Costa Rica, Cuba, Chile, Ecuador, Guatemala, Perú, Uruguay, Venezuela).

Este libro reúne los trabajos aceptados en el evento el cual tiene como objetivo presentar los esfuerzos de investigación de la academia, la industria o las agencias gubernamentales en el diseño, desarrollo y usabilidad de aplicaciones para la Televisión Digital Interactiva (TVDi) y tecnologías relacionadas.

A jAUTI 2019 - VIII Conferência Ibero-Americana de Aplicações e Usabilidade da Televisão Digital Interativa, foi realizada durante o WebMedia 2019 - XXV Simpósio Brasileiro de Multimídia e Sistemas Web, de 29 de outubro à 1 de novembro no Rio de Janeiro (Brasil). O jAUTI 2019 é a oitava edição de um evento científico organizado anualmente pela Rede Temática de Aplicações e Usabilidade da Televisão Digital Interativa (RedAUTI), formada por mais de 250 pesquisadores de 32 universidades de Espanha, Portugal e onze países da América Latina (Argentina, Brasil, Colômbia, Costa Rica, Cuba, Chile, Equador, Guatemala, Peru, Uruguai, Venezuela).

Este livro reúne os trabalhos aceitos no evento, que visa apresentar os esforços de pesquisa da academia, da indústria ou de agências governamentais no projeto, desenvolvimento e usabilidade de aplicativos para Televisão Digital Interativa (TVDi) e tecnologias relacionadas

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The jAUTI 2019 VIII Ibero-American Conference on Applications and Usability of Interactive Digital Television, were held during WebMedia 2019 XXV Brazilian Symposium on Multimedia and Web Systems, from October 29 to November 1 in Rio de Janeiro (Brazil). jAUTI 2019 is the eighth edition of a scientific event organized annually by the RedAUTI Thematic Network of Applications and Usability of Interactive Digital Television, formed by more than 250 researchers from 32 universities in Spain, Portugal and eleven Latin American countries (Argentina, Brazil, Colombia, Costa Rica, Cuba, Chile, Ecuador, Guatemala, Peru, Uruguay, Venezuela).

This book gathers the works accepted in the event which aims to present the research efforts of the academy, industry or government agencies in the design, development and usability of applications for Interactive Digital Television (TVDi) and related technologies.

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ÍNDICE ·

ÍNDICE ·

INDEX ·

Contextos de Aplicación para la TVDi ·

· Contextos de aplicação para TVDi ·

· Contexts of Application of the IDTV ·

Transmedia y Crossmedia ·

Transmedia e Crossmedia ·

Transmedia and Crossmedia ·

Diseño y Desarrollo ·

Projeto e desenvolvimento ·

Design and Development ·

Interfaces e Interacción ·
Interfaces e interação ·
Interfaces and Interaction ·

Testing, Usabilidad y Experiencias de Usuario ·
Teste, Usabilidade e Experiência do Usuário ·
Testing, Usability and User Experience ·

Contextos de Aplicación para la TVDi ·

Contextos de aplicação para TVDi ·

Contexts of Application of the IDTV ·

Proceso de implementación de un software de capacitación en Televisión Digital Interactiva para gestión de riesgos y eventos provocados por fenómenos naturales

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Abstract. La aplicación "Guía de Gestión de Riesgos de Desastres" para Televisión Digital interactiva (TVDi) utiliza una metodología de desarrollo de software incremental, basada en entregas constantes y avances progresivos. En este artículo se presenta el proceso de desarrollo, implementación, pruebas y mejoras de dicha aplicación, que incluye tres Objetos de Aprendizaje (OAs): a) Introducción a la gestión de riesgos de desastres, b) Plan familiar de emergencias y medidas de autoprotección, c) Mapa de riesgos, recursos y capacidades; y una opción adicional con información geográfica sobre alertas de emergencia en tiempo real, obtenida desde un servidor de mapas. Cada OA aborda temas informativos y educativos, además de una auto-evaluación para el televidente. La aplicación ha sido desarrollada en Ginga Ncl-Lua, y las pruebas se han realizado en dos ambientes: 1) simulación con emuladores Ginga-NCL y 2) utilizando el equipo receptor Set Top Box EiTV Smartbox. En las pruebas se enfocan principalmente los procesos realizados para identificar los formatos de audio y video soportados en los dos ambientes, las opciones más adecuadas para integrar texto en las interfaces y la solución de problemas encontrados durante el proceso de implementación.

Keywords: Ginga, televisión digital, NCL, LUA, interactividad, Set Top Box, ISDBT-TB, Canal de retorno, Composer, usabilidad, TDT, TVDi.

1 Introducción

La cantidad de equipos de televisión en los hogares ecuatorianos se ha venido incrementando de forma paulatina, aunque en relación a la cantidad de teléfonos celulares entre ellos los teléfonos inteligentes, tiene incluso un mayor incremento. Sin embargo, las cifras de penetración de internet, por estos últimos siguen siendo bajas. Según documentos estadísticos de la Agencia de Regulación y Control de las Telecomunicaciones emitido recientemente [1] el número de líneas con internet móvil no llega al 50% de las líneas activas en alguna de las operadoras con mayor representación, incluso podría estar alrededor del 35%. En este mismo informe se presenta que cerca a los 10 millones de cuentas de acceso a Internet móvil existen al 2018, pero en

ningún caso se diferencia las cuentas que tienen acceso a whatsapp solamente o servicios limitados. Este dato podría ser diferenciador para identificar la posibilidad de brindar alertas al ciudadano por medio de uso de esta tecnología. Por otro lado, no sucede lo mismo con la penetración de televisión en Ecuador. Según estadísticas del año 2015 [2] ya para entonces supera 86% a nivel de toda la población. Finalmente en caso de un eventual catástrofe, como fue el caso de eventos donde se pierden comunicaciones, se intuye la ventaja que significa levantar antenas de televisión vs las antenas para telefonía celular. El área de cobertura con una antena de televisión es totalmente mayor al área de cobertura de una antena celular. Por todo ello buscar soluciones de alertas a ciudadanos en televisión es de interés en nuestro país. Si a eso sumamos que la filosofía de televisión digital terrestre, tiene la filosofía de televisión abierta, en el sentido de no necesitar una suscripción para recibir el servicio. Entonces la televisión digital terrestre abre un abanico de posibilidades para la creación de soluciones en alerta temprana para el ciudadano.

La televisión digital interactiva (TVDi) mejora la calidad de audio y video, a través de un decodificador, la televisión digital permitirá a los espectadores interactuar con varios programas y acceder a numerosos servicios e información. MINTEL presentó el Plan maestro de transición a la TDT 2018-2021, que contiene una hoja de ruta clara y precisa para la evolución de esta nueva tecnología de transmisión de televisión. Hay una transición progresiva que comienza en las grandes ciudades.

En este artículo se presenta una implementación trabajada para TVDi con la supervisión de los contenidos por parte del Servicio Nacional de Gestión de Riesgos y Emergencias. Describe mejoras respecto a la aplicación interactiva y el uso de objetos de aprendizaje orientados y adaptados al formato de televisión digital y, se genera un curso básico de gestión de riesgos, utilizando una metodología de diseño y adaptación objetos de aprendizaje con contenidos validados por el SNGRE, se mejora el diseño de las interfaces al integrar personal especializado en el área, se utiliza una metodología de desarrollo que permite realizar constantes validaciones y optimización de la aplicación. Finalmente, se realizan pruebas de usabilidad, que permiten analizar la facilidad con la que el usuario puede realizar las tareas y aplicar correcciones a las deficiencias encontradas.

1.1 Implementaciones de TDT

Entre algunas implementaciones, a nivel local desde el año 2011, se realizó la primera incursión en el área de Televisión Digital, con un proyecto que evidenció el uso de la televisión digital como proveedora de contenidos interactivos manejados como herramienta complementaria de la educación inicial mediante un software educativo multimedia, cuyo contenido se trabajó con personal especializado y fue validado con niños de escolarización pre-básica y sus educadores [3].

En el año 2012, se desarrolló una aplicación interactiva utilizando el lenguaje Ginga, para presentación de noticias provenientes de canales RSS [4], el sistema además permite al usuario seleccionar temas de interés los cuáles se almacenarán en su perfil.

En el año 2018 se definió un esquema general de envío de alertas de emergencia utilizando el protocolo EWBS [5], junto con la alerta, se realiza la emisión de conte-

nidos interactivos de apoyo (a través del canal de televisión), mediante una aplicación desarrollada en el lenguaje GINGA-NCL, que se trasmite una vez activada la alerta. Estos contenidos permitirán a la población obtener información útil y actualizada que le ayude a tomar decisiones respecto a eventos ocasionados por fenómenos naturales.

1.2 Ventajas y Desventajas de Implementaciones en GINGA y LUA

En los principales sistemas terrestres de Televisión Digital (TVD) como el middleware brasileño Ginga admite aplicaciones declarativas (a través de su entorno declarativo Ginga NCL) y aplicaciones procesales (a través de su ejecución o entorno de procesamiento, Ginga-J) [6]. Ginga-NCL es un subsistema lógico, responsable del procesamiento y presentación de documentos NCL. "El lenguaje de programación NCL (Nested Context Language) ha sido desarrollado por PUC-Rio para facilitar las especificaciones de interactividad, sincronización espacio-tiempo entre objetos de medios, adaptabilidad, soporte de múltiples dispositivos y soporte de programas interactivos en vivo" [4]. Por otro lado, Ginga-J es el subsistema de middleware encargado de definir las Interfaces del programa de aplicación Java (API), contenido, formatos de datos, además de protocolos a nivel de la aplicación [7].

Tabla 1. Propiedades de las arquitecturas soportadas por el middleware Ginga

Ginga-NCL	Ginga-J
Lenguaje declarativo.	Lenguaje Procesal.
Puede hacer uso de lenguajes procesales como LUA para la implementación de la lógica de negocio por ejemplo.	Puede hacer uso de elementos declarativos, para contenidos textuales o estructuras gráficas.
Código abierto con documentación existente.	Se encuentra en desarrollo.
Al ser declarativo sigue un alto nivel de abstracción. "una aplicación NCL solo define cómo se estructuran y relacionan los objetos multimedia en el tiempo y el espacio" [8].	Bajo nivel de abstracción en la codificación. Se deben implementar los procedimientos y presentaciones en pantalla.
El desarrollador proporciona un conjunto de tareas que deben realizarse, sin preocuparse por los detalles de intérprete o compilador debido a que la máquina virtual se encarga de ese procesamiento [8].	"El desarrollador tiene más poder sobre el código y le dice a cada paso qué hacer" [8]. Provee así un entorno de programación más versátil.
NCL permite el uso y manipulación de audios, videos, contenido html entre otros elementos multimedia, mediante la asignación de valores a los atributos de los diversos elementos que hacen parte del lenguaje declarativo.	Compuesto por API (interfaz de programación de aplicaciones) que tiene como objetivo proporcionar las funcionalidades necesarias para la implementación de aplicaciones utilizadas en TV digital. Con él, es posible manipular videos, audios, textos e incluso protocolos de acceso [9]

Dependiendo de la funcionalidad requerida en el diseño de cada aplicación, un paradigma será más apropiado que el otro [8], además, una aplicación Ginga no necesita ser puramente declarativo o procesal. Las aplicaciones declarativas a menudo hacen uso de scripts Lua, que es un lenguaje de naturaleza procesal. Además, una aplicación declarativa puede hacer referencia a un JavaTV Xlet incorporado. Del mismo modo, una solicitud de procedimiento puede hacer referencia a contenido declarativo, como contenido gráfico, o puede construir e iniciar la presentación de declaraciones contenido. Por lo tanto, cualquier tipo de aplicación Ginga puede hacer uso entornos de aplicación [7].

En [4] se lleva a cabo un estudio comparativo entre las dos alternativas de implementación para aplicaciones de televisión digital interactiva soportadas por el middleware Ginga, dicho estudio menciona que Ginga-J se encuentra en desarrollo y provee escaso soporte para los desarrolladores, por lo que recomienda la implementación de las aplicaciones bajo Ginga-NCL y LUA; también menciona las ventajas que brinda Ginga-NCL en la usabilidad de una aplicación para la televisión, relacionando la usabilidad de una aplicación al éxito o fracaso de la tecnología de TVDi.

La

Tabla ***1*** muestra un resumen de las ventajas y desventajas de las arquitecturas Ginga-NCL y Ginga-J según lo descrito en el estudio de [8] y la experiencia de implementación detallada en el presente artículo.

1.3 Objetos de Aprendizaje

El apoyo de las tecnologías ha permitido innovar en metodologías y recursos que fortalezcan los procesos educativos. Uno de ellos los Objetos de Aprendizaje, éste término fue nombrado por primera vez en 1992 por Wayne, quien asoció los bloques LEGO con bloques de aprendizaje normalizados, con fines de reutilización en procesos educativos [10]; El concepto de OA u Objeto Virtual de Aprendizaje (OVA), no es un concepto unificado debido a que "no existe un consenso en la definición de objetos de aprendizaje. La idea básica permite una amplia variedad de interpretaciones" [11], sin embargo a nivel internacional y con un concepto más estructurado se define a un Objeto de Aprendizaje como cualquier entidad digital o no digital que puede ser usada, re-usada o referenciada para el aprendizaje soportado en tecnología [12].

Los objetos de aprendizaje deben cumplir con características básicas que lo acrediten como tal, sin embargo [13] afirma que la reusabilidad y granularidad representan "las dos propiedades más importantes de los objetos de aprendizaje". El concepto de granularidad hace referencia a resaltar una concepción de objetos como pequeñas unidades, que pueden ser acopladas y/o adicionadas de diversas maneras, mientras que [14] establecen que "la reusabilidad es en gran parte una función del grado de granularidad de los objetos". La reusabilidad del objeto de aprendizaje va a depender en gran medida del grado de granularidad del recurso.

2 Dificultades y aciertos desarrollando para TDT

2.1 Diseño de OAS

El diseño de material sobre OA se convierte en un desafío, ya que no solo deben cumplir con abarcar la temática de la forma clara, sino además cumplir con características propias de los objetos de aprendizaje [12]. En relación al diseño de un objeto de aprendizaje, según [13] implica el trabajo coordinado de diferentes actores, que partiendo de un conocimiento interdisciplinario, desarrollan componentes técnicos, académicos y metodológicos, con el fin de hacer un Objeto de Aprendizaje coherente y sobre todo útil para el alcance de los objetivos de aprendizaje por parte del estudiante.

2.2 Usabilidad vs Limitaciones en TDT

Las aplicaciones para Televisión Digital Interactiva (TVDi) tienen requerimientos diferentes a los del software de otras plataformas tradicionales [15]. Las principales diferencias se presentan en el uso del control remoto en lugar del ratón y teclado o las pantallas táctiles en el caso de las aplicaciones móviles. Una aplicación para la televisión debe adaptar sus interfaces y funcionalidades a las ofrecidas por un control remoto, considerando la reducción de la resolución en pantalla, que hace que los elementos multimedia sean más grandes y la omisión casi obligatoria de elementos como botones tipo radio, barras de scroll o menús jerárquicos; y las limitaciones de movilidad propias del uso de un control remoto, que no puede imitar el movimiento de un ratón.

Además de las limitaciones en el uso de recursos y tamaño de la aplicación para ser transmitida junto con el contenido televisivo en un transport stream en TVD. Debido a estas limitaciones las aplicaciones para la televisión digital interactiva tienden a ser aplicaciones sencillas sin mayor escalabilidad de contenido y con un alto grado de usabilidad [15].

2.3 Buscando la mejor implementación de GINGA y LUA en TDT

El proceso de implementación se basó en la metodología de desarrollo de software incremental en el que se contempló un es el ciclo de vida de desarrollo software basado en incrementos y entregas continuas de funcionalidades que tienen asignada una prioridad basado en plan de desarrollo del proyecto, la mayoría de incremento cuenta con fases propias de diseño, codificación y pruebas.

La aplicación para televisión digital interactiva “Guía de Gestión de Riesgos de Desastres” se implementó, principalmente en Ginga - NCL 3.0 bajo el perfil EDTV, desarrollando en este lenguaje declarativo las interfaces gráficas correspondientes a los tres objetos de aprendizaje que hacen parte de la aplicación. Mientras que la información georeferenciada obtenida en tiempo real desde un servidor de mapas, que complementa la funcionalidad de la aplicación, se desarrolló en el lenguaje de programación Lua, el cual permite que el televidente sea receptor de información por medio de eventos de clase TCP que realizan peticiones http al servidor para mostrar el resultado procesado en la pantalla del televisor.

Por otro lado, para el desarrollo en el lenguaje declarativo NCL se destaca la utilidad de la herramienta NCL Composer [16] que permite obtener una mejor comprensión de la estructura de la aplicación, mediante la vista gráfica de la estructura de la aplicación (Fig. 1). Esto suaviza el inconveniente pues NCL, al ser un lenguaje declarativo basado en XML, tiende a generar muchas líneas de código y tornarse complejo debido a las referencias a elementos que se ubican en diferentes zonas del documento NCL.

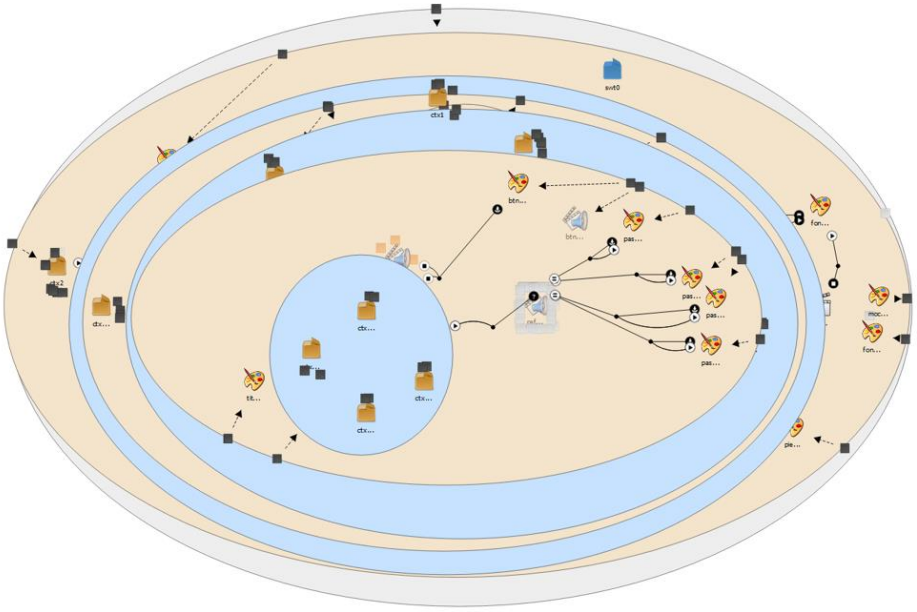

Fig. 1. Vista estructural de la aplicación en NCL Composer

La Fig. 1 muestra la vista estructural de la aplicación desarrollada en NCL en la que se visualizan los links que describen acciones y eventos de los elementos multimedia, también se visualizan contextos que contienen elementos media, contextos, switch, entre otros. Un elemento "switch" permite que mediante reglas lógicas booleanas inicie uno u otro contexto interno, esta funcionalidad del lenguaje NCL se ha usado dentro de la aplicación para la elección de opciones de los diversos menús que se pueden encontrar en la aplicación.

Parte fundamental de este artículo es presentar las pruebas realizadas que detallan los resultados según el ambiente de ejecución de la aplicación ya sea en las herramientas emuladoras como máquinas virtuales, Ginga4Windows, o en el Set Top Box EiTV y también depende de la funcionalidad evaluada. En la Tabla 2 se describen algunos de los resultados funcionales de la aplicación "Guía de Gestión de Riesgos de Desastres" para cada uno de los ambientes probados.

Tabla 2. Prueba de funcionalidades en tres ambientes de ejecución

Funcionalidad	*Ginga4Windows* y Ginga Máquina Virtual	*Set top box* EiTV smartbox	Soluciones implementadas
Teclas del control remoto	La tecla "OK" al ser presionada setea la variable *service.currentFocus* y asigna valor a la propiedad focusSrc, posteriormente desselecciona el elemento *media*. Las teclas back, info y numeros (0-9) se reconocen correctamente.	La tecla "OK" al ser presionada setea la variable *service.currentFocus* y asigna valor a la propiedad focusSrc y el elemento *media* queda seleccionado. Las teclas back, info y numeros (0-9) se reconocen correctamente.	Se establece un *link "onSelectionStopStartSet_var"* para desactivar, activar y ubicar nuevamente el elemento seleccionado permitiendo la navegación sobre otras opciones del menú. Las teclas back, info y numeros (0-9) realizan funciones propias del televisor y no se reconocen las acciones programadas por la aplicación.
Regresar a la pantalla anterior	La funcionalidad de regresar a la pantalla anterior termina el contexto actual, y envía una acción start al contexto padre correspondiente	La funcionalidad de regresar a la pantalla anterior termina el contexto actual, y no inicia el contexto anterior debido a que los atributos del contexto cerrado continúan cargados en memoria.	Adicionalmente se establecen eventos de tipo *stop* a elementos switch y contextos internos y se re-establecen los atributos de los elementos a los valores asignados antes del inicio del contexto a cerrar.
Reproducción de audios	Cualquier formato de audio se reproduce normalmente dentro de la aplicación	El formato de audio mp3 no se reproduce en la aplicación, sin importar qué atributo se le asigne al elemento media que contiene el audio.	Los audios de la aplicación fueron convertidos a formato mp2, ya que éste y otros como el formato wav se reproducen correctamente en el set top box EiTV.
Reproducción de videos	Los videos en formato mp4 se reproducen con normalidad y se aplica correctamente el atributo de redimensionamiento.	Los videos en formato mp4 se reproducen pero el atributo de redimensionamiento no se aplica cuando el video tiene una duración menor o igual a cuatro segundos.	Se estableció una duración mayor para el video que la aplicación incluye.
Textos en archivos planos	Los textos con caracteres especiales como tildes no se visualizan correctamente	Los textos con caracteres especiales como tildes se visualizan correctamente, mos-	Al obtener un resultado favorable sobre el stb no se considera configurar la codificación en los emuladores de GINGA.

		trando en el televisor un texto legible.	
Contenido html	El contenido html se visualiza correctamente con tiempo de carga (2-5 seg.), pero al cargar varias veces el contenido la aplicación tiende a colgarse.	Luego de un tiempo considerable de carga (5-10 seg.) el contenido html se visualiza correctamente, pero al cargar una segunda vez el contenido la aplicación tiende a colgarse o cerrarse.	Se utilizaron archivos en texto plano asignando propiedades de color y tipo de letra.
Atributos de elementos <media> en NCL	Los valores se asignan correctamente a los atributos de un elemento *media.*	Atributo *type*: cuando se asigna un valor a este campo, como por ejemplo en elementos de audio mp2 e imágenes png o jpg, los elementos no llegan a mostrarse en pantalla	Atributos como el caso de *type* no necesitan tener un valor asignado para la presentación de los elementos multimedia.
Carga de elementos NCL	Tiempo de carga muy rápido, en cuestión de milisegundos para contenido (texto, audio, video).	Tiempo de carga rápido, en cuestión de milisegundos y no más de 3 segundos para contenido (texto, audio, video)	El tiempo de carga no provoca molestias en los televidentes (según pruebas de usabilidad)
Trasmisión televisiva como un elemento *media*	Un elemento media con el atributo src="sbtvd-ts://" hace referencia a la transmisión de señal digital en directo que recibe el set top box. En primera instancia el media recibe correctamente las propiedades de redimensionamiento, stop y start, pero no se asignan los atributos de sonido, duración y pausa.		
Asignación de atributos a elementos *media* LUA	En el emulador Ginga4Windows los atributos no se envian correctamente desde NCL al script LUA	Los atributos y funcionalidades programadas en LUA se ven reflejadas correctamente en la aplicación al igual que el paso parámetros entre los lenguajes, el resultado también es correcto al ejecutar la aplicación en la máquina virtual Ginga	
Redimensionamiento de imágenes en televisores con pantallas de diferente tamaño	Los elementos de tipo imagen cargados mediante LUA no se redimensionan correctamente en los emuladores	Las imágenes tanto de LUA como NCL se ajustan correctamente al tamaño de pantalla en el que se ejecute la aplicación.	La aplicación muestra correctamente la interfaz en un ambiente real, como lo es un stb, por lo que los ajustes no son necesarios

Adicionalmente se realizan pruebas de transmisión de aplicaciones GINGA mediante una trama TS (Transport Stream) en un en la señal digital televisiva, obteniendo resultados preliminares, que se ven afectados por el tamaño de la aplicación.

3 Resultados en software obtenido

El esquema general de la aplicación es el siguiente:

Opción 1: Introducción a la Gestión de Riesgos de Desastres
- Reseña Histórica
- Factores de riesgos de desastres
- Actividades

Opción 2: Plan Familiar de Emergencias y Medidas de Autoprotección
- Terminología básica de gestión de riesgos
- Plan Familiar de emergencias
- Medidas de autoprotección
- Juega y aprende

Opción 3: Mapa de riesgos, recursos y capacidades
- Mapa de riesgos
- Acciones y responsables en el Plan Comunitario
- Juega y aprende

Opción 4: Avisos de alertas en vivo

A medida que se ha avanzado en el proceso de implementación, se han realizado pruebas de los diferentes elementos que contiene la aplicación. En primer lugar se realizaron pruebas sobre dos programas de software instalados en una PC: el emulador Ginga4Windows y la máquina virtual de GINGA sobre Ubuntu. Una vez que la ejecución en los entornos de simulación resultó exitosa, se procedió a la ejecución en el equipo receptor Set Top Box EiTV. Durante este proceso se evaluaron las funcionalidades, tiempos de carga y resolución del contenido multimedia para su posterior mejora o corrección. Estas actividades fueron necesarias debido a que el middleware GINGA resulta ser muy variable en ese contexto; es decir, aquellas funcionalidades que son exitosas en el emulador GINGA sobre una PC, no siempre son totalmente funcionales en un entorno más real con el uso de equipo receptores.

En las Fig. 2 y Fig. 3, se puede observar interfaces de la aplicación.

4 Conclusiones

La implementación de aplicaciones para TVDi tiene grandes limitaciones que podrían verse como inconvenientes cuando se lo comparan con otros lenguajes. Sin embargo, la principal ventaja de esta tecnología es poder llegar a la mayor cantidad de ciudadanos que cuenten con un equipo de televisión y que con la transición planteada desde el gobierno nacional, deberán evolucionar a equipos de TDT. El comprender que la transmisión de aplicaciones por aire permitiría que todos estos televidentes tengan acceso a una aplicación sin necesidad de contar con internet es una real ventaja.

Este artículo presenta las ventajas e inconvenientes de la implementación en lenguajes dedicados para TVDi. Al no contar con manuales específicos ni detalles comunes en otros lenguajes, así como ser un grupo reducido de desarrolladores se ha convertido en un sin fin de prueba error para conseguir que la implementación sea la más

adecuada. Por otra parte, se ha contado con dos filosofías incluidas en este artículo, la de Objetos de Aprendizaje y la de Usabilidad, cada una correspondiente a su campo pero que permiten que el resultado presentado sea completo.

La potencialidad de una aplicación en televisión digital interactiva permitiría incluso poder comunicarse con el ciudadano con aplicaciones que permitan el entendimiento no solo a personas relacionadas con la tecnología como son los jóvenes *milenials*, sino para personas mayores. Es mucho más fácil buscar el uso de la televisión digital con adultos mayores que esperar una respuesta adecuada con pantallas tan pequeñas como las de teléfonos celulares.

Fig. 2. Interfaz principal de la aplicación

Fig. 3. Interfaces de la aplicación

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Prototipo de sistema centralizado de alerta y emergencias para TDT en Ecuador

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Abstract. Ecuador al igual que los demás países de la región, se encuentra coordinando la migración de televisión terrestre abierta de analógica a digital conocida como el apagón analógico, previsto para el año 2020. El estándar ISDTB-T, adoptado por Ecuador, tiene la capacidad de transmisión de datos para aplicaciones interactivas, guía de programación, alerta de emergencia, entre otros. En relación al sistema de alerta de emergencia, se define el proceso de transmisión y recepción de EWBS (Emergency Warning Broadcast System). En los últimos años, se han coordinado pruebas para el proceso de implementación de un sistema de alerta de emergencias que incluye EWBS y Cell Broadcast para televisión digital terrestre y telefonía celular, respectivamente. En publicaciones previas se ha presentado el desarrollo de un servidor de códigos de emergencia que alertan regiones del país y envío de mensajes de EWBS a través de canales comerciales de televisión. Así también, en el último año, se ha sumado un servicio que centraliza el sistema de alerta de emergencias para ser controlado por el Servicio Nacional de Riesgos y Emergencias. En este artículo se presentan los primeros resultados obtenidos de la integración de la plataforma del sistema de alerta de emergencia que centraliza el envío de códigos y el mensaje de alerta de emergencia a los servidores de EWBS y la red celular, que incluye también el apoyo de prevención de la gestión de riesgos a través de aplicaciones interactivas utilizando Ginga-NCL. Se integra además una propuesta de gestor CAP (Common Alert Protocol) para este tipo de servicios.

Keywords: First Keyword, Second Keyword, Third Keyword.

1 Introducción

La ley de seguridad pública y del Estado ecuatoriano, establece a la Secretaría de Gestión de Riesgos como organismo técnico. De conformidad a la ley de la materia: "son funciones del organismo técnico rector del sistema nacional descentralizado de gestión de riesgo, entre otras, articular las instituciones para que coordinen acciones a fin de prevenir y mitigar los riesgos, así como para frenarlos, recuperar y mejorar las condiciones anteriores a la ocurrencia de una emergencia desastre; y, realizar y coordinar las acciones necesarias para reducir vulnerabilidades y prevenir, mitigar, atender

y recuperar eventuales efectos negativos derivados de desastres o emergencias en el territorio nacional...". Por esta razón, es indispensable integrar diferentes medios y tecnologías de comunicación que ayuden a generar alertas tempranas de posibles catástrofes o emergencias, que a la vez sean masivas.

En [1] se presentaron las pruebas de campo del sistema de alerta temprana EWBS (de sus siglas en inglés Emergency Warning Broadcast System) en la ciudad de Quito, integrado en el sistema de televisión digital terrestre ISDB-T internacional, a través de la señal de radiodifusión de un canal comercial en la frecuencia de 635,143 MHz, dentro de la banda UHF, correspondiente para el canal 41. En el transmisor fue implementado un servidor de EWBS, donde se configura las ubicaciones físicas que serán alertadas, a través de códigos de 12 bits definidos por cantones para Ecuador en el documento de Armonización Parte 3 "Sistema de Alerta de Emergencia EWBS", así como también la edición del mensaje de alerta que será visualizado en el televisor sobrepuesto a la señal de video y audio de la programación, conforme la norma ARIB STD-B14. El servidor reconfigura las tablas PSI/SI y genera un flujo de transporte TS (de sus siglas en inglés Transport Stream) que multiplexado con el contenido del canal de televisión es transmitido como flujo BTS (de sus siglas en inglés Broadcast Transport Stream) en conjunto con el bit de emergencia de la capa física a través de un enlace microondas a la moduladora ubicada en el cerro Pichincha y por broadcast distribuida a toda la ciudad. La configuración del servidor EWBS se realizó utilizando un escritorio remoto al servidor de EWBS ubicado en la estación de televisión, activando la señal de alerta de emergencia en los receptores ubicados en la ciudad con un retardo menor a un segundo.

La experiencia exitosa de las pruebas del sistema EWBS generó el requerimiento de una plataforma única liderada por el Servicio Nacional de Gestión de Riesgos y Emergencias que configure los códigos de los cantones del país y la edición del mensaje de emergencia en los servidores que serán instalados en los canales de televisión, de una forma ágil y dinámica.

El presente artículo presenta los primeros resultados obtenidos de la integración de la plataforma del sistema de alerta de emergencia que centraliza para los servidores EWBS, que además integra la gestión de riesgos a través de aplicaciones interactivas diseñadas en Ginga-NCL, la recepción paralela en equipos de telefonía móvil y la propuesta del gestor CAP (siglas en inglés Common Alert Protocol) para este tipo de servicios

1.1 IDE como Core de un Sistema de Alertas Tempranas usando TDT

La gestión de eventos producidos por desastres naturales, tiene gran necesidad de información que aporte con agilidad a los entes llamados a brindar socorro en caso de emergencias. Por otra parte, en caso de alertas tempranas, la cantidad de información disponible para un usuario, sea este el ciudadano como los organismos de socorro, debe también mantener la mayor comprensión posible y estar inundada de información validada y disponible. En ambos casos es totalmente deseable que la información a ser utilizada sea de tipo geográfica es decir que pueda mantener geoposicionamiento de los detalles presentados. Mientras mayor descripción de estos elementos en un

mapa y que mantenga el mínimo error de precisión posible, toda ayuda, acción o planificación será mejor estructurada, más eficaz y totalmente redundante en beneficio de los afectados.

Por todo ello, desde los proyectos relacionados a Infraestructura de Datos Espaciales, se ha venido trabajando en como dicha filosofía de gestión de información geoespacial pueda aportar a este posible beneficio. En esta búsqueda se han producido varios proyectos cuyos avances y resultados han sido objeto de innumerables presentaciones y publicaciones [2]–[4].

Finalmente en el artículo [5] se describe los últimos avances que permite el uso de la IDE como núcleo de un sistema de alertas tempranas para televisión digital terrestre (ver Fig. 1).

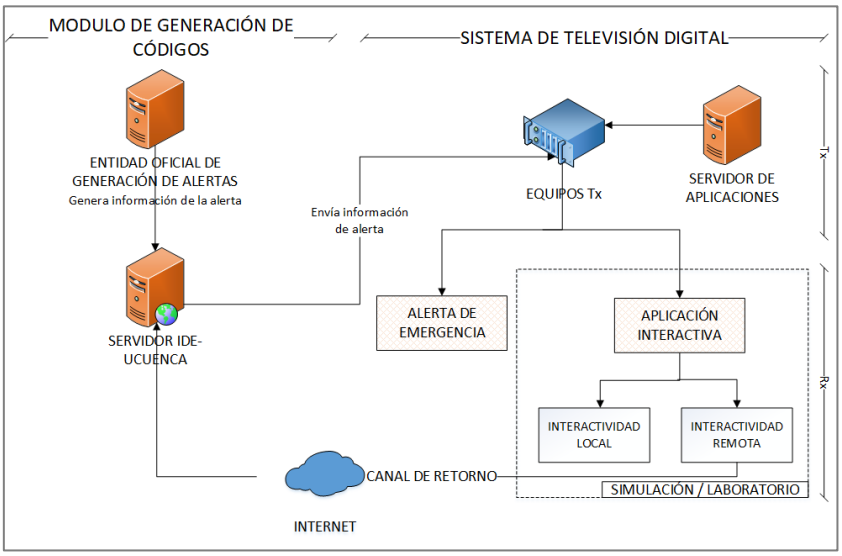

Fig. 1. Esquema de IDE como core del sistema de Alerta Temprana para Televisión Digital.

Este core permite la integración de nuevas funcionalidades que principalmente cumple dos expectativas, una para la gestión por el órgano que emite las alertas y que puede utilizar una plataforma centralizada en dicho trabajo, y otra como integrador de información a ser presentada a los posibles usuarios (ciudadanos, organizaciones, gobiernos etc). En esta ocasión se presenta la posibilidad de conectar dicha plataforma como generador de información a ser captada por el CAP. Así, a través de un servicio CAP creado para este fin, se permita la disponibilidad de dichas alertas a otros elementos que en este artículo se presentan.

1.2 Common Alert Protocol implementaciones internacionales

El Protocolo de alerta común (CAP) es un foro comercial estándar para alertas de emergencia. CAP, tal como fue designado por la Recomendación X.1303 de la Unión Internacional de Telecomunicaciones [6], es ampliamente reconocido internacional-

mente como el estándar clave para que las sociedades superen los peligros, mediante todos los medios de comunicación de alerta pública para emergencias (ver Fig. 2).

Fig. 2. Funcionalidad de la normativa CAP

Las grandes emergencias implican un gran número de personas, que obtienen mucha información de diferentes maneras. Sin embargo, todos deben obtener los datos clave de la emergencia de la misma manera. Por ejemplo: ¿Cuál es el evento? ¿Qué deberían hacer las personas? ¿Dónde está el área de alerta? ¿Qué tan pronto viene? ¿Qué tan malo será? ¿Qué tan seguros están los expertos? Estos hechos clave se incluyen en los elementos de un formato de mensaje CAP[7].

El CAP utiliza el formato estándar digital XML para intercambiar alertas de emergencia que permite que un mensaje de alerta consistente se difunda simultáneamente en muchos sistemas de comunicación diferentes. El formato de datos base XML (en lenguaje de marcado extensible informático) permite que el software y las redes de todo el mundo lo procesen. Cuando los mensajes clave se transmiten en el formato de mensaje CAP, la alerta de emergencia es mucho más accesible.

El CAP debe ser emitido por una autoridad oficial de alerta, como puede ser:

- Servicio Nacional de Meteorología e Hidrología.
- Agencia de Manejo de Emergencias.
- Cualquier otra organización autorizada a tomar las funciones de alertar.

Debido a que las alertas ahora se emiten a través de redes públicas de gran alcance, resulta imposible conocer las fuentes de forma directa, como podría ocurrir en una ciudad pequeña. Los distintos países tienen sus propias políticas sobre lo que significa estar "oficialmente autorizada". Sin embargo, existe consenso con respecto a que las autoridades de alerta oficiales deben ser conocidas a nivel internacional [8].

Para ello, es necesario realizar un registro de la entidad autoriza a alertar, en este caso se lo hace en el WMO (Word Meterological Organization), que se encarga de mantener un registro de las entidades oficiales para emitir una alerta. En este registro, principalmente se ingresan datos que caractericen a la entidad, como puede ser: las categorías de peligros sobre los que esta autoridad habitualmente emite alertas, la

zona de alerta habitual de esta autoridad de alerta, una dirección URL del canal de noticias de alertas en formato CAP.

Existen varios países en todo el mundo que han adoptado el formato CAP y que pertenecen a la WMO, entre los países de la región de Sur América están: Colombia, Perú, Bolivia, Ecuador, entre otros. Cada uno consta con el registro de una o varias entidades autorizadas a reportar alertas, en el caso de Ecuador se encuentra el INAMHI (Instituto Nacional de Meteorología e Hidrología) [9].

2 Implementación prototipal CAP

El grupo de trabajo de Infraestructura de Datos Espaciales de la Universidad de Cuenca ha venido trabajando principalmente en temas relacionados a la mitigación de amenazas naturales, adaptándose a las tecnologías que principalmente son desarrolladas con el fin de ayudar a la población, tal como es el caso del CAP.

En esta sección se va a exponer parte del trabajo que se ha realizado, relacionando las herramientas existentes que ofrece la IDE UCuenca con el desarrollo de un módulo que permite el ingreso de información para obtener como resultado una alerta en el formato CAP. Tomando como partida, se empezó conociendo la estructura del CAP y cada uno de los parámetros que lo involucra, en este caso se tomó como referencia las indicaciones que propone el OASIS. El OASIS se trata de un consorcio sin fines de lucro que impulsa el desarrollo, la convergencia y la adopción de estándares abiertos para la sociedad global de la información [10].

Luego de conocer la estructura que conforma el formato CAP, se realizó un análisis de cada uno del parámetro, para que el formulario encargado de ingresar la información, valide cada uno de los datos que exige el estándar CAP.

2.1 Herramientas que intervienen en el desarrollo

En este caso se ha utilizado varias tecnologías que han permitido tener como resultado un módulo que ha adoptado las características que ofrece el formato CAP. Como herramientas principales se ha utilizado Angular, Java, PostgreSQL.

Angular. Como herramienta principal está involucrado el framework de Angular, que principalmente se utiliza para la creación de páginas web SPA mantenido por Google. SPA es el acrónimo de “Single Page Aplicación” o lo que es lo mismo, cuando un usuario entra en una web SPA, se carga todo a la vez en una misma página y Angular lo que hace por debajo es cambiar la vista al navegar por la página para que de la apariencia de una web normal [11].

El framework de Angular ha permitido el desarrollo de un formulario WEB dinámico, capaz de adaptarse a navegadores de Escritorio, Tablets o Móviles, además de contar con un diseño amigable para el usuario.

PostgreSQL. Es un gestor de bases de datos relacional y orientado a objetos. Su licencia y desarrollo es de código abierto, siendo mantenida por una comunidad de desarrolladores, colaboradores y organizaciones comerciales de forma libre y desinte-

resadamente. En este caso, esta herramienta se utilizó para la gestión y organización de la información, mediante la generación de una estructura de base de datos.

Java Es un lenguaje de programación orientado a objetos desarrollado por Sun Microsystems que trabaja a nivel del servidor. En este caso se utilizó una librería llamada "Cap-library", que consiste en una colección de código y herramientas para trabajar con mensajes de alertas en el CAP.

Utilizando conjuntamente las herramientas mencionadas, fue posible realizar un proceso de ingreso, validación, almacenamiento y publicación de la información.

2.2 Módulo CAP y la IDE UCuenca

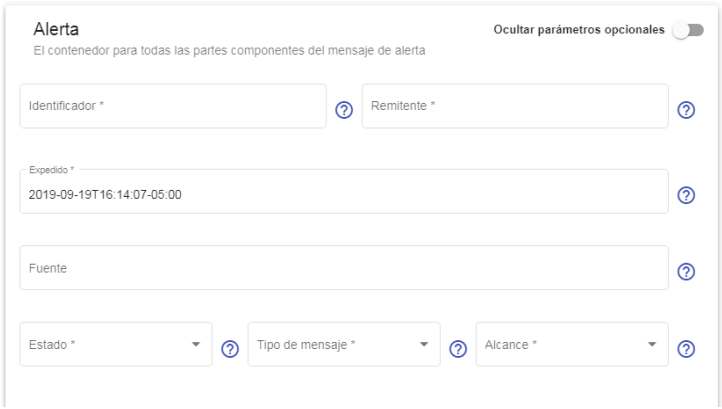

Fig. 3. Formulario del módulo CAP

Al contar con un módulo que permite la gestión de la información para la generación de una alerta en un formato CAP, existe la posibilidad de adicionar funcionalidades que permita el ingreso de información de manera dinámica en el formulario (ver Fig. 3). En este caso se implementó una funcionalidad que permita interpretar datos de otros sistemas que contengan información relacionada con alertas de peligro. Tal es el caso del sistema generador de códigos de la IDE Ucuenca [5], que si bien, como resultado de un proceso de un reporte de alerta se cuenta con un formato propio de información, es posible leerlo, interpretarlo y adaptarlo al módulo CAP.

En el caso del sistema generador de códigos de la IDE Ucuenca, cuenta con un formato que contiene un título, descripción, tipo de evento y códigos que representan a las geometrías de los cantones del Ecuador. Para consultar la información de los eventos reportados de del sistema generador de códigos de la IDE UCuenca, se agregó al módulo CAP una función que permita listar todos los eventos que se han reportado mediante un servicio WEB que dispone la IDE UCuenca. De esta manera es posible listar y adaptar la información de cualquier entidad que emita este tipo de reportes, utilizando un proceso o geo procesos que permita adaptar esta información al formato CAP (Fig. 4).

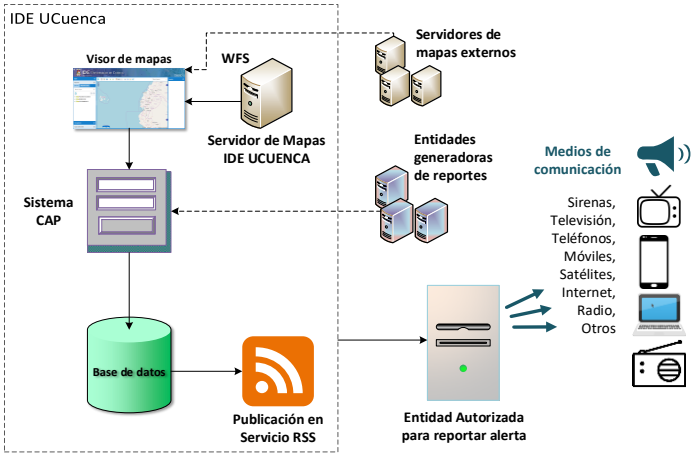

Fig. 4. Esquema funcional del módulo CAP con las IDE

2.3 Ventajas y desventajas de un módulo CAP

Ventajas:

- CAP proporciona consistencia a través de múltiples canales, lo que permite la corroboración exacta de información de alerta.
- CAP define un formato de mensaje digital compatible con todo tipo de sistemas existentes y emergentes - redes de datos, así como de difusión de radio y televisión.
- CAP útil para las poblaciones multilingües y con necesidades especiales.
- Un remitente del mensaje CAP puede activar múltiples sistemas de alerta con una sola entrada.
- Alertas estandarizadas de muchas fuentes pueden ser compilados para "conocimiento de la situación".
- Los administradores pueden monitorear toda la imagen en todos los tipos de alertas locales, regionales y nacionales (alertas públicas, así como los mensajes entre el personal de emergencia).
- Al contar con un módulo que trabaja conjuntamente con un sistema completo de gestión de información geográfica, es posible generar geometrías de forma dinámica, a partir de la información que contiene el servidor local u otros servicios de mapas WEB.

Desventajas:

- Para la integración de información de otras entidades al módulo CAP, es necesario desarrollar funciones que interpreten el formato que disponen, esto debido a que cada entidad maneja su propio formato.
- La información que se pretenda integrar en el módulo CAP desde otra entidad, puede contener caracteres que no permite el formato CAP, por lo tanto, esta información debería ser modificada para adaptarla al formato.

- Si la información de otras entidades contiene información geográfica es necesario saber cuál es el tipo de formato, o contar con una URL de un servicio WFS para realizar un geo proceso y convertirla al formato que acepta el módulo CAP.

3 Resultados obtenidos

3.1 Generación de códigos mediante el uso de la IDE UCuenca para la trasmisión de información mediante TDT

Como resultado de este trabajo se obtuvo un servicio WEB que contiene los códigos que representan a los cantones del Ecuador, seleccionados mediante el uso de un visualizador de mapas del sistema generador de códigos de la IDE UCuenca [5].

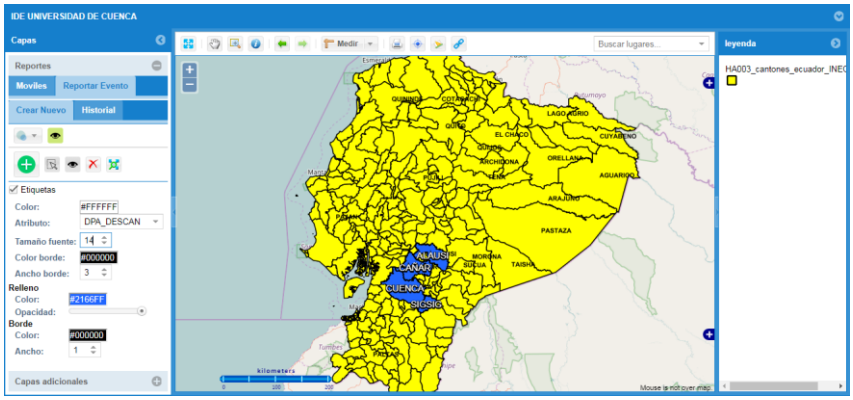

Fig. 5. Sistema generador códigos de la IDE UCuenca

El servicio WEB es consumido por un aplicativo desarrollado por la ESPE (Universidad de las Fuerzas Armadas), que se encarga de procesar la información necesaria para trasmisión de una alerta mediante TDT a los cantones que se han seleccionado en el visualizador de mapas de la IDE UCuenca**.**

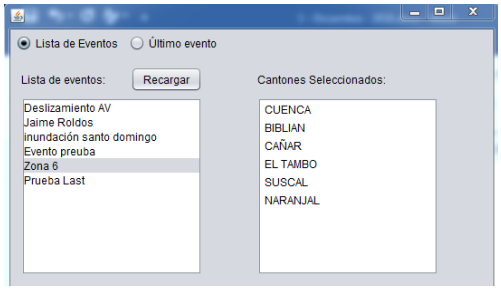

Fig. 6. App consulta códigos de la Plataforma IDE - Historial de eventos

3.2 Generación de una alerta utilizando el Módulo CA

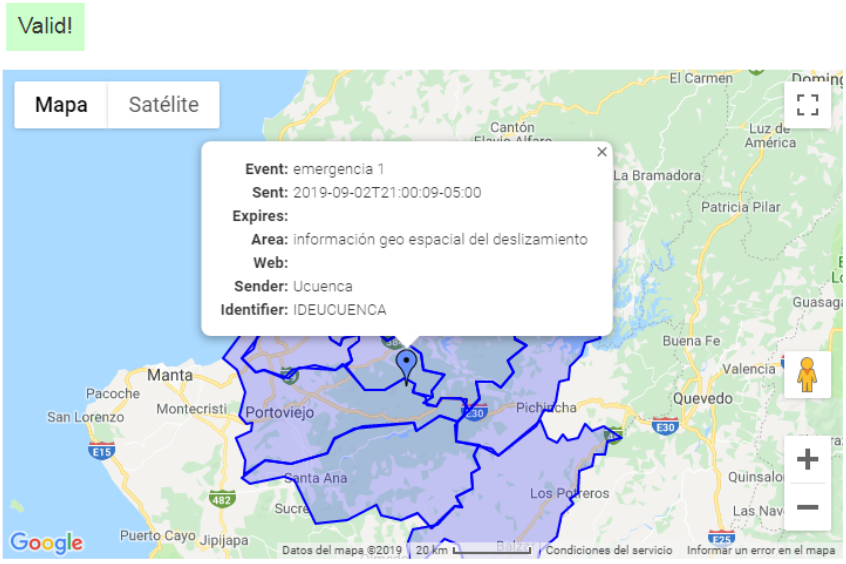

Fig. 7. Validación del servicio RSS del Módulo CAP

Luego de ingresar información mediante el formulario del Módulo CAP, integrando información generada por el sistema generador de códigos de la IDE UCuenca, se tiene como resultado el almacenamiento de la información en la base de datos, y a partir de ello un servicio WEB RSS que contiene la información ingresada en formato CAP.

https://ide.ucuenca.edu.ec/rest/feedcap

Debido a que este tipo de información es estandarizada, los datos que contiene deben cumplir con las especificaciones del formato CAP. Para constatar que este servicio WEB cumple con lo requerido, se realizó una validación en el sitio WEB https://cap-validator.appspot.com/. Esta página realiza una validación de todos los parámetros y datos que contiene el formato CAP, y en este caso al validar la información que contiene el servicio RSS, el resultado fue satisfactorio (Fig. 7).

4 Conclusiones

En la búsqueda de soluciones para alertar al ciudadano de formas ingeniosas y con la posibilidad de llegar a la mayor población posible, se han diseñado diferentes tipos de elementos de alerta. En esta evolución se establece al CAP como el último de los fenómenos a seguir y que se ha venido implementando a nivel internacional. Entre las principales ventajas aquí descritas es la posibilidad de servir de interfaz tanto para la generación de alerta como para la lectura. En este artículo se presenta la forma de implementación de un servicio CAP capaz de integrar la plataforma de generación de

alertas tempranas basada en una Infraestructura de Datos Espaciales con la posibilidad de servir de generador CAP para otros servicios adicionales. Esto abre las puertas a que varios otros organismos puedan hacer uso de este codificador que además fue pensado con un traductor interno que permite que cualquier codificación enviada bajo un formato establecido, sea traducida a inglés. De tal forma que el servicio sea accesible por cualquier posible lector de CAP internacional y que permita la interpretación adecuada. Esto permite que la emisión de alertas puedan ser incluso utilizadas por otros sistemas internacionales y nacionales, tales como sirenas diseñadas para leer servicios CAP.

La presentación de esta propuesta da mayor relevancia a los resultados obtenidos de un proyecto que pretende generalizar la generación de alertas tempranas para la población.

Agradecimientos

Este proyecto recibe el cofinanciamiento de CEDIA por medio de los proyectos CEPRA año 2018-2019. Así mismo tiene financiamiento interno de la Dirección de Investigación de la Universidad de Cuenca.

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Integration of content services to improve data broadcasting digital terrestrial television in Cuba*

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Resumen Digital Terrestrial Television (DTT) is a modern emerging scenario that allows to transmit informative content using a medium of great penetration in most of the peoples of the world. However, currently DTT is mainly used to transmit entertainment multimedia content. On the other hand, useful content is scattered on the Internet, making it difficult for most people to appropriate it easy. This paper presents a software solution that demonstrate the possibilities of DTT in a real scenario. The solution called TVC+ collects useful information available on the Internet and integrates it with the DTT services. Some of its functionalities have already been deployed in Cuba, demonstrating their usefulness in some areas of UN Sustainable Development Goals 2030: Education, Health, Food and Heritage. The technologies used comply with FOSS philosophy, allowing it to be adapted to other existing technological scenarios. Developing countries find an unprecedented opportunity to transmit useful, significant, up-to-date information with a minimum cost reaching most households with only a television and a decoder box. The experiences gained may serve as a basis for other developing countries, although also developed, to promote the improvement of the people in this way.

Keywords: microservices · web standards · interoperability.

1. Introducción

En Cuba existen en la actualidad 3,5 millones de TV funcionando ([10], V.17, p. 409). Hasta inicios de 2019 se han distribuido en Cuba más de dos millones de receptores de televisión digital terrestre (TDT) incluyendo las llamadas cajitas (STB, del inglés setup-box) y los TV híbridos. Lo anterior indica que existe un potencial de más de un millón de hogares que aún no tienen TDT, teniendo en cuenta que en muchos hogares existen más de un TV. Por otro lado, la

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importancia del TV es crucial para llegar de una manera sencilla y barata a la mayor parte de población [7].

La interactividad de la TDT es una de las funcionalidades principales incorporadas a la televisión digital a través de sus servicios de valor agregado [5]. En la Figura 1 se muestra un esquema general de la TDT incluyendo la interactividad tal y como existe a nivel mundial. Este esquema incluye las funcionalidades de comunicación del STB con el proveedor de Internet utilizando el "Canal de Retorno" y la comunicación del mismo con dispositivos de pantalla acompañante que a su vez puede estar conectados a Internet [2].

A pesar de los adelantos que existen a nivel mundial al respecto, en Cuba solo se dispone de software y hardware que gestiona y visualiza contenido en texto plano, estático, de poca actualidad y utilidad los usuarios finales.

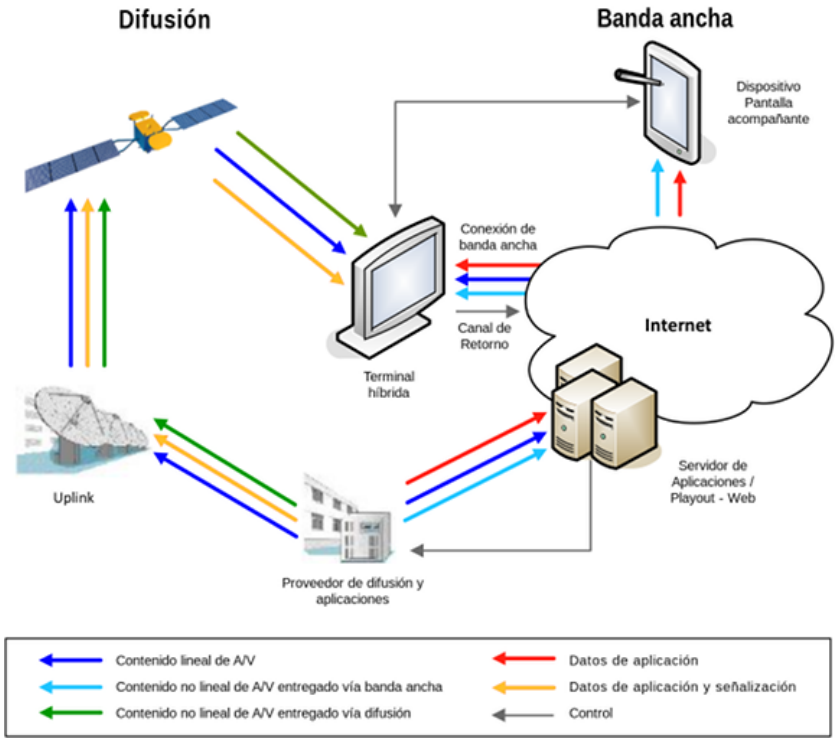

Figura 1. Esquema general de HbbTV (basado en [2]). Las flechas indican el sentido de la conexión. El recuadro inferior indica el significado de los colores de las diferentes conexiones existentes.

A pesar de los adelantos que existen a nivel mundial al respecto, en Cuba solo se dispone de software y hardware que gestiona y visualiza contenido en texto plano, estático, de poca actualidad y utilidad los usuarios finales.

Los autores de este trabajo han propuesto una solución que corrige la situación de la actualización de la información a través de la nueva plataforma tecnológica TVC+. Este sistema permite la gestión del contenido de manera manual pero también de forma automática tal y como se realiza a nivel internacional [4], [3], [9], [8] a partir de fuentes externas RSS y servicios Web. Desde septiembre de 2018, TVC+ está a prueba y de forma ininterrumpida ha publicado más de 50 000 noticias desde 13 fuentes externas (Periódico Granma, Cubadebate, Instituto de Meteorología, La Papeleta, etc.) que son captadas por todos los receptores de TDT del país. En estos momentos se encuentra en fase de ajuste para que se muestre en todos los tipos de STB siguiendo la especificación china que define su estructura y formatos [1]. En este trabajo se exponen las principales funcionalidades que se incorporan a TVC+ para incorporar los primeros elementos de interactividad en la TDT cubana mediante la utilización del canal de datos que provee la empresa de telecomunicaciones del país.

2. Contenido

La Televisión Digital (TVD) permite la inclusión de datos y software como valor agregado al flujo tradicional de audio y video. Este canal de datos permite al televidente profundizar en la información audiovisual que se transmite e incluso puede interactuar de manera que mejora la experiencia de usuario tradicional tal y como se sugiere a nivel internacional [11],[3], [12] (por ejemplo: consulta de alertas sobre eventos naturales como ciclones tropicales, sinopsis y repertorio de la película, estadísticas de la competencia deportiva, encuesta/examen que debe responder, etc.). Estas funcionalidades se agrupan en la denomina interactividad y en función del requerimiento de conexión con redes de telecomunicación se le conoce como interactividad local y total. En la televisión cubana por ahora solo es posible la interactividad local debido a las limitaciones actuales de la inexistencia del canal de retorno que hace imposible la comunicación bidireccional. Sin embargo, aún no se explota lo suficiente la interactividad local debido a inercia de la producción y transmisión del contenido tradicional que desde el comienzo ha existido.

Para resolver el problema planteado, los autores han propuesto el desarrollo de un conjunto de nuevas funcionalidades que permiten mejorar la actualización y calidad del contenido que transmite por el canal actual de datos. De esta manera, se introduce de forma escalonada la interactividad en la TV cubana, en una primera etapa de forma local y se preparan las condiciones para la interactividad total. En la Figura 2 se muestra como TVC+ obtiene la información desde fuentes primarias de contenido mediante los estándares de RSS y servicios Web. Este contenido es empaquetado en los ficheros que son transmitidos para que sean visualizados por los receptores de TDT.

Entre las funcionalidades implementadas que mejoran el anterior, se encuentran:

1. permite establecer el orden de las noticias,
2. incorpora un flujo de aprobación de la noticia,

3. mantiene un registro de trazas para futuras auditorías y reportes,
4. obtiene de manera automática de noticias desde fuentes externas RSS lo que facilita su edición y mejora la actualidad de su contenido,
5. habilita el acceso desde cualquier medio de cómputo conectado a la intranet del ICRT (acceso nacional e incluso desde móviles),
6. incorpora imágenes ajustando automáticamente su tamaño y formato,
7. permite asignar permisos de forma personalizada, incluso a nivel secciones y subsecciones específicas,
8. realiza la extracción y publicación automática de noticias desde fuentes RSS y servicios Web permitiendo que la fuente responsable del contenido específico sea la que se encargue de su actualización.

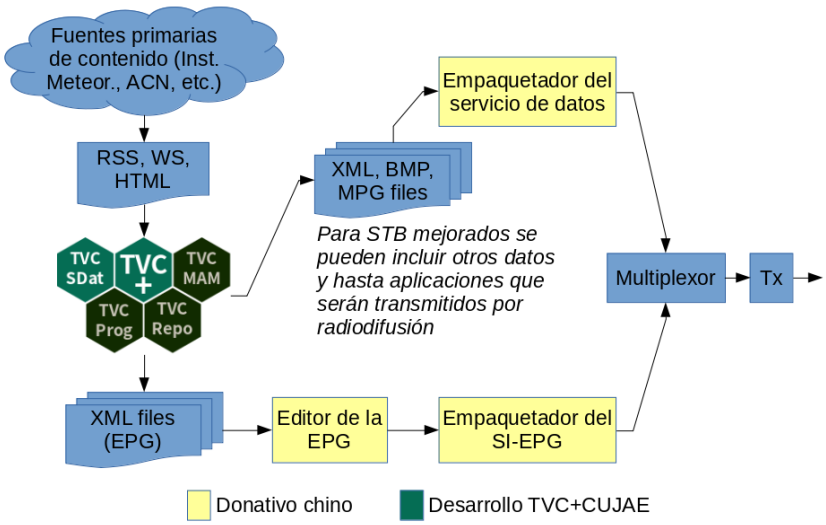

Figura 2. Esquema general de la solución propuesta en su despliegue inicial.

Adicionalmente, se propone la incorporación de la gestión de eventos y acciones para lograr la dinámica automática de cambio del contenido y la gestión de la programación de una manera integrada con el servicio de datos.

En las imágenes generadas por TVC+ se propone incluir códigos QR que encapsulan la información de interacción. Este código puede ser escaneado por teléfonos móviles que tengan conexión a los datos móviles del proveedor de telefonía móvil (ETECSA). En una primera etapa del proyecto se han incluido QR de navegación y televotación (ver Figura 3).

Figura 3. Ejemplos de utilización de navegación web (3(a)) y televotación mediante SMS (3(b)).

La idea permite ampliar las potencialidades del servicio de datos transmitido por la televisión cubana sin cambiar la infraestructura actual. El alcance de la propuesta es muy amplio teniendo en cuenta que la TV es el medio promotor de contenido informativo que con más penetración y tiempo llega a la población. No existen antecedentes a nivel nacional y no se ha encontrado la publicación de algunas funcionalidades propuestas a nivel internacional. Las funcionalidades propuestas se resumen a continuación:

- Automatizar la obtención de contenido desde fuentes primarias identificadas como útiles a la población,
- Incorporar propiedades que indiquen el período de publicación de cada noticia,
- Sincronizar las noticias con los programas que se transmiten,
- Incorporar la gestión de eventos y acciones para lograr la dinámica automática de cambio del contenido:
  Eventos: Al llegar determinado momento, Al expirar el tiempo de publicación de un contenido (sección, subsección o noticia), Al mostrarse determinado contenido, Al tener/no tener alguna noticia en una determinada subsección, etc.
  Acciones: Cambiar propiedad de determinado contenido (sección, subsección o noticia) a un valor dado, Cambiar plantilla de formato, Publicar contenido, etc.
- Incorporar contenido con código QR que permita funcionalidades de interactividad utilizando el canal de datos de ETECSA:
  - Televotación (SMS para votación o selección de respuesta),
  - Navegación (URL http para conectar mediante navegador) y
  - Pago de servicios mediante transferencia bancaria (Código de cuenta para efectuar pago por transferencia mediante Transfermóvil)
- Gestión de las actividades realizadas mediante el canal de datos del proveedor de telefonía.

Entre los eventos y acciones se han implementado los siguientes:

- Si aparece una noticia en una determinada subsección (p. ej. alerta) entonces se ocultan determinadas subsecciones (p. ej. deportivas y culturales).
- Cuando expira el tiempo de publicación de una noticia que está en una sección entonces se mueve la noticia a otra subsección con otro tiempo de expiración.
- Si no hay ninguna noticia en determinada subsección entonces se oculta esta subsección.
- Si se oculta una subsección entonces se muestra determinadas subsecciones.
- Si un determinado programa comienza en un lapso de tiempo dado entonces se muestra determinada noticia.

Se utilizaron tecnologías novedosas, de software libre y estándares abiertos sobre una arquitectura en capas basada en servicios web lo que permite la extensibilidad y adaptabilidad de la propuesta (Apache, Node.js, AngularJS, MongoDB). La arquitectura del software TVC+ permite la incorporación gradual de los elementos de interactividad logrando su compatibilidad con los codificadores actuales y futuros. En la actualidad TVC+ tiene como salida los ficheros especificados en la documentación china [1] pero ya se ha comenzado a implementar la entrega de su estructura y contenido siguiendo otros estándares como el especificado en HbbTV [2]. La convergencia tecnológica planteada en la actualidad permite la integración con otros estándares a nivel mundial [6],[13]. Este aspecto constituye una importante novedad que se presenta en este trabajo. La solución propuesta permite la soberanía tecnológica de nuestro país en esta importante área del conocimiento con posibilidades futuras reales de intercambio con otros países de la región.

3. Análisis de los resultados

Las pruebas iniciales se han realizado en un entorno controlado mediante un el modulador (en el centro) que transmite la señal generada en la PC desde TVC+ y finalmente se visualiza en el TV desde un STB (ver Figura 4).

Luego de varios meses de estabilidad en su funcionamiento, TVC+ se desplegó desde el 27 de septiembre de 2018 y desde esa fecha funciona ininterrumpidamente las 24 horas de cada día. Se han publicado casi 200 noticias nuevas cada día y se reemplazan las antiguas para mantener alrededor de 400 en cualquier instante. Este software ahorra al país alrededor de 20 mil USD teniendo en cuenta que es de propósito específico. Además, reporta un ahorro de recursos equivalente a 5 mil CUP cada mes teniendo en cuenta que todo se hace digital, de forma instantánea y utilizando los recursos de cómputo e infraestructura de red actualmente instalados en el ICRT (ver Figura 5).

Figura 4. Escenario de prueba donde se muestra el modulador (en el centro) que transmite la señal generada en la PC y finalmente se visualiza en el TV desde el STB.

Figura 5. Despliegue en la emisora Radio Reloj el 27 de septiembre de 2018.

Todas las instituciones que brindan información útil a la población pueden integrarse a la solución propuesta (algunos ej. Gobiernos de todos los niveles para informar de su gestión, InsMet para otros partes útiles como agricultura y marítimo, Emp. Omn. Nac. para informar el horario actualizado de salidas y arribos, Farmacia para informar la distribución de medicamentos, Banco para informar las tazas de cambio y horarios, MINED para orientar las tareas extraclase y preparación de las pruebas de ingreso, INDER para informar los resultados deportivos tales como la tabla de posiciones y líderes de la SNB, ICRT para transmitir información complementaria de programas que salen al aire y que ayudan a la cultura general y al debate). Solo tienen que publicar su contenido mediante los estándares RSS y servicios Web siguiendo las especificaciones de interfaz de servicios definida en TVC+.

En la Figura 6 se muestran algunos de los ejemplos que demuestran las funcionalidades brindadas por TVC+.

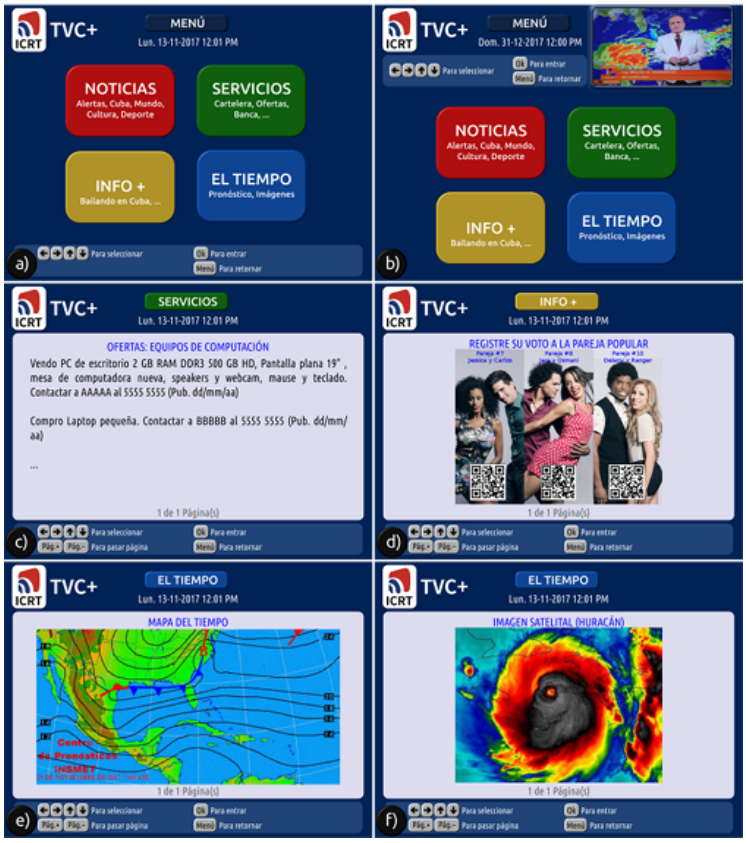

Figura 6. Algunos ejemplos de dinámica interactiva que se han incorporado a TVC+.

4. Conclusiones y trabajos futuros

La solución propuesta facilita la gestión dinámica de los contenidos de valor agregado de la televisión digital terrestre en Cuba y la incorporación gradual de los necesarios elementos de interactividad que permiten su compatibilidad con los codificadores actuales y futuros. Algunas de estas funcionalidades ya están incluidas en la versión de TVC+ que en la actualidad está desplegada en el ICRT y cuentan con el aval del mismo. Con la propuesta se puede generar contenido que prepara las condiciones para la interactividad (información complementaria del programa que se transmite, utilizar canal de retorno mediante SMS o los datos móviles de ETECSA). La evolución hacia la interactividad es factible al agregar las nuevas funcionalidades manteniendo la compatibilidad con los STB actuales. Esta solución permite la soberanía tecnológica de nuestro país en esta importante área del conocimiento con posibilidades futuras reales de intercambio con otros países de la región. A partir de la solución propuesta se puede afirmar que la naciente industria cubana del software encuentra en esta idea otra puerta hacia la informatización de la sociedad cubana mediante el despliegue de servicios que brinden contenido actualizado de interés para los hogares y lugares comunitarios de todo el país, incluso, sin tener conexión a Internet. Como trabajo futuro queda realizar las pruebas de las funcionalidades en varios STB para su debido ajuste y culminar la implementación de las funcionalidades prototipadas.

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Revisión de TIC orientadas al adulto mayor y su envejecimiento activo

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Resumen. Este trabajo presenta una revisión sistemática desde 2012 hasta principios del año 2019, de experiencias realizadas con personas de 65 años o más, empleando las Tecnologías de Información y Comunicación (TIC) con el objetivo de mejorar su auto-asistencia y empoderamiento para el cuidado de su salud para un envejecimiento activo. Se indaga TIC en general y la utilización de la televisión digital interactiva en particular.

Palabras Clave: Adulto mayor, Envejecimiento activo, tecnología, plataformas de salud, televisión digital

1 Introducción

La esperanza de vida del adulto mayor a nivel mundial está creciendo, y ante la necesidad de asegurar la buena calidad de vida de las personas mayores, existen instituciones que promueven la salud y el envejecimiento activo. La Organización Mundial de la Salud (OMS 2015) define el envejecimiento activo como "el proceso de optimización de las oportunidades de salud, participación y seguridad con el fin de mejorar la calidad de vida de las personas a medida que envejecen". Y para ello existen cuatro pilares fundamentales que lo promueven, tales como nutrición saludable, actividad física, prevención y comportamientos sociales. En relación con estos pilares, se dice que la nutrición juega un papel muy importante en el proceso de envejecer debido a que se pierde masa muscular por múltiples enfermedades propias de la edad, además de la pérdida de piezas dentales, lo que genera una dificultad en la digestión y absorción de nutrientes. En la actividad

física es beneficioso para la salud, ayudándole a reducir dolores, molestias, previniendo a desarrollar enfermedades.

Las actividades preventivas en los adultos mayores deben tenerse en cuenta para que no deterioren su estado de salud, y para que exista un envejecimiento exitoso y saludable tiene que existir una integración social y familiar de los que envejecen, lo que implicará resaltar los desafíos sociales y culturales que continúan e imposibilitan a los adultos mayores poder desarrollar sus potencialidades.

El envejecimiento ha representado el mayor desafío del siglo XXI en el desarrollo de nuevas herramientas permitiendo promocionar el envejecimiento activo y saludable, a través de las Tecnologías de la Información y la Comunicación (TIC) que contribuyan a su promoción de la salud y el bienestar para apoyar la vida independiente del adulto mayor. Para (Castrillón, et al., 2010) el impacto de la innovación tecnológica y social se reconoce en las acciones, hechos y actividades que producen cambios en las conductas, actitudes y prácticas sociales, lo que supone transformaciones en las mismas, para resolver problemas, carencias o necesidades propias o del colectivo. El empleo de la tecnología constituye avances que representan cambios positivos en las personas en el desarrollo de sus actividades de su vida cotidiana, haciendo de su práctica de forma más sencilla, fácil, agradable y de confort al momento de realizarlas.

Las TIC tienen un amplio potencial de soporte en el campo de la salud, brindando servicios informáticos que facilitan el intercambio de información y habilitan el acceso al conocimiento sobre variedad de tratamientos y prácticas médicas (Martínez-Alcalá, et al, 2015), así como los sistemas de tele tratamiento permiten que las personas se mantengan independientes en sus propias casas. Las bondades que otorga esta época digital contribuyen a proporcionar evaluaciones, que con sus resultados, se puede aplicar la asistencia más precisa en beneficio de la salud del otro (Abreu, et al. 2014).

Los cambios demográficos, epidemiológicos sociales y económicos han generado grandes transformaciones en el estilo de vida, tipo de hogares y dinámicas familiares, llevando a sus miembros a estar cada vez más involucrados en el cuidado de los adultos mayores (Giraldo, et al., 2013). Las diferentes sociedades de acuerdo a sus culturas, costumbres o estilos de vida, proporcionados por su clase social y su estatus, por el afecto a sus mayores, tratan de encontrar soluciones que redunden en mejorar la atención en sus familiares de edad avanzada, teniendo relación con lo que expresa, Agudo, et al. (2012), que, la utilización de las tecnologías de la comunicación con personas mayores nos abre grandes posibilidades de intervención, favorece la conexión y el acercamiento de las personas mayores a los nuevos temas y fenómenos que en la sociedad van surgiendo.

En los últimos años la aplicación o innovación de nuevas tecnologías, han servido para brindar de forma positiva un servicio utilitario para el otro –edad avanzada-, en especial en el área de la salud, las que están siendo empleadas para otorgar satisfacción desde lo individual a lo colectivo y desde lo particular a lo

universal, sin importar la condición social, sino para fortalecer la labor social, según lo expresado por Querol (2011), es que cualquier estudio que pretenda profundizar en las nuevas tecnologías deberá considerar un marco contextual que vaya más allá de los dispositivos y su acceso, contemplando sus interrelaciones con la vida cotidiana y con los procesos de estratificación social.

En algunos países latinoamericanos la televisión digital es un servicio de entretenimiento, pero este dispositivo además puede ser aplicado como un servidor auto asistencial para la persona que se encuentra en su casa, en concordancia con lo plantea (Púrez, et al., 2009), que desde una perspectiva social el hecho de que un dispositivo ayude a que los mayores permanezcan en sus domicilios con total independencia supone un importante logro social.

El presente artículo presenta una revisión sistemática sobre el uso de tecnología para mejorar la auto-asistencia y empoderamiento para el cuidado de la salud de adultos mayores para un envejecimiento activo. La sección 2 describe la metodología empleada para esta revisión sistemática. La sección 3 muestra los resultados destacando los principales de cada estudio. Finalmente la sección 4 presenta conclusiones y trabajo futuro.

2 Metodología

La revisión sistemática requiere un proceso de investigación con el objetivo de obtener, evaluar e interpretar de forma clara, precisa, rigurosa y metódica toda la información que va relacionada con una pregunta de investigación o una disciplina de interés especifica. Para este estudio, se ha seguido el método propuesto por (Kitchenham, 2004) constituido por seis pasos tales como: (i) Formulación de la pregunta; (ii) Búsqueda de las fuentes; (iii) Selección de los estudios a través de los criterios de inclusión y exclusión; (iv) Extracción de información; (v) Presentación de los resultados; (vi) Discusión.

2.1 Preguntas de investigación

Se plantearon las siguientes preguntas de investigación:
PI1. ¿Cuáles son las TIC utilizadas recientemente para ayudar adultos mayores a cuidar su salud mediante el ejercicio físico?
PI2. ¿Con qué propósito se utilizan?
PI3. En relación a los estudios de aplicación realizados ¿en que países se realizaron, qué metodología aplicaron y en qué fase de desarrollo están?
PI 4. ¿Cómo se utiliza la Televisión Digital Interactiva (TVDi) para ayudar adultos mayores a cuidar su salud?

2.2 Búsqueda de Fuentes

Se realizó una búsqueda bibliográfica en diferentes bases de datos científicas como: ACM Digital Library, Scopus, Springer y Google Scholar. La búsqueda se realizó en abril de 2019, y se seleccionaron artículos íntegros, disponibles y publicados desde el 2012 hasta principios del año 2019.

Para la búsqueda se utilizaron descriptores en Ciencias de la Salud (DeCS) presentes en el título y el resumen de los artículos, siendo las cadenas de búsqueda: (Technology AND Health AND Elderly AND Exercise); (Interactive AND Televisión AND Health AND Elderly).

2.3 Criterios de Inclusión y Exclusión

La búsqueda con las palabras claves presentada anteriormente produjo un resultado de 573 artículos. Se aplicaron criterios de exclusión e inclusión en tres etapas (tabla 1).

Tabla 1. Resultados de búsqueda y aplicación de criterios de selección

Cadena de Búsqueda	Fuente	Encontrados	Sin duplicados	Cumplen criterios de inclusión	Satisfacen criterios de Exclusión
Technology AND Health AND Elderly AND Exercise	ACM Digital Library	58	32	16	17
	Google Scholar	132	33	9	5
	Springer	102	26	5	8
	Scopus	48	6	4	3
Interactive AND Televisión AND Health AND Elderly	ACM Digital Library	37	16	3	1
	Google Scholar	68	22	7	6
	Springer	48	39	9	6
	Scopus	80	36	13	2
	Total	573	210	66	48

i. Se eliminaron los hallazgos que no contenían ninguna comunicación. Las publicaciones que provenían de una misma investigación, conservándose el artículo que ofreciera detalles relevantes para esta exploración. Luego de aplicar estos criterios de exclusión quedaron 210 artículos.

ii. Se incluyeron artículos que presentan el desarrollo o implementación de TIC utilizadas para ayudar adultos mayores a otorgarse auto-asistencia para mejorar su salud, aplicados para el envejecimiento activo, de tipo asistenciales, monitoreo o rehabilitación. Además los estudios deben haber sido realizados con personas de 65 años o más. El número de artículos se redujo a 66.

iii. Finalmente se aplicó un segundo proceso de exclusión descartando artículos dirigidos a personas con casos especiales de envejecimiento fisiológico, enfermedades degenerativas del sistema nervioso, mentales, osteoarticulares con cuidados asistenciales que han estado empleando herramientas convencionales portables para monitorear funciones vitales, parámetros clínicos, etc.

Quedaron 48 artículos presentados en la tabla 2.

Tabla 2. Resultados por cadena de búsqueda

Cadena de Búsqueda	Autores relacionados
Technology AND Health AND Elderly AND Exercise	Vuorimaa, et al., (2012); Hamid, & Foong, (2012); Park, et al., (2014); Nazário, et al., (2015); Ojetola, Gaura & Brusey (2015); Suyama, (2016); Ren, et al., (2016); Anastasiou, Giokas & Koutsouris (2016); Dulva Hina, et al., (2016); Lo Bianco, et al., (2016); Tsiachri Renta, et al., (2017); Takayuki Suyama(2017); Palipana, et a., (2018); Matthies, et al., (2018);Sáenz-de-Urturi & Santos (2018); Philipp Urbauer, et al.,(2018); Parvaneh Parvin,et al., (2018); Trujillo, Muñoz & Villada (2013); Cisneros Perdomo, et al.,(2015); Muntaner, et al., (2016); Netto & Tateyama (2018); Toribio-Guzmán, et al., (2018); Lasheng, et al., (2012); Tseng, Hsu & Chuang, (2013); Molina, et al., (2014); Johnson, et al., (2014); Palacio, et al., (2017); Kyriazakos, et al., (2017); Al-khafajiy, et al., (2019); Rao. (2019); Konstantinidis, et al., (2016); Luna-García, (2015); Saracchini, (2015)
Interactive AND Televisión AND Elderly	Godard, Pecci & Isokoski (2013); Aal, et al., (2014); Silva, de Abreu, & Pacheco (2014); Añaños (2015); Blanco (2016); Santana-Mancilla ; (2017); Ribeiro, et al., (2017); Picking, et al., (2012); Spinsante & Gambi (2012); Stojmenova, et al., (2013); Epelde (2013); Miyoshi, et al., (2015); Orso, et al., (2017); Scandurra , Sjölinder (2013); Santana & Anido (2016)

2.4 Extracción de información

Para contestar las preguntas de investigación PI1 a PI3, de cada publicación se extrajo la siguiente información (véase tabla 3):

- Propósito de aplicación: asistencia (A) cuando se trata de soluciones interactivas para ayudar al adulto mayor a hacer sus labores y actividades llevándoles a tener un bienestar; monitoreo (M), cuando se trata de una solución capaz de observar y asistir a las personas mayores de forma remota; y rehabilitación (R) cuando se trata de soluciones que ayudan a cambiar la conducta sedentaria del adulto mayor por medio de ejercicios o rutina diarias.
- Metodología del estudio: cualitativa, cuantitativa o mixta;
- País donde se realizó el estudio;
- Tecnología aplicada;
- Estado del desarrollo: aplicación implementada (I), estudio de factibilidad (EF), prototipo (P).

Tabla 3. Categorización de las publicaciones

Referencia	Aplicación	Metodología	País	Tecnologías	Estado
Lasheng, et al., (2012)	A	Cualitativa	China	Sensores - Dispositivo Móvil	EF
Vuorimaa, et al., (2012).	A	Mixta	Finlandia	Nube- PC	EF
Hamid, & Foong, (2012)	A	Mixta	Singapur	Dispositivo Móvil	P
Picking, et al., (2012)	A	Mixta	Gales, Reino Unido	Set Top Box - Sensores - Televisión interactiva	EF
Spinsante & Gambi (2012)	M	Mixta	Italia	Televisión interactiva - Dispositivo móvil	I
Tseng, Hsu & Chuang, (2013)	M	Mixta	Taiwan	Nube - Sensores- Dispositivo Móvil - PC	I
Scandurra , Sjölinder (2013)	A	Mixta	Suecia	Televisión Interactiva - Dispositivo Móvil	I
Godard, Pecci & Isokoski (2013)	A	Mixta	Francia, Finlandia	Kinect- Televisión Interactiva- Dispositivo Móvil	P
Trujillo, Muñoz & Villada (2013)	M	Mixta	Colombia	Kinect - Set Top Box - Dispositivo Móvil - PC	P
Stojmenova , et al., (2013)	A	Mixta	Eslovenia	Nube - Sensores - Televisión interactiva -Dispositivo móvil - PC	P
Epelde (2013)	M	Mixta	España, Alemania, Reino Unido	Sensores-Televisión interactiva -Dispositivo móvil - PC	I
Aal, et al., (2014)	M	Mixta	Alemania, España, Australia	Nube - Televisión Interactiva - Dispositivo Móvil	P
Molina,et al., (2014)	R	Mixta	EE.UU., Brasil, Portugal, Australia, Canadá	Kinect - Nube - Sensores	EF
Johnson, et al., (2014)	M	Mixta	Países Bajos, Italia, Alemania, Austria	Nube-Sensores - Dispositivo Móvil- Bluetooh	P

Referencia	Aplicación	Metodología	País	Tecnologías	Estado
Silva, de Abreu, & Pacheco (2014)	A	Mixta	Portugal	Televisión Interactiva	P
Park, et al., (2014)	M	Mixta	Corea del Sur	Sensores - Dispositivo Móvil	P
Konstantinidis, et al., (2016)	R	Mixta	Grecia	Audífonos - Sensores-PC	I
Miyoshi, et al., (2015)	R	Mixta	Japón	Televisión Interactiva-Dispositivo Móvil	P
Nazário, et al., (2015)	M	Mixta	Brasil	Nube- Sensores- Dispositivo Móvil	I
Ojetola, Gaura & Brusey (2015)	M	Mixta	Inglaterra, Reino Unido	Sensores - Dispositivo Móvil - Bluetooh	I
Añaños (2015)	M	Mixta	España	Nube- Televisión Interactiva-Dispositivo Móvil	I
Cisneros Perdomo, et al.,(2015).	R	Mixta	Cuba	PC	EF
Luna-García, (2015)	A	Mixta	México	PC	I
Saracchini, (2015)	A	Mixta	España	Nube - set Top Box - Televisión Digital-Dispositivo móvil	I
Suyama, (2016)	A	Mixta	Japón	Nube - Sensores - Dispositivo Móvil - Bluetooh	EF
Ren, et al., (2016)	M	Mixta	Países Bajos	Nube- Sensores- Dispositivo Móvil	P
Anastasiou, Giokas & Koutsouris (2016)	M	Mixta	Grecia	Dispositivo Móvil	I
Dulva Hina, et al., (2016)	M	Mixta	Francia	Dispositivo Móvil	I
Lo Bianco, et al., (2016)	M	Cualitativa	Australia	Sensores - Dispositivo Móvil-Bluetooh	P
Santana & Anido (2016)	A	Mixta	México, España	Televisión Interactiva	P
Blanco (2016)	M	Mixta	España	Sensores - Televisión Interactiva - Bluetooh	I
Muntaner, et al., (2016)	M	Mixta	España	Nube - Sensores - Dispositivo móvil - Bluetooh	EF

Referencia	Aplicación	Metodología	País	Tecnologías	Estado
Santana-Mancilla (2017)	M	Mixta	México	Set Top Box - Televisión Interactiva	P
Palacio, et al.,(2017)	M	Mixta	México	Kinect - Nube - Sensores - Dispositivo Móvil	EF
Kyriazakos, et al.,(2017)	M	Mixta	Austria, Italia, Dinamarca, Países Bajos	Nube -Dispositivo Móvil	I
Tsiachri Renta, et al., (2017)	A	Mixta	Grecia, Canadá	Nube- Sensores- Dispositivo Móvil	I
Ribeiro, et al., (2017)	A	Mixta	Portugal	Kinect - Nube - Sensores - Televisión Interactiva- Dispositivo Móvil - Software- PC	P
Takayuki Suyama(2017)	A	Mixta	Japón	Nube- Sensores- Dispositivo Móvil - Bluetooh	I
Orso, et al., (2017)	A	Mixta	España, Italia	Set Top Box - Sensores - Televisión interactiva - PC	P
Palipana, et a., (2018)	M	Mixta	Irlanda	Sensores - Dispositivo Móvil - Bluetooth	P
Matthies, et al., (2018)	M	Mixta	Alemania, Nueva Zelanda	Sensores - Dispositivo Móvil- Bluetooh	P
Sáenz-de-Urturi & Santos (2018)	R	Mixta	España	Kinect - Nube - Sensores - Dispositivo Móvil	I
Philipp Urbauer, et al.,(2018)	A	Mixta	Austria	Sensores - Dispositivo Móvil - Bluetooh -	P
Parvaneh Parvin,et al., (2018)	A	Cuantitativa	Italia	Nube- Sensores - Dispositivo Móvil - Bluetooh	I
Netto & Tateyama (2018)	A	Mixta	Brasil	Nube - Sensores - Dispositivo móvil	P
Toribio-Guzmán, et al., (2018)	R	Mixta	España	PC	I
Al-khafajiy, et al., (2019)	M	Mixta	Inglaterra, Reino Unido	Nube - Sensores - Dispositivo Móvil -Bluetooh	I
Rao. (2019)	M	Mixta	EE.UU.	Sensores	EF

La tabla 4 presenta los estudios en que las TIC contribuyen al envejecimiento activo y saludable en particular a través del ejercicio, de los cuales se extrajo el tema, el objetivo y el resultado de la experiencia.

Tabla 4. Caracterización de los artículos que promueven el ejercicio físico

Ref.	Tema	Objetivo	Resultado
Rao. (2019)	Tecnología de sensor portátil para medir la actividad física (PA) en los ancianos.	Investigar el uso de dispositivos wearable para medir actividades físicas de adultos mayores	Se identificó brechas en sensores para adultos mayores (no existen sensores, algoritmos y estándares para medir tipo de actividad física y no ambulatoria, entre otros).
Molina,et al., (2014)	Realidad virtual utilizando juegos para mejorar el funcionamiento físico en adultos mayores: una revisión sistemática	Estudiar la efectividad de Realidad virtual en juegos para el funcionamiento físico en adultos mayores	Estudio comparativo de mejores ejercicios para aplicaciones exergames en adultos mayores
Ojetola, Gaura & Brusey (2015)	Conjunto de datos para eventos de otoño y actividades diarias desde inercial Sensores.	Elaborar un sistema de detección de caídas mediante sensores.	Se desarrolló protocolos para caídas en tiempo real a través de un algoritmo de aprendizaje de máquina.
Palipana, et a., (2018)	FallDeFi: Detección ubicua de caídas mediante dispositivos Wi-Fi de productos básicos	Elaborar un sistema de detección de caídas mediante sensores WiFi.	El P pre-entrenado permitió incorporar técnicas que sirvieron para detectar caídas a través de WiFi CSI.
Ren, et al., (2016)	FLOW Pillow: Explorando Sentarse, experiencia hacia el envejecimiento activo.	Desarrollar una app innovadores para permitir el ejercicio en adultos mayores	El P de alta inmersividad solo permitió realizar ejercicios de baja intensidad en adultos mayores.
Dulva Hina, et al., (2016)	Juego serio: autonomía y mejor salud para las personas mayores.	Desarrollar un juego que promueva actividades físicas y mentales en adultos mayores.	A través de los Videojuegos diseñados para jubilados demostró obtener un grado de aceptación alto por adultos permitiendo mejorar la autonomía física.
Lo Bianco, et al., (2016)	Una perspectiva de la industria de la salud sobre la realidad aumentada como herramienta de comunicación en la prevención de caídas en ancianos.	Uso de Realidad Aumentada para prevención de caídas en adultos mayores.	La aplicación se centró en necesidades de adultos mayores permitiendo establecer comunicación bidireccional para identificar cambios estructurales en una casa.
Cisneros Perdomo, et al.,(2015)	Eficacia de la plataforma Cobs en trastornos de equilibrio, postura y marcha del adulto mayor.	Evaluar usabilidad de aplicación Cobs en adultos mayores	Grupo experimental con la plataforma Cobs predominaron las alteraciones del equilibrio sentado, de pie e inclinación de la parte superior del cuerpo. Grupo de control usando el método clínico predomino las pruebas de estación unipodal y "levántate y camina".

Ref.	Tema	Objetivo	Resultado
Muntaner, et al., (2016)	Efectos de un programa de entrenamiento presencial vs prescripción a través de una aplicación móvil en personas mayores.	Comparar la efectividad de un programa físico presencial con una aplicación a distancia móvil.	No se observaron diferencias significativas en ninguna en el grupo móvil. Los resultados sugieren que el ejercicio dirigido es más efectivo. Futuros estudios que impliquen muestras de mayor tamaño deben confirmar o refutar estos resultados.
Trujillo, Muñoz & Villada (2013)	Exergames: una herramienta tecnológica para la actividad física.	Determinar la factibilidad de uso de exergames como una herramienta de actividad física.	Se concluye que es una forma dinámica de realizar actividades físicas por adultos mayores por lo que tuvo gran aceptación la app exergame.
Konstantinidis, et al., (2016)	Diseño, implementación y amplia implementación piloto de FitForAll: una plataforma de ejercicio fácil de usar que mejora la condición física y la calidad de vida de las personas mayores	Analizar la usabilidad de la plataforma FitForAll (FFA), la adherencia del usuario al ejercicio y la eficacia del diseño.	Se aplicaron nuevos estándares en la plataforma exergaming para ser evaluada de forma intensiva con más de 100 participantes.

En relación a la PI4, los estudios que utilizan la TVDi en los adultos mayores para atender su salud se resumen en la tabla 5 donde se extrajo el tema, el objetivo de la experiencia y los resultados obtenidos en la experiencia.

Tabla 5 Caracterización de los artículos sobre TVDi

Ref.	Tema	Objetivo	Resultado
Santana-Mancilla (2017)	La aceptación tecnológica de una plataforma de TV para personas mayores que viven solas o en hogares de ancianos públicos.	Desarrollar una aplicación TVDi que sirve de recordatorio para los adultos mayores.	La adopción de esta aplicación TVDi fue muy aceptable por su público objetivo que permitió tener mayor control de actividades diarias realizadas por adultos mayores.
Aal, et al., (2014)	Una solución iTV preventiva contra caídas para adultos mayores.	Diseñar un sistema de entrenamiento para predecir y prevenir caídas en adultos mayores.	Usuarios prefirieron utilizar aplicación a través de instrucciones orales (control remoto es obsoleto por sus teclas pequeñas)
Scandurra , Sjölinder (2013)	Diseño participativo con personas mayores: Diseño del futuro Servicios y refinamientos iterativos de servicios de eSalud interactivos para personas mayores	Desarrollar una aplicación TVDi enfocada en: actividades cognitivas, actividades físicas y actividades sociales.	Este sistema permitió establecer comunicación entre personal médico/adulto mayor, adulto mayor/jóvenes y entre adultos mayores promoviendo la inclusión social.

Ref.	Tema	Objetivo	Resultado
Silva, de Abreu, & Pacheco (2014)	El uso de un P de Wizard of Oz para la determinación de métodos automáticos de identificación de espectadores mayores.	Promover el envejecimiento activo a través de la creación de Wizard of Oz (control remoto para TVDi).	Se incorpora un elemento novel (Wizard of Oz) para facilitar la personalizacion de contenido TVDi.
Santana & Anido (2016)	Evaluación heurística de un sistema de televisión interactiva para facilitar el cuidado en el hogar de ancianos.	Evaluar la usabilidad de aplicaciones TVDi siguiendo escala heurística.	iTVCare demuestra ser una aplicación interactiva con interfaz intuitiva y que siguió lineamientos heurísticos durante la fase de desarrollo para sobrellevar problemas de adultos mayores.
Ribeiro, et al., (2017)	Solicitud para adultos mayores para pedir ayuda a voluntarios a través de la televisión: diseño y evaluación de un P de alta fidelidad visual.	Elaborar una app TVDi que permita voluntariado entre adultos mayores.	Se evaluó el diseño de la interfaz en sesiones de evaluación heurística y pruebas de usuario, los primeros fueron apoyados por una lista de heurísticas, extraído de otros esquemas utilizadas en investigaciones recientes y adaptadas al contexto del estudio.
Blanco (2016)	Buenas prácticas del Proyecto Piloto Enred@te: red social digital para personas mayores y voluntariado de la Cruz Roja Española.	Promover el voluntariado a través de una aplicación de video-comunicación (TVDi).	Los tres perfiles: participantes, usuarios, voluntarios y técnicos evaluaron la calidad de la video-comunicación, al utilizar 4G y 3G, en ocasiones en localizaciones fue de escasa cobertura.
Añaños (2015)	La tecnología del «EyeTracker» en adultos mayores: cómo se atienden y procesan los contenidos integrados de televisión.	Comparar la efectividad de eyetracker en adultos mayores y jóvenes para su uso en TVDi.	Adultos mayores presentaron dificultades al procesar y reconocer información en TVDi en comparación con jóvenes.
Godard, Pecci & Isokoski (2013)	WeSlide: Entrada de texto gestual para usuarios mayores	Elaborar una técnica de gestión para ingreso de datos en TVDi.	Se comparó WeSlide con otros dispositivos y se concluye que este método de ingreso de texto es amigable con el paciente.
Orso, et al., (2017)	Contenido multimedia interactivo para adultos mayores: el caso de SeniorChannel	Analizar si SeniorChannel se adapta a las necesidades (por ejemplo: usabilidad, accesibilidad, entre otros) de adultos mayores.	La aplicación TVDi permitió que los adultos mayores no sean un espectador pasivo promoviendo varias actividades físicas. Presentao un conjunto de guías para el diseño de aplicación TVDi.

Ref.	Tema	Objetivo	Resultado
Picking, et al., (2012)	El proyecto Easyline+: evaluación de una interfaz de usuario desarrollada para mejorar la vida independiente de personas mayores	Ayudar en la interacción entre adultos mayores con objetos de cocina.	El uso del producto siguió estrictos lineamientos éticos y de usabilidad.
Stojmenova, et al., (2013)	Soluciones de vivienda asistida para personas mayores a través de la TV interactiva	Desarrollar una aplicación TVDi capaz de recordar a adultos mayores hora de prescripción y posología	La aplicación fue amigable con el usuario con una interfaz intuitiva.
Spinsante & Gambi (2012)	Proporcionar servicios interactivos de acceso universal a través de televisores: implementación y validación con usuarios mayores.	Desarrollar una aplicación TVDi que incorpore nuevas funcionalidades (videoconferencia y voz) para asistir a adultos mayores.	Aplicación TVDi interactiva que permite personalizar GUI.
Miyoshi, et al., (2015)	Sistema inteligente de capacitación en rehabilitación de viviendas y hogares mediante un televisor interactivo.	Desarrollar una aplicación TVDi de rehabilitación casera para adultos mayores.	Toma de muestras médicas (presión y sangre) antes y después de usar aplicación. Se demuestra que el uso de aplicación ayuda a mejorar estos indicadores y la actividad física.
Epelde (2013)	Proporcionar servicios interactivos de acceso universal a través de televisores: implementación y validación con usuarios mayores	Desarrollar una aplicación TVDi que incorpore nuevas funcionalidades (videoconferencia y voz) para asistir a adultos mayores	Aplicación TVDi interactiva que permite incorpora conceptos de Inteligencia de Ambientes

3 Resultados

3.1 Año de publicación

La figura 1 muestra la distribución de los trabajos en años, incrementándose ligeramente desde 2012 (10%) a 2016 (17%) manteniendo un 15% en 2017 y 2018 (15%) y el porcentaje de 5% del primer cuatrimestre de 2019.

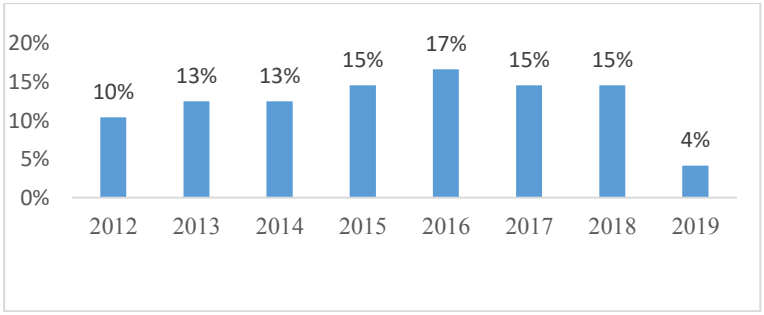

Fig. 1. Estudios agrupados por año de publicación

3.2 Uso de las TICs

La utilización de las diferentes TIC utilizadas para fomentar que el adulto mayor cuide su salud se muestra en la figura 2, observándose el empleo con mayor frecuencia del dispositivo móvil, sensores y plataformas web para el servicio de la salud. Una mayoría de estudios utilizan dispositivos móviles (27%), los cuales permiten aumentar la autonomía del adulto mayor. En segundo lugar, un 22% de los estudios utilizan sensores que permiten al adulto mayor moverse libremente con control. En tercer lugar en un 16% de estudios utilizan aplicaciones en la nube (16%). En particular el 11% de los estudios hace uso de la TVDi.

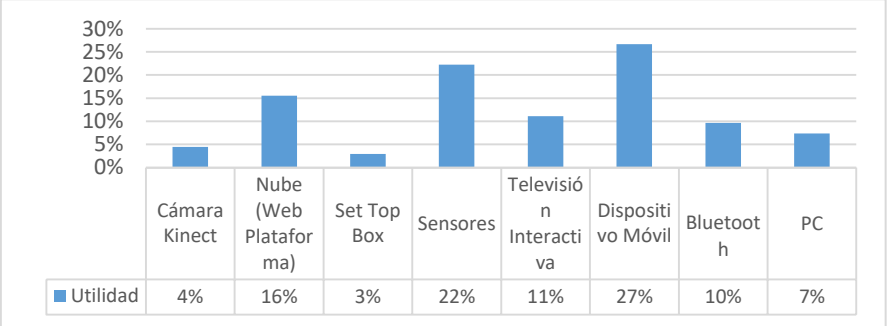

Fig. 2. TIC que utilizaron los estudios

3.3 Distribución de los estudios por países

La figura 3 presenta la población donde se realizaron las investigaciones agrupadas por continentes. En algunos casos de estudios se realizaron en países de diferentes continentes. La mayoría de los estudios se centran con un porcentaje del 50% en países de Europa (Alemania, Dinamarca, Eslovenia, España, Finlandia, Francia, Gales, Grecia, Inglaterra, Irlanda, Italia, Portugal, Reino Unido, Suecia, Austria, Países Bajos). Un 17% de los estudios se realizaron en países de América

(Brasil, Canadá, Colombia, Cuba, Estados Unidos, México); Asia alcanzo el 15% agrupada en (China, Corea del Sur, Japón, Singapur, Taiwán); el 4% en países de Oceanía (Australia, Nueva Zelanda. Los estudios que se ejecutaron en países de diferentes continentes, da como resultado que el 8% es entre América y Europa; el 4% Europa y Oceanía y el 2% América, Europa y Oceanía. En estos casos los investigadores buscaban diferentes aportaciones que permitan conocer el trabajo investigativo y su colaboración científica para el empleo del adulto mayor en diversidad entre países.

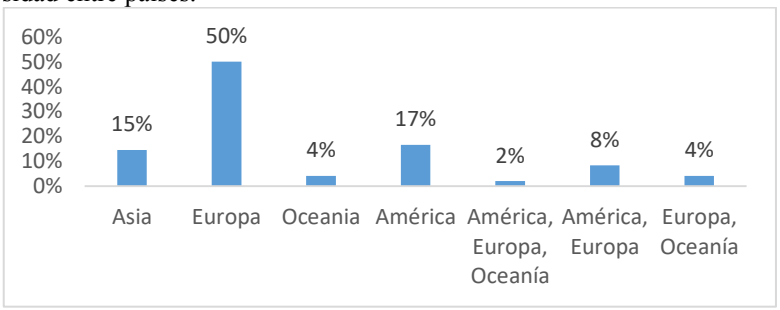

Fig. 3. Distribución de la población por continentes

3.4 Clasificación de los estudios por tipo de aplicación

Se puede ver en la figura 4 que casi la mitad de los estudios (47.92%) se utiliza con la funcionabilidad de monitoreo (M), seguido del 39.58% para asistencia (A) y con un porcentaje de 12.50% para rehabilitación (R).

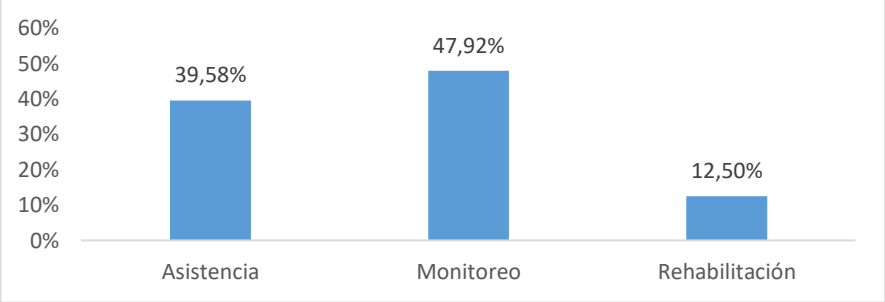

Fig. 4. Distribución de artículos seleccionados por tipo de aplicación

3.5 Clasificación de los estudios por estado de desarrollo y metodología

Sobre el estado de desarrollo que alcanzaron los estudios analizados se evidencia que el 41.67% de los estudios son aplicaciones implementadas y puestas en marcha en lugares que permitieron el seguimiento interviniendo un equipo

multidisciplinario entre los cuales se incluye personal médico y cuidadores. El 39.58% se trata de prototipos desarrollados que aún falta incorporarles alguna funcionalidad por lo que se probó su utilidad o beneficio para facilitar la intervención. Finalmente el 18.75% que refiere a estudios de factibilidad en el empleo de los recursos o herramientas necesarias para determinar si un grupo de adultos mayores que sufren o padecen de problemas de salud están dispuestos a probar una estrategia o aplicación que le contribuya en la reintegración a la sociedad (figura 5).

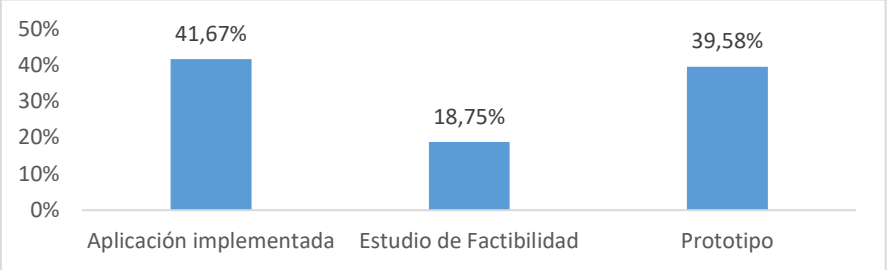

Fig. 5. Distribución del estado de desarrollo según los artículos seleccionados

En relación a la metodología del estudio se observa que el 94% presenta un abordaje mixto (cualitativo y cuantitativo), el 4% cualitativa y el 2% cuantitativo.

4 Conclusiones y trabajos futuros

Se ha presentado una revisión de las TIC orientadas al adulto mayor con el propósito de estar al tanto de las herramientas que han sido aplicadas para su envejecimiento activo. Los resultados permitieron conocer que existe diversidad de soluciones teniendo funcionalidades de tipo asistencia, monitoreo, y rehabilitación. Se hizo especial foco en los estudios que promueven el ejercicio físico en el adulto mayor ayudándoles a fortalecer su condición en la movilidad.

Los estudios emplearon mayoritariamente dispositivos móviles, sensores de movimiento, y aplicaciones en la nube. Se hizo especial foco en los estudios que utilizan la televisión digital interactiva como medio para promover el cuidado de la salud del adulto mayor.

La tecnología adoptada para ser utilizada por el adulto mayor en los servicios de salud permite reflejar la práctica de auto-asistencia, manteniendo un equilibrio entre la inserción de maquinaria tecnológica y el mantenimiento de la humanización del cuidado. Las soluciones analizadas permitieron contribuir a mejorar la calidad de vida del adulto mayor mediante el empoderamiento, evidenciando que la tecnología cumple un rol significativo dentro del ser humano en cualquier etapa de su vida.

El presente estudio sirve como punto de partida para el trabajo que se está actualmente desarrollando sobre el uso de la televisión digital interactiva para

promover ejercicios que ayuden a la condición funcional de la marcha para el adulto mayor.

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Mobility in a Crossmedia Environment Capable of Generating Personalized Informal Learning Contents from iTV, PC and Mobile Devices

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Abstract. iTV has been gaining increasing attention from researchers, TV operators and the general public, due to its potential in entertainment, learning, and many other areas, made possible by technological advances, the convergence tendency and better interface and services design. The convergence tendency, which resulted in the use of different devices as part of the same crossmedia environment, has created new opportunities to support a multiplicity of contexts of use, as for instance, the ones associated with learning. This paper addresses the effective design of crossmedia environments to generate personalized informal learning contents from iTV, PC and mobile devices with a special focus on mobile devices. It presents the opportunities and challenges of the inclusion of mobile devices on this crossmedia environment designed and evaluated based on cognitive and affective aspects that influence the user experience. The system generates a crossmedia personalized informal learning content, through the form of a web-based content, which provides extra information about users' selected topics of interest while watching a specific video. The web content may be generated and accessed through iTV, PC and mobile devices and, depending on the users' needs, viewed immediately or stored for latter view, individually or simultaneously, from the same devices. An evaluation was carried out with high fidelity prototypes with a special focus on mobile devices. The achieved results were very good considering that they helped rethink our mobile related assumptions and they showed that the integration of mobile devices on the environment was a success.

Keywords: Mobility, Crossmedia, iTV.

1 Introduction

The proliferation of new devices able to support human activities across a range of contextual settings [1] is one of the main motivations for media integration in what is

designated as Crossmedia or Transmedia environments [2]. These environments, based in the integration and co-existence of various media technologies with an integrated and specific purpose are becoming increasingly popular due to their flexibility and mobility. They create new opportunities for the generalization of communicational practices, as those associated with formal and informal learning and information access, which are becoming more relevant considering the importance of lifelong learning [3] and the pervasive nature of media technologies and devices.

Video is a very rich medium to support learning, and TV, PC and, more recently, mobile devices are privileged ways to access it. Through structure and interaction, these devices can open the door to flexible environments that can access video and integrate it with different media, accessible from different devices, adequate to support different cognitive modes and learning processes in several contexts. In spite of their valuable potential to create rich and flexible environments, the design of these crossmedia systems faces some challenges that may affect their effective use. Some of the proposed systems failed because too much effort was put into technical details, leaving behind crossmedia conceptual aspects such as interaction and service design based on: cognitive processes, usability, user experience, contextualization, continuity, media affordances, and device characteristics.

Our main concern is to focus also and mainly on these aspects, while studying and understanding this emerging paradigm, where research has not been complete [1][4]. Our eiTV application has been designed and developed to illustrate our research and has been through an evolution process of 3 generations of prototypes, all ranging from low to high fidelity prototypes. The third generation prototypes, presented in this paper, were the richer ones in terms of devices and functionalities involved, which increased to match a more flexible perspective. These third generation prototypes fully support mobile devices and contexts of use. Running from iTV, PC and mobile devices, it provides users with the possibility to choose, from a video, usually watched in a more experiential cognitive mode (which allows us to perceive and react to events naturally), which topics they would want to know more about. They may also choose with which level of detail, and later decide when and where they would want to access those extra related contents (a web-based content), in a more reflective mode (the mode of thought), and with whom they would want to share them with, having the adequate support from the application in the different access contexts. Important to refer that the mentioned generated web-based extra related content, also referred to as a personalized informal learning content, will be referred along the text, simply, as web content. The architecture and the main features available in iTV and PC contexts were already explored and described in previous publications [5][6][7], this paper will focus on the introduction of mobile devices and their specific functionalities and design in this crossmedia video-based environment.

After this introduction, Section 2 includes a review of related work and concepts, Section 3 describes the design challenges of crossmedia applications and mobile devices in that context, Section 4 presents the design decisions on the crossmedia eiTV mobile device module, evaluated in Section 5. Finally, Section 6 presents the conclusions and perspectives for future research and developments.

2 Related Work

This section addresses some of the more relevant related research studies in Crossmedia environments that include mobile devices.

The TAMALLE project [8] developed a 'dual device system' for informal English language learning, based on watching iTV and selecting what to access later on mobile phones. This was an interesting system capable to accommodate different cognitive modes and different contexts of use, especially, if considering the mobile phone possibilities. Obrist et al. [9] developed a "6 key navigation model" and its interface for an electronic program guide running on the TV, PC and mobile phone. The different devices were not used in a complementary way since the intention was to test a similar interface, on three different devices. They have perceived that viewers prefer a reduced number of navigation keys and a unified UI with the same functionalities across devices. This confirmed our prototypes UI design last decisions. Newstream [10] provides extra information about what is being watched and related websites, using TV, PC and mobiles. Depending on the viewers' needs, that extra information may be viewed immediately, stored for later view or pushed to other device. Each device maintains awareness of each other and are able to: move interaction to the device that makes the most sense in a specific context, use several devices simultaneously, and use the mobile device as a remote to the TV and PC. Limitations include: the system relies almost exclusively on social networks to receive and share content, for interaction and dialogues; and the limited viewer direct influence on the new contents presented as extra information. Our work is more flexible in these concerns. 2BEON [11] is an iTV application which supports the communication between viewers, textually and in real time, while watching a specific program. It also allows viewers to see which of their contacts are online, which programs they are watching, and instant messaging on the iTV, demonstrated to be important to give viewers a sense of presence. Currently called WeOnTV, it is being implemented with smartphones as "secondary input devices", soon to be distributed by one of the most popular Portuguese TV cable companies. This work demonstrates the importance of sharing information with viewers' contacts about what they are watching on TV, which supports our own decision of including a sharing functionality in eiTV.

3 Design Challenges

This section describes the central aspects, cognitive and affective, that need to be considered to effectively design crossmedia services and interfaces, with a special focus on the design challenges associated with video and mobile devices.

3.1 Crossmedia Design Challenges

Media and Cognition: Norman's view [12] defines two fundamental cognitive modes. The experiential mode allows us to perceive and react to events naturally and without cognition, but require different technological support, and the medium affects the way

we interpret and use the message and its impact on us. For example, TV and video are typically watched in an experiential mode, but learning strongly relies on reflection. A successful integration of media should have into account what each medium and device is most suited for in each context of use, augmenting and complementing their capabilities in a flexible combination.

Crossmedia Interaction, Conceptual Model and User Experience: the main challenges of crossmedia interaction design described by [13] include: consistency, interoperability, and technological literacy needed for the different devices. The conceptual model, how the software will look like and act, is also a very important aspect, since several interaction scenarios and contexts are involved [14]. The quality of the interaction cannot be measured only by the quality of its parts, but as a whole. In this context, the user experience (UX) may be evaluated through how well it supports the synergic use of each medium and the different kinds of affordances involved, also understanding what makes the user pass the current medium boundaries to use other media as well. According to [15], the UX may involve the isolated perception of the medium (distributed), one of the biggest barriers to its efficient use and adoption, or the perception of the system as a whole unity (coherent). According to [16], the UX evaluation methods and measures relevant, when ubiquitous TV is involved, are: physiological data; data mining, log files, observation, case studies, lab experiments, experience sampling method, probes, diaries, interviews, surveys and focus groups. The combination of methods to use depends on each specific case.

Supporting Crossmedia HCI: In this context, the migration of tasks is supported via crossmedia usability and continuity, influencing on how well and smoothly users' skills and experiences are transferred across the different devices [17]. The consistent look and feel across media is an important requirement, even if it should not limit the goal of having each medium doing what it is most suited for and extending its characteristics (synergic use) [18].

Designing for Different Devices and Contexts of Use: Crossmedia design involves designing interfaces for different devices. To understand the devices, and have each device doing what it is most suited for, the best approach is usually to study each particular situation, including device characteristics and cognitive and affective aspects associated to its use: why people use them, in which mode, compare them, etc., and the design guidelines for each device [6] followed by an adequate combination.

3.2 Mobile Devices Design Challenges

Interactive systems design has always been a hard task considering the diversity of factors that were involved and thus requiring the designer's attention, ranging from the final users needs to the context in which the solution is going to be used. More recently, the appearance of mobile and ubiquitous computing supported through different and new devices, and as in our particular case as part of a crossmedia application, contributed to a substantial increase of opportunities and challenges associated with the design process for these new devices.

Due to the specific characteristics of mobile devices, namely, their ubiquitous and permanent nature, small dimensions, several interaction modalities, the multiplicity of

possible contexts of use, these devices interfaces are becoming extremely hard to design, but nevertheless very desirable in many contexts, and in particular in our application, due to their flexibility, mobility and location awareness.

As to the main challenges of mobile devices design, they are spread through the design process phases [19]:

1) *Analysis and requirements recoil:* on mobile scenarios where the use of the mobile device or application is constantly based on mutational contexts, where users may be walking and passing through different places and environments, the recoil of requirements is a difficult task and needs a specific approach;

2) *Prototyping:* prototyping techniques that support the construction and evaluation of prototypes in realistic scenarios is needed. In general terms, all components (device prototype and UI prototype) must be as faithful to the original as possible;

3) *Evaluation:* Recent research experiences suggest that given their intensive and pervasive use, mobile devices and correspondent applications should be evaluated on multiple and realistic settings [20]. There are also design guidelines for mobile devices that we took into account. For example, Brewster's [21] set of guidelines to overcome the limited screen space, Kar et al. [22] guidelines about the system's usability, Sánchez et al [23] navigational hints to the construction of mobile web pages, and Apple [24] guidelines for SmartPhones.

4 Mobile Devices Design in eiTV

This Section presents main functionalities and design options concerning mobile devices in the eiTV Crossmedia system, in response to the challenges identified in Section 3.

4.1 Mobile Devices Design Process

As stated by several authors, when designing applications and interfaces to mobile devices, the design and development process should be transported out of the laboratory [19], which was exactly what we did, along with taking into account the design challenges and guidelines addressed in Section 3, in addition to traditional design guidelines in User-Centered Design methodologies. The specific mobile device challenges identified in Section 3 were addressed as follows:

In the Analysis and requirements recoil phase: It was decided to pay attention to the user behaviour changes according to the surrounding environment, the variables that trigger the changes and how they affect usability. For this, we used [19]: contextual scenarios, scenario transitions, and scenario variables (location and settings; movement and posture; workloads distractions and activities; devices and usages; users and personas).

In Prototyping: we separated the physical prototype (the device) and the GUI prototype while building a realistic graphical UI in the high-fidelity prototypes. Real devices (TV, PC and mobile) were used and all the functionalities were implemented in breadth and depth. The *evaluation* is described in Section 5.

4.2 Mobile Devices Functionalities

In the mobile devices, the central functionalities of the eiTV system are present: Create, Search, Share and Profile. These functionalities are available: at the 'departure point', which occurs while watching the video and generating the web content, and at the 'arrival point', when accessing/editing/etc. the generated web content. Although these functionalities allow the same actions as on iTV and PCs, they were not provided exactly in the same way, considering the different devices characteristics. To briefly remind these central functionalities: Create allows users to watch videos and select topics of interest to create further information; the Search functionality searches videos based on different criteria and allows to watch them, and edit the associated generated web content if there is one; the Share functionality allows sharing the generated web content, or retrieved video, with user's contacts; and the User Profile contains personal data in order to personalize the generated web contents.

In order to have each device doing what it is most suited for, contexts of use, device characteristics and cognitive and affective aspects associated to its use were studied. In what concerns to *specific mobile devices functionalities*, after this study, the following were made available:

1) *Great flexibility and mobility* (use it everywhere, anytime, anyway): when using the TV, the scroll is not an option, but that does not happen when using the other devices; contrary to TV and PC, mobile devices may be used everywhere, even when users are standing up, mining that any extra time may be used (if waiting for a medical appointment, in a bus queue, while in the train, etc);

2) *Location-based search using the GPS functionality*: the search functionality allows users to search videos related to their current location. As an example, when near the liberty statue the user may use this functionality to search, from its own system and the internet, videos related to that specific spot (this type of video files need to be inserted when using iTV or PC);

3) *Add immediately, or latter, shot pictures or videos,* that may be *related,* to the video being watched, as additional information to the web content or, instead, really integrated as part of the web content.

4.3 Mobile Devices Design Options

As part of a larger crossmedia system, the design challenges identified in Section 3 were considered in the mobile devices design module. As to the cognition modes, all functionalities (central or specific to mobile contexts) were designed to accommodate users' changes in cognition modes, attention levels, and different levels of technological literacy or preferences. Namely: they may be more or less intrusive of the video watching experience, designed with 3 different information levels, ranging from less to more intrusive and informational (see **¡Error! No se encuentra el origen de la referencia.**), prepared to be viewed immediately or latter, overlaid or embedded on-screen, etc; if viewers turn off the device when in the middle of generating a web content, all the selected topics, will be stored and the web content will be generated; the user has a simplified navigation layout that takes advantage of the typical

smartphones navigation characteristics as the scroll bar, tactile screen, etc. Thus, a simplified interface, when compared to the other devices (PC and iTV), was possible. Nevertheless different levels of intrusion were made available; on the search functionality, a specific location may be inserted through text or through the GPS of the mobile device; shot pictures or videos (stored or capture at that time) may be inserted as additional information to a web content at any moment.

Fig. 1. eiTV Mobile Interface *Create* functionality (a); topics selection interface with the information level 2 activated (b); aditional information immediately presented when a topic is selected by the user and the information level 2 is activated (c); interface to the addition of files captured on the moment to the web content being created (d); interface of the generated web content, based on the users selected topics (b-e)

Consistency in UX and the perception of the system as a whole coherent unity independently of the device being used was also a priority. In spite of having considered the mobile device characteristics and contexts of use in the design, towards a more simplified design, we decided to keep a coherent layout in terms of colours, symbols and other graphic elements, as navigational buttons, in order to better contextualize

users, give them a sense of unity in their UX and to allow a smooth transition among media and devices. This way, it was possible to provide users with a sense of sequence and continuity, respect the context of use and be consistent in terms of look and feel and navigational options in all the devices, and to help the perception of the application as a unity. Users are aware that they may access their eiTV application through different devices whenever they create web contents, helping to conceptually understand the system as an 'ecosystem of devices'. An example of the resulting mobile module design interface is presented in **¡Error! No se encuentra el origen de la referencia.**. Considering that it is the main focus of this paper, but not the only one, the presented interactions (**¡Error! No se encuentra el origen de la referencia.**) are exclusively from mobile devices. However, this interaction proposal was already developed and tested on the other eiTV devices (iTV and PC), obviously taking into account these devices specific characteristics.

5 Evaluation

The UX evaluation methods and measures considered relevant for this specific case as a final evaluation were: observation, case studies, lab experiments, experience sampling method, questionnaires, interviews and focus groups.

The evaluation process started with a demonstration of the last tested high-fidelity prototype on a PC, in order to remind users and to create a sense of unity of the whole application. Then, users were asked to perform tasks that allowed using all the eiTV functionalities (central and also mobile specific ones, already described in Section 3), designed for mobile devices, through the prototype in three different contextual scenarios, and devices, with transitions between them. Users started using the prototype, by generating a web content, through iTV at a simulated 'living room' environment. The web content was later accessed, and personalized, via PC and mobile (in the same 'living room'). Then, they used the PC to generate a second web content which was later, viewed and personalized via TV and mobile (at the simulated 'living room'). Finally, they used the mobile to generate the third web content while seated at the school bar. Then, they moved to the school backyard, created a video and searched related videos by GPS coordinates (*Location-based search using the GPS functionality)* which were added to the web content in order to personalize it. Then, they entered the school and used the mobile to take a picture, add the metadata manually, and add the picture to the web content. Next, they moved to the bar and, standing up at the end of the bar queue (similar to other public queues), they personalized the web content with their GPS coordinates. Finally, they moved to the library that, although surrounded by people, is a quiet place (context similar to a medical clinic waiting room) in order to view the final web content and use the SEARCH functionality. Note that during the changes of context, the luminosity conditions, as well as the surround conditions (noise), changed when going from the building interior to the exterior, and vice versa. The interaction with the GUI high-fidelity prototype occurred, mainly, via the smartphone but also via PC and iTV. It is important to mention that the evaluation

process took place in real contexts of use, one of the most important factors to consider when testing crossmedia applications.

Finally, viewers were asked to fill a questionnaire and were interviewed. The questionnaire was based on the USE questionnaire (usefulness, satisfaction and ease of use) [25]; the NASA TLX questionnaire (cognitive overload) [26]; and usability heuristics. There were 30 participants, ranging from 19 to 55 years old, which were grouped into 3 evaluation groups: 10 students with high technological literacy; 10 students with medium technological literacy and 10 persons with poor technological literacy (on the three groups, 5 elements already participated on previous evaluation and 5 were new). Fifteen participants were the same that had participated in the last prototypes evaluation, to maintain a conceptual idea of the whole application, and allowing to ask for comparisons. As to the participants technological literacy categorization, it was possible via the use of a questionnaire with questions as: do you use Internet? e-mail? Facebook? How many hours a day? From which devices? Do you have a smartphone? Which functionalities do you use on your smartphone? etc. Results are presented next. At both the 'departure interface' (generate the web content through mobile device), and 'arrival interface' (access that web content) as presented in tables 1 and 2: The mobile interface was considered easier to learn than the TV and PC interfaces. At the 'departure interface', the TV and PC interfaces were considered more pleasant visually and better designed than the mobile interface. At the 'arrival interface', only the PC interface was considered more pleasant visually and better designed than the mobile interface. Important to note that, when compared with previous results from mixed-fidelity prototypes, these results are good.

Table 1. Evaluation of eiTV Overall Departure and Arrival Interfaces

eiTV Crossmedia System		Easy to learn	Visually pleasant	Well designed	Could be better
Departure Interface:	TV	73%	87%	73%	87%
	PC	80%	83%	80%	70%
	Mobile	93%	73%	60%	87%
Arrival Interface:	TV	63%	70%	67%	90%
	PC	87%	87%	80%	67%
	Mobile	93%	80%	73%	87%

In terms of information level, more users preferred level 1 (the less intrusive and less informational) on mobile and TV than on PC. This result stresses an increase in users preference to select additional info to access later on when they are watching video on the move with a mobile, when compared with TV or PC, where users already prefer this option not to interrupt the more experiential mode of watching videos.

Table 2. Evaluation of eiTV Overall Departure Interfaces (Information Levels)

eiTV Crossmedia System		Most used information level		
		1	2	3
Departure Interface:	TV	47%	40%	13%
	PC	37%	43%	20%

	Mobile	50%	33%	17%

In general, the central functionalities Create, Search, Share and Profile (see tables 3 and 4) were considered more interesting, ease to use and useful, than in previous tests with mixed-fidelity prototypes [27]. As to the most important ones in the context of the application (Create and Search) they were also considered more interesting. As to specific actions inherent to the use of mobile devices: all users appreciated the idea of mobility (100%), the possibility to use GPS in location-based searches (100%), and the possibility to add pictures and videos to the web content, at that particular moment or later, both related and unrelated to the video being watched (100%). Most functionalities were considered more difficult to use, if considering the smaller screen size and font (63%), but easier (87%) if considering the interaction mode (tactile screen versus mouse and remote). These aspects, along with having the access to the web content in the same device that created it, also influenced (decreased) the perceived need for contextualization at arrival.

Table 3. Evaluation of the Create and Search Functionalities from TV, PC and Mobile Departure Interfaces

Characteristics:	**Create**			**Search**		
	TV	**PC**	**Mobile**	**TV**	**PC**	**Mobile**
Interesting	87%	83%	93%	73%	70%	100%
Ease to use	80%	87%	67%	77%	87%	63%
Useful	87%	90%	100%	87%	80%	93%

Table 4. Evaluation of the Share and Profile Functionalities from TV, PC and Mobile Departure Interfaces

Characteristics:	**Share**			**Profile**		
	TV	**PC**	**Mobile**	**TV**	**PC**	**Mobile**
Interesting	77%	87%	83%	67%	63%	60%
Ease to use	73%	80%	73%	47%	73%	80%
Useful	77%	83%	93%	57%	73%	70%

It is important to mention that the intention of transmitting a sense of unity was achieved: 93% of the users referred that they immediately felt “inside” the same application, in spite of using a different device (table 5).

Table 5. Evaluation of Contextualization from Departure to Arrival Interfaces

	Sense unity	Context with video or image need	Context with video playing need
TV	80%	83%	77%
PC	80%	93%	73%
Mobile	**93%**	87%	60%

As a whole, the eiTV crossmedia application with the mobile devices was considered (table 6): more useful, easy to use, easy to learn, and more users would like to have it and would recommend it to a friend, when compared to having only iTV and PCs, with high percentages.

Table 6. Overall Evaluation of the Whole eiTV Crossmedia Application

Whole Application	Useful	Easy to use	Easy to learn	Like to have	Recommend
TV & PC	87%	73%	67%	87%	80%
TV&PC&Mobile	100%	77%	87%	100%	100%

In general, there was no substantial difference of opinion amongst the 3 evaluation groups. Nevertheless, it was possible to observe that the group with poor technological literacy, in general, took more time to accomplish the proposed tasks and asked more questions. However, like the other 2 groups, they all made it and the enthusiasm was the same. Interesting to note, no considerable differences were detected between the group with high technological literacy and the group with medium technological literacy. This may be explained by the fact that half of the participants had already participated on previous eiTV evaluations so they are, probably, more familiar with it.

6 Conclusions and Future Work

The evaluation results were very encouraging. In many aspects, the increased functionalities and flexibility inherent to the mobile context were perceived as useful and an added value in this crossmedia context (e.g., location-based search). Some design options allowed to accommodate the users cognitive mode changes (e.g., information levels), and the prototypes where designed and tested in real mobile scenarios and contexts of use. In general, the results showed that the integration of the mobile devices in the eiTV application was a success. Considering the design framework followed, the trends in the use of multiple devices, and the results of this and previous studies, we have reasons to believe that our goal for this crossmedia context is worth pursuing and that we can achieve quite good results with all the devices in different scenarios. As future work, we intend to explore the devices technological advances in order to create new functionalities capable to better support users needs, different cognitive modes and flexibility. A continuous improvement of the interfaces, so they may become easier to learn and adopted by an elderly population, is also a goal.

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@vamosjuntasporto: Instagram as protagonist in transmedia strategy to promote female tourism in Portugal

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Abstract. imagery-based narratives published on Instagram have great potential for engagement of the audiences, especially when there is a relevant quality in the audiovisual production. Combined with a transmedia strategy, it has the potential to offer an even more robust user experience, especially in tourism contexts. From this, the present study looked at how people interact with the imagery content on Instagram and how the combined use of different channels has been able to provide a complete and immersive user experience in both the digital and physical worlds. A transmedia campaign based on Instagram was created, targeting women to promote the city of Porto. After analyzing the main metrics and the opinions of followers of the project, it was found that the actions were effective in promoting routes and sights.

Keywords: transmedia, tourism, tourism feminism, Instagram, imagetic narrative.

1 Introduction

Image has occupied an increasingly central position in communication strategies. When faced with a photograph, the human brain makes different connections and is stimulated by the components that are there (colors, historical constructions, memories, elements of nature and people, among others). That is, the response is usually instantaneous and more impactful than when words are used [3]. Therefore, the imagetic narrative gains strength. Historically, this resource has always been used to record something in various situations of everyday life. It all started with paintings, then photography and advanced to film and television productions. Thus, the image gained even more strength, especially when combined with other features.

With the emergence of the internet in 1969 (but only popularized in the 1990s), imagery content multiplied across different channels, devices and formats. That is, it was even stronger and more present in people's lives. This digital

environment has given way to creating new ways of telling stories and engaging audiences. This happened, contrary to what was previously predicted, without ending the existing media. Such vehicles and platforms inspired the new, who, over time, developed their own characteristics. This phenomenon was named Convergence Culture [2] and made possible, within the narratives, to add elements to the whole. Thus, one medium began to complement the other (and not to nullify its history). However, despite any platform replacing the other, it is possible to notice a significant change in the way narratives are experienced. From the moment the mass media hegemony began to be broken by digital channels, headed by social networks, the public was invited to step out from behind the "curtains" to be the central participant. Granting this freedom to the public, however, comes up with a question: How can you ensure that you get involved in the story to the point where you want to move through its chapters without leaving midway? Transmedia narratives meet this kind of demand. It is a hypertextual and interactive format that allows viewers to put all their freedom and creativity into the content consumption experience [1]. For this, the author disposes the story in multiple platforms and formats. Each, in turn, has a very specific language as well as a defined role within a general context.

In the field of tourism, a central subject of the present study, companies and institutions (public and private) found in transmedia strategies a way to offer not only content to travelers, but a complete experience based on the material disseminated in both digital and physical environment. And in this context, Instagram, especially as an essentially imaginary social network, appears as a centerpiece in communication strategies and marketing campaigns. Manovich [5] defines it as a space for reorganization of a society that relied on images to establish and rescue relationships. This research aimed to make a transmedia narrative to understand the behavior of the public in the network and the ability to stimulate tourism.

2 From linear narrative to transmedia

A narrative is composed of distinct elements. It is up to the sender to choose the “pieces” that will be used to design the story and present it in the most appropriate way for the type of profile it wants to impact (its receiver). It is also the role of the narrator to opt for the channels that will enable it and at what times the information will be passed to the receivers [7]. Contrary to what has been common, especially with *old media*, today people can get the information they want at any time and place. Jenkins [2] states that they are always linked to a medium to search for this data. This means that convergence is not a simplified process, but a cultural transformation.

In this context, autonomy is in the hands of the user. Jenkins [2] also says that the public has the power to define where they want to follow the story, at what time and what kind of format is most appropriate. Thus, it can be seen that the transmedia narrative is born in response to the culture of convergence.

This type of narrative has a structure built from elements (with different formats, such as videos, comics and games, among others) distributed on different platforms, on or offline. It is the ability to encode or decode messages from a constant overlap of media and languages [9]. The viewer is then encouraged to go through all these

spaces in order to know the story and find complementary information to it. Murray [6] compared such an experience to a dive, as the narrative transports people to a completely different reality. For him, its purpose is to "flood" the mind of those who follow the narrative with stimuli and sensations. Following is a description of a campaign that encompasses all these aspects connected to real situations in a transmedia narrative in the field of tourism.

3 The campaign

The public uses social networks to seek information and inspiration about upcoming destinations[1]. This type of behavior is directly linked to Kehrwald's perception [8], who understands the power of images as a compilation of sensory, intellectual, neurological, cultural, emotional and economic components. According to her, a photo or video, which are the most common formats used for tourism promotion, are capable of arousing longings and desires in the human being. As such, they are key resources in the first step of the vacation process: a choice of destination. The tourist begins a journey even without leaving the place, just projecting himself in that space from the photographs he searches in the Internet [4].

Therefore, the collection of materials was a fundamental step. Making eye-catching photos and videos was essential, which required very detailed planning. Such a phase happened in stages. First, the city was defined based on official tourism-related numbers. Then we opted for an audience cut - the purpose of choosing a niche was to create something more personal that would bring people together through a real cause. From this, the platforms that integrate the narrative were defined and, consequently, the type of content that should be produced for each one of them. The next step was to define language, both visual and textual. In addition, the schedule for the collection of materials and the campaign's dissemination strategy also materialized at this stage. It was decided to focus the campaign on publicizing the city of Porto.

Regarding the audience, due to the increase of feminist movements and the relevance that the cause has gained in different platforms and channels, the defined segmentation was the female audience. The central objective, then, was to create a strategy that encouraged women to travel alone, based on a community focused on the exchange of experiences and stimuli.

From the content posted on the Instagram feed and related platforms, the project sought to stimulate the participation of other women. For this reason, the project was named *Vamos Juntas*[2] *('we are going together')*, as it stimulated the public to contribute with tips, comments, observations and experiences. The aim was to make the campaign an important network for support and partnership. Based on these definitions, three essential aspects were established. The first is the campaign's target audience, made up of women who like to travel, discover new places and accumulate experiences. The goal was to impact the female audience as a whole, without age distinctions or barriers, since the definite purpose is to create a group that

[1] Information extracted from data collected from the *Digital Channels in Travel* survey.

[2] Available in https://www.instagram.com/vamosjuntasporto/.

holds similar interests. Although the profile is aimed at the female audience, it also impacted men who are supporters of the feminist cause.

The second step was to define the channels or platforms to use: Instagram, YouTube[3], real world and our own website[4]. For all platforms and media mentioned above it was necessary to create specific content, able to engage the user and make him move through the narrative. Based on this, an initial planning of the audiovisual materials that should be developed for each platform was made. Such organization was fundamental to take advantage of all the photographic outputs and, thus, to supply the campaign with the content already framed in the previously defined formats.

Because it is a transmedia campaign, different initiatives were defined whose objective was to provide a real, integrated and immersive experience for the public. Therefore, all chosen platforms and media had a specific proposal, which intersected at predefined times in this planning phase.

1. Incentives to cross-visits to the different project channels. During the campaign this was observed in different situations: the Instagram stories (The most used medium for this purpose) provoked the curiosity of the followers through quizzes and curiosities; the site, as it contained additional information, was recommended in the Instagram posts as a mean to find extra content; for the physical environment posts made on Instagram suggested that the user went to the tourist spot in exchange for a rewarding real experience.
2. The central channel is Instagram, which concentrates the tourist routes divided by color. The user is able to follow the narrative linearly or nonlinearly, choosing only the colors that correspond to his route of interest.
3. By closely monitoring all Instagram posts and their Stories users were able to get the information and access exclusive content on YouTube.

Finally, the period was set. The campaign was planned for a total of 60 days (started on July 21 and ended on September 21). The longer period is justified by the feasibility of assessing the evolution of involvement as it is built gradually. Thus, it was possible to collect more genuine results than in a shorter period. The time of year chosen was the European summer, because it is when people are on vacation or are encouraged to travel.

One of the project's starting points was the segmentation of the script by themes. Thus, routes were created, represented by colors, as shown below. So, it was decided that the route would be divided into the following themes: outdoor walks (green color); gastronomy and night (red color); and culture (yellow color). Each image or video posted in the Instagram feed should have a highlighted color. In a restaurant tip, for example, the challenge was to find something with the red hue to include in the photographic composition. Thus, when the user entered the profile, he could readily identify which route the suggestion referred to. The same happened with the open-air programs, which should have green elements, and the cultural programs, which

[3] Available in: https://www.youtube.com/channel/UCHcIAThENcC1Ylab1txBxPA.
[4] Available in https://vamosjuntasporto.wordpress.com.

brought out the highlighted yellow. The colors mentioned above were strategically chosen because, together, they form the Portuguese flag, a characteristic designed to give the campaign a regional identity.

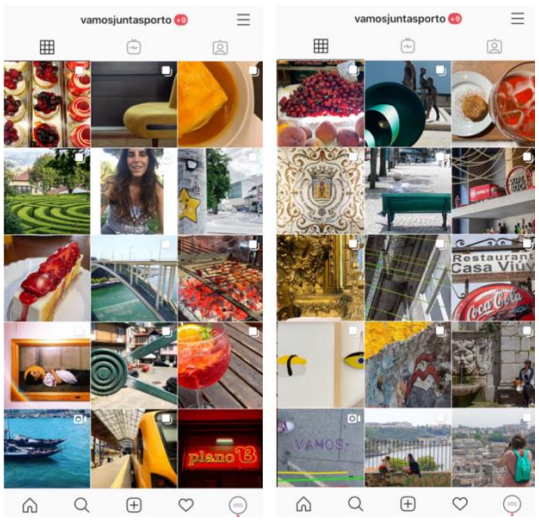

Figure 1 – Vamos Juntas' profile.

Regarding the published photos and videos, a special care was taken to bring impactful content that transported the user to a certain location (as shown in figure 2).

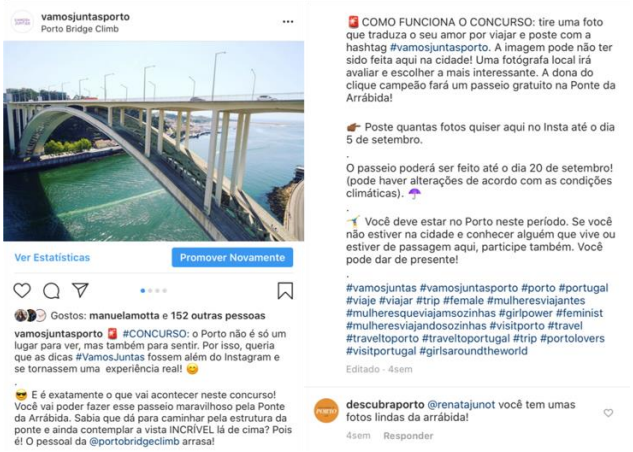

Figure 2 – Territorial transmedia experience.

All angles were analyzed so that the photographs showed the beauty of the place, but at the same time generated a curiosity that stimulated people to know the advertised spaces.

4 Complementary Platforms

The site was launched along with the start of spreading tips on Instagram. The platform's initial promotion came through a video posted on the feed and later gained reinforcement of weekly stories, extolling all the information that could be found on the page. The role of the platform was to bring additional data regarding the sights and reinforce the central objective of the campaign. Therefore, there was also a space for the publication of texts related to previous travel experiences, anxieties, doubts and incentives.

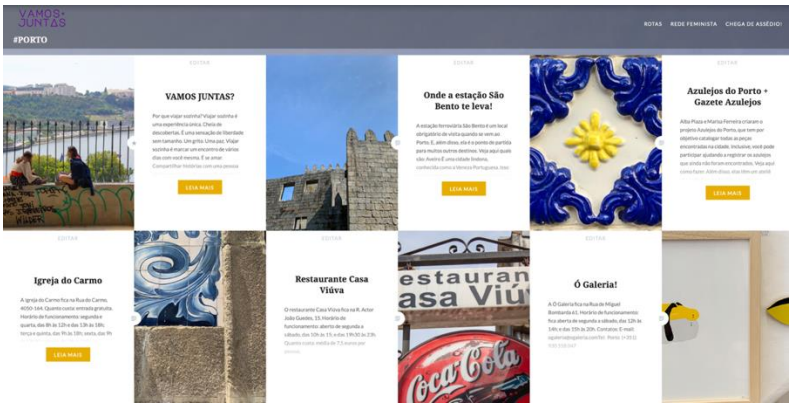

Figure 3 – Vamos Juntas'website.

The main way to get followers to the site was to use Instagram's stories feature. Being a dynamic tool that allows different publications in short periods of time, its use was able to generate volume of traffic to the page. Thus, it was necessary to plan specific content for the dissemination of the site, always with images and phrases that urged the user to leave Instagram and visit the page. Its purpose was to concentrate useful information regarding the disclosed tourist attractions, such as address and telephone. For each Instagram post, one was published simultaneously on the page, with the same theme, but with this important data for those who would actually visit the city of Porto. The user was invited from the social network to go to the page for additional information.

The YouTube channel was also released in the early period of the campaign, based on jokes, humorous actions and interactions made mainly by the Stories. The more relaxed tone was adopted to continue the language that permeates the campaign. The platform's role was to be a medium in which the public could find additional content, such as behind-the-scenes videos of recordings and routing, for example. A

weekly story was scheduled to publicize the channel and its materials. The content disclosed was related to some post or theme pictured on Instagram. Many videos were not listed, precisely because they are exclusive. That is, only those who followed all the tips available throughout the publications could have access to the material. In Figure 4 there is an example of this type of approach. Anyone who responded with a heart emoji[5] to the story question would receive extra material.

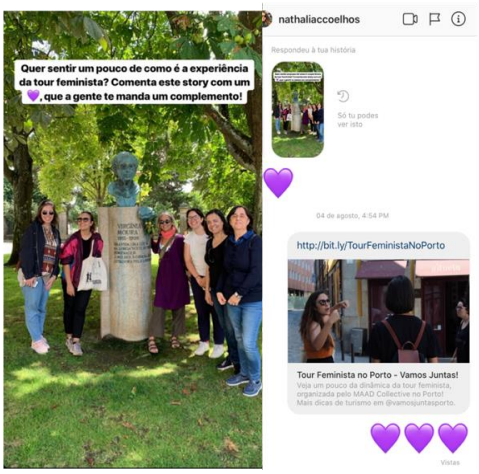

Figure 4 - YouTube channel promotion strategy.

The system defined for the channel was to complement the user experience. Making him feel on the spot, which, according to the strategy, could encourage him to take the walks or create a closer and more affective bond with the campaign.

5 Results obtained

To assess the impact of the campaign, an evaluation methodology based on three pillars was established: netnography, questionnaire survey and, finally, a focus group. Regarding the survey, it was sent to 40 people who interacted at some time with the @vamosjuntasporto profile, either through direct messages, likes and / or comments. From the definition of the methodology, the questionnaire was created and divided into two sections. The first one aimed at the characterization of the evaluator his preferences and consumption habits, and the second to gather opinions towards the campaign, its elements and impact. multiple choice questions and evaluation scales were adopted. An open question was also included so that respondents could leave comments and suggestions. This was not a mandatory question, but there were 35

[5] Ideograms used in electronic messages.

comments, including suggestions, tips and observations. The survey was distributed online between September 23 and October 2, 2019.

Most respondents are female (75%). Although the campaign was aimed at encouraging women to travel alone, one of the initial goals outlined in the planning was not to restrict content and actions to the female audience. As in the public analysis of the profile *Vamos Juntas* on Instagram (described in the previous section), the survey also noted the participation of a male audience (25%). That is, the men also interacted with the campaign and in the end made their contributions.

Of the 40 respondents 33 are Brazilian and 7 Portuguese, which is a close to the real representation, since, according to the metrics extracted from the platform, the profile has more Brazilian followers than Portuguese (51% and 39%, respectively). Regarding the age group, a large variation was noted. Most respondents are between 23 and 29 years old (35%). Then come the 30-34 age range (32.5%); 35 to 49 years (25%) and 50 to 65 years (7.5%). Content consumption on Instagram is recurrent among respondents. The largest portion (67.5%) stated that they access the network "many times a day". In second place was the option "a few times a day" with 30%. Only one person (2.5%) said they access the social network a few times a week. Regarding the theme "tourism", the social network appeared as a widely used tool - 67.5% said they use the platform every time they decide to travel; 27.5% seek tips on the spot, but not so often; and only 5% said they do not use the network for this purpose. An indicator of Instagram's influence in tourism is that, among respondents, 50% said they have already opted for a travel destination based on any tips or images seen on Instagram.

Still in the characterization phase, the questionnaire addressed points related to public preference for Instagram as a means of publicizing travel destinations - and the format chosen for the answers was a 5-level rating or estimation scale.

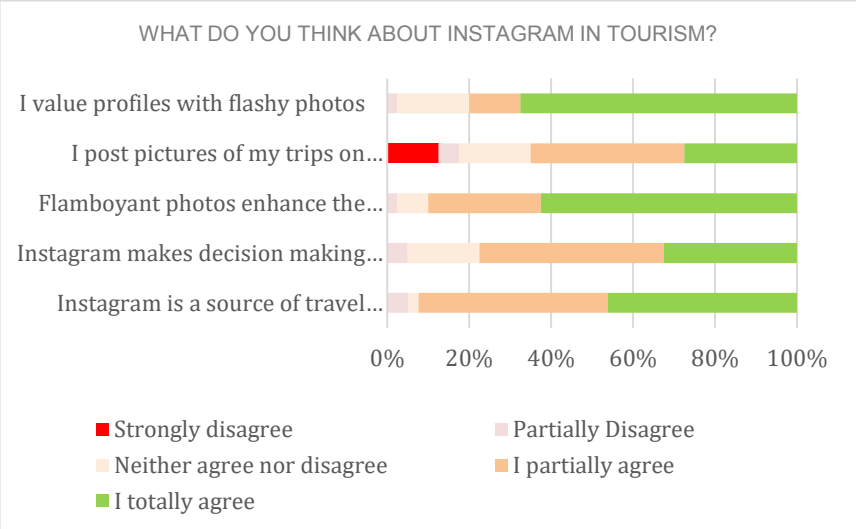

Chart 1 - Instagram as a stimulus for decision making.

The feedback towards the campaign section began by asking how respondents learned about the project. Most, 62.5%, said it was through a referral of friends. In second place (35%) was the option "saw in another profile on Instagram". One person (2.5%) said they knew about the campaign through one of the stickers that was glued to the streets of Porto. In the first contact with *Vamos Juntas* respondents said that the two most striking features of the project were the cause itself (62.5%), the off-road tips (47.5%) and the quality of the project's photographic material (40%). Regarding the posts published in the feed or in the Instagram Stories, the ones that caught the most public attention were the ones that contained videos about different sights of the city. Here, there is a preference for audiovisual content, widely explored in the stories. Among the available routes, the one of outdoor tours was the one that drew the most public attention (45%), followed by the cultural one (40%) and gastronomy (35%). In the analysis of the metrics, commented in the previous section, the route of outdoor tours was the one that obtained the most likes and the gastronomy route the highest incidence of comments.

It was also asked if respondents contacted the campaign directly, by direct message or email. Of the total, 62.5% chose the "yes more than once" option, 20% said they did it only once and the remaining 17.5% did not contact them directly. Five factors motivated the interaction: to congratulate the profile (40%), create a network of supportive women (22.5%), send suggestions for a place or walk (12.5%), ask questions about the posts (5%) %) and appreciation for the given tips (5%). An indicator that the adopted language and the chosen media gave autonomy and made the public comfortable to "talk" to Vamos Juntas at some point.

Concerning the complementary platforms, the site was visited by 40% of respondents. Most (42.5%) said they did not realize there was a complementary website, although it was highlighted 27 times throughout the campaign. Of those who visited the site, (40% agreed that the platform complements the posts posted on Instagram. In contrast, 5% totally disagreed with the statement. Still on the site, the content that most caught the public's attention was the script with the campaign tips (25%). Information about times, addresses and payment methods obtained the same volume of preference as the list with feminist associations in Porto (5%).

Survey responses confirmed and provided the reasons for a poor YouTube channel success. Most respondents (52.5%) said they did not visit the platform, and 22.5% of respondents said they do not recall joining the platform. Of the total, 25% confirmed that they consumed the available content. Most respondents said they did not visit the YouTube channel because they do not have the habit of leaving Instagram while consuming the content available on it (38.9%). Another portion (19.4%) also said they do not have the habit of watching videos on the platform (You Tube).

Regarding the main purpose of the campaign, which was the use of Instagram to motivate the public to know a tourist destination, 100% of respondents said they felt encouraged to do any tips / activities they saw in the project. Regarding the city itself, 57.5% said they wanted to know Porto, 25% said they already know the city and 17.5% said they already know the city. A percentage of followers even visited the suggested places practically during the campaign - 17.5% of respondents said they were in at least one attraction; 15% visited more than one suggestion and 17.5% confirmed they had already planned to go. Most (45%) are not in Porto, so

could not respond positively. However, among those who are or were on site, the campaign made them move or otherwise plan to interact with the physical places? In some way, confirming the effectiveness of the trans-territorial territorial strategy.

Respondents were then asked to state their levels of agreement on different elements that made up the campaign: **content, levels of travel stimulation, transmedia strategy and future of the project.** In Chart 2, it can be noted that in general the content was well accepted, as in this case the option "totally agree" referred to positive responses (represented by the orange color). The statements with the highest levels of agreement were "the Stories complemented the content" and "I was pleased with the contents". It is also possible to note that the division of the route by color, which allowed the reading of a linear or nonlinear narrative, was well accepted by the public. In addition, the "photo quality" and "interaction with followers" initiatives were also highlighted.

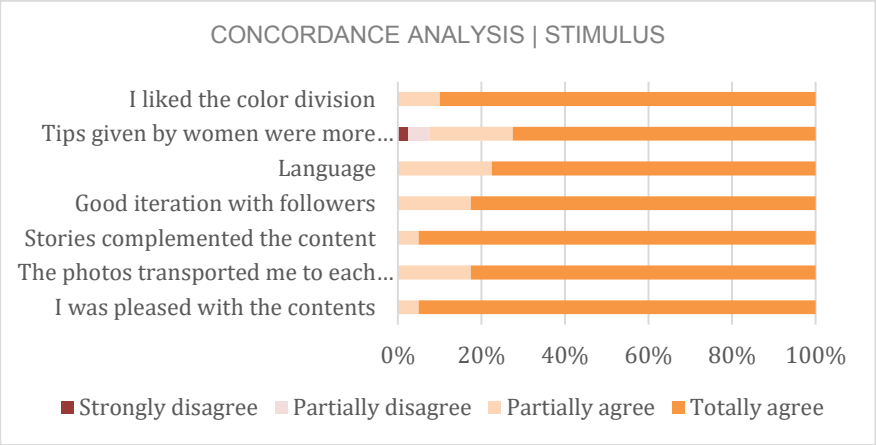

Chart 2 - Analysis of agreement regarding content aspects.

Regarding the stimulus to visit that the campaign promoted, the main indicator obtained only positive responses.

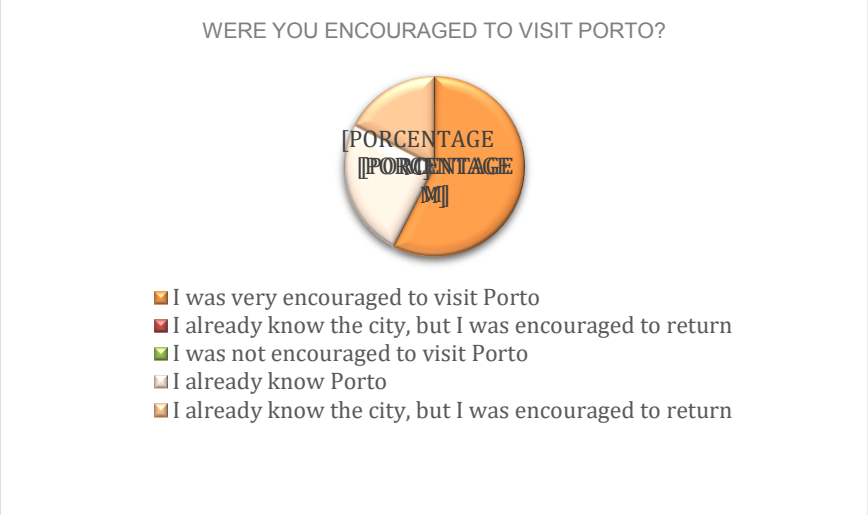

Chart 3 - Encouragement to visit Porto.

The results related to the transmedia strategy confirm the metrics discussed in the previous section. Note that users prefer to stay on Instagram rather than transit through other channels. Therefore, the main information was concentrated on the network.

6 Conclusions

This study aimed to analyze in what ways a transmedia strategy, focusing on Instagram, is able to disseminate a tourist location in Portugal. From these parameters, one wondered: *could a transmedia narrative centered on the use of the image contribute significantly to stimulate interest in visiting a specific destination in Portugal?*

Spontaneous responses shared by users throughout the campaign were the first clues that, yes, there is a great tendency for Instagram-centered transmedia narratives to positively promote a tourist destination. The quantitative analysis confirmed these initial perceptions, as 100% of respondents said they were encouraged to know at least one of the tips presented during the campaign. In addition, 75% said they wanted to visit Porto (25% of participants already knew the city).

It could be observed that the quality of the published content was a decisive factor. That is, as it was possible to detect in the analysis of metrics and empirical investigation, the images need to have quality and strength to positively impact the user and stimulate him to travel. Moreover, despite not being a central element in an imagetic narrative, the informal and direct tone of voice facilitates the involvement of followers.

Moreover, based on the results obtained, it was also clear the need to provide an experience that makes sense to the follower, with a journey made up of platforms that

bring relevant content and suggest an immersive experience. In this context, the physical actions obtained positive results in this work because they allow a true immersion in the city. The language adopted and the images used allowed the campaign to overcome virtual barriers. The public actively participated in the proposed activities and decided to know the tips that integrated the routes, which is a very representative indicator of the effectiveness of a transmedia narrative focused on tourism.

The choice of the platforms/channels was also decisive to ensure good results. It was possible to detect during the study, for example, that 58.3% of people are unwilling to leave Instagram while browsing, especially to watch videos, since the social network has its own platform for the dissemination of this type of format. Therefore, giving autonomy to the public was essential throughout the narrative construction. It was also noted that YouTube, in this case, behaved as a support platform, which released complementary content, so its metrics were below those viewed on Instagram.

Regarding the site, 60% of respondents said they were interested in knowing it. However, by observing the global numbers of accesses and followers of Instagram, it was found that only 7% of followers accessed to the site. Such indicators show that the site was not an essential element for understanding the narrative itself but behaved as a deeper layer within the strategy. That is, it acted as a complement for vacation decision-making. From the experience conducted in this project, the idea that the user searches on social networks and on the Internet in general, for references for the holidays. So, knowing how to harness this potential is a differentiating factor to make the narrative efficient. Therefore, a presence in multiples channels, especially when complemented with physical actions can be a way to reach your audience more easily.

Finally, engaging the audience and playing a leading role was essential throughout the narrative. In fact, this movement began with stimuli inserted in the general content and then followed a natural course. Gradually, the followers placed themselves at the center of the discussion, confirming the concept of Participatory Culture. In tourism, tips and sharing experiences has always been a common attitude. However, the trend observed during the campaign shows that social networks, especially Instagram, have enhanced this search for real experiences, often stimulated by the imagery content, to be more appealing and charming.

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Diseño y Desarrollo ·

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Theories, Methods and Techniques on Digital Storytelling for Fiction and Entertainment: A Systematic Review

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Abstract. This work presents a Systematic Literature Review about the state of the art on Digital Storytelling used for fiction and entertainment, including uses and applications of theories, methods and techniques. Digital Storytelling main feature is its potential for interactivity, which brings new possibilities of what is needed to design narratives for the digital medium. Since this type of narrative has many forms or representation inside digital medium and these same forms are in constant development, we notice the importance of understanding what is available and what are the future heeds in terms of possibilities for entertainment. The review followed the PICO's research protocol. Three databases were searched: ACM, Springer and Scopus. By a search string, we collected a total 309 articles, of which 61 were selected for further examination. Results were then separated into categories of problems and solutions. This works found advancements on areas like generative systems, virtual and augmented reality and a some of new uses of artificial intelligence on digital storytelling.

Keywords: Digital Storytelling, Interactive Storytelling, Fiction, Entertainment

1 Introduction

Digital Storytelling (DST) can be understood as any kind of narrative that uses digital means and its affordances to be created and reproduced. There can be as much different definitions for DST as areas for its usage (digital fictions, video games, iCinema) or social sectors where it is deployed (entertainment, health, education, journalism, etc.). In summary, fictional narratives are defined as the telling of events that compose a story, which can be dramatized and are organized as a structure with a beginning, a middle and an end, with its events articulated in a chain of cause and effect and with characters searching for objectives. Also, beyond other factors, they intend to provoke some kind of emotional reaction on the audience [1-2]. Being fictional, they still can be used for many purposes other than entertainment. Despite that, it is common that those elements referred as part of narrative structure undergo modifications, being alternated, reduced or subverted [3].

This work presents a Systematic Literature Review on fictional Digital Storytelling for entertainment. Our goal is to describe the state of the art, identifying theories, methods and techniques used to design artifacts and content where these narratives are applied. We also seek to understand and discuss which technologies or knowledge, new or old, are being employed to create these narratives. Hence we have as a goal to discover field gaps and investigate future perspectives, for instance: what is discussed about digital narratives used in fiction and entertainment, which theories, techniques and methods are used to create this kind of narratives and, which are the most recent developments of the area considering those many forms of entertainment.

Digital storytelling main feature is its capacity for interactivity [4], which increases design possibilities inside digital means. Once the consumer can somehow alter the story content of a product, he becomes a participant, passing from the state of passiveness to a state of activity in relation to content. In common terms, the individual who was once leaning back from the screen, is now leaning forward towards it, reaching the screen. This change or addition in the way of designing narratives opened space to researches that seek to understand its performance in different genres and areas of use.

2 Background

The term narrative is single but not simple or easy to define. This happens because narrative is commonly defined according to the media in which it takes place. Every media, like books, cinema or video games, have a set of narrative conventions and strategies to better convey their stories that developed through time.

In the work of [5] it's found an attempt to dissect the term in order to better suit transmedia studies, which involves the many media where the story universe is spread. The result of the discussion (which takes into account definition from authors) leads to what the author defines as the core of narrative being represented events that are temporally interrelated in a meaningful way and, story being some kind of a scaffolding core of a narrative. This emphasizes the fact that the same story can be narrated in different ways according to the type of narrative or medium where it is vehiculated.

In digital media these narratives become digital narratives, and the practice of digital storytelling can benefit not only from this simple definition, but also from digital affordances [6]. That is because the computer can be seen as a simulation machine, that is, a machine that imitate functionalities from machines of the real world, but not only that. Many technical functions were developed to the digital medium, like the types of hyperlink and hypertext, systems of data visualization and so on [7]. When inside digital medium, narratives are susceptible to these techniques and can be worked upon it, so the possibilities are great and undefined (as digital medium techniques are still evolving). This is why we believe the dissected transmedia definition of narration proposed by Mr. Elleström is better suited for the digital medium than those complete ones (like the one presented at the introduction), because other aspects of its structure definition, like having characters, objectives or being interactive (as

DST may not be interactive) can be added on the fly, as they become necessary according to what is proposed or simulated.

One further mention in this section is necessary, because informal research found a Systematic Review on Digital Storytelling. The problem of this Review is that the definition applied to DST is very limited, referring to Digital Storytelling, as they put it, as a 2 to 5-minute audio-visual clips that combine photographs, voice-over narration, and other audio originally applied for community development, artistic and therapeutic purposes, as well as an arts-based research method [8]. The authors understand that the term has a broader sense (like basically telling a story using the digital media), and they chose the definition for their work deliberately. Also, their work is focused on how DST is used on research. That said, the results found on this Systematic Review on Digital Storytelling Research were not included in this article, since it escapes the scope.

3 Methods

In this review it was used the PICO protocol (P for population, I for intervention, C for comparison and O for outcomes) described by [9]. Concerning population, we delimitated primary studies about theories, methods and techniques used in digital narratives for fiction and entertainment. Intervention comprehended these same theories, methods and techniques usage reports. On results, we intended the gather data for an opinion or position on the state of the art and new approaches concerning the future of the field. Along with the structuring of these topics, the following questions were raised: what is discussed about digital narratives used in fiction and entertainment, which theories, techniques and methods are used to create this kind of narratives and, which are the most recent developments in the filed considering the many forms or genres in which digital narratives applies?

3.1 Search Protocol

Searches were performed on SpringerLink, ACM Digital Library and Scopus databases. The following string was used: (“digital storytelling”, AND (fiction OR “digital fiction” OR entertainment) NOT (education OR health OR politics). The reason for picking theses databases was because they presented the best papers searching result related to an informal review anterior to this one and also because they are the most relevant to the topics addressed here. To refine search results, advanced search was performed adding the following filters: articles published only in English, works available to access in selected databases or through alternative sources, complete articles in either periodicals or conferences, articles relating to digital narratives for fiction and entertainment and articles published between 1999 and 2019.

3.2 Inclusion and Exclusion Criteria

Resulting articles were all submitted to a review process with inclusion (I) and exclusion (E) criteria: I1, it's a primary study; I2, available access; I3, protocol's key-words digital storytelling, fiction, digital fiction, entertainment and/or interactive storytelling are present in works title, abstract or key-words; I4, the article directly concerns theories, methods and techniques used in the creation of digital narratives for fiction and entertainment. Exclusion criteria are listed as follows: the article negates criteria I1, I2, I4 or is either segmented or duplicated.

3.3 Studies Selection and Classification

Applying search string in cited databases, a total of 311 articles were obtained for review. At the end of the reviewing processed, 63 articles were considered suitable for data extraction after following inclusion and exclusion criteria. See results are visible at Table 1.

Table 1.Results after application of search criteria

Base	Return	Criteria			
		Duplicated or Segmented	Irrelevant or Unfit	Unavalable or Broken	Approved
Scopus	33	1	13	3	17
'Springer	57	3	33	0	24
ACM	219	23	199	0	20
Result	309	27	245	3	61

As we can see, 17 articles were found at Scopus, 24 at Springer and 22 at ACM. Only three (3) articles were unavailable or broken and a total of 27 were found duplicated or segmented. Selected articles were organized into categories of problems and solution in order to establish a relationship between them and research objectives, that is, to split them into thematic affinity and to determine theories, methods and techniques found on the articles.

4 Results

In this section we are going to describe the problems that articles collected by this review tried to solve and the solutions they implemented, divided by categories that took into consideration a thematic affinity between them.

4.1 Problems

The problems of works gathered were classified into four groups. The first correspond to limitations in systems and environments involving digital narratives. The second group concerns fruition problems related to software production. Group three include

works that deal with fruition in interactive stories and both immersive and interactive environments. The fourth group include those works directed towards theoretical problems.

Limitations in systems and environments for digital narratives

Works here presented were concerned with systems or virtual environments problems that are used to tell stories in digital environment, one way or another, regarding diverse topics on this matter. The problems targeted by each article will be described below.

Article [10] raises the necessity for a method to automatically generate a narrative that doesn't force the listener to become a character in the story in a Campfire Storytelling System. Article [11] deals with the non-existence of a public tool for creating systems for computational entertainment, such as mobile applications for interactive narratives in augmented reality. Article [12] says that interactive digital systems are made only to provide single player narratives. Article [13] sees the impact of urban computational systems on people's life, since urban areas are more and more becoming a hybrid of the physical environment and the digital datasphere. [14] concerns about generating opportunities for creating intuitive interfaces. [15] wants to understand and create future applications for learning and entertainment that uses interactive digital storytelling. Article [16] states the lack of tools to write interactive fiction. [17] wants to guarantee that the resulting plots on automatic story generation is well constructed. [18] deals with narratives that emerge from collaborative and improvised negotiations. Article [19] seeks a way to get actors to learn how to adapt to their dynamic environments and how to efficiently combine previously knows tasks to perform activities. Article [20] is concerned in creating varied and cohesive narratives within specific genres. [21] addresses the difficult of deploying attractive mobile augmented reality services because of the complexity of computer vision relevant techniques. Article [22] intend to generate haiku poems from another denser source material, like a book chapter. [23] states that approaches proposed to create procedural interactives stories for games are limited and commonly use a fixed set of characters with predefined relationships. [24] exposes the lack of discussion in detail on why a given planning algorithm was used to develop an interactive story. Article [25] just wants to provide new solutions for digital interactive storytelling through interactive applications capable of generating consistent, emergent and rich stories. Article [26] is concerned with the deployment of cinematography concepts for storytelling applications. [27] is concerned with individual and comparative structural story analyses. Article [28] regards the integration of narrative generation through artificial intelligence planning with video processing and modeling to construct film variants from a baseline content. [29] regards the possibility of narration by a narrating entity, to generative systems. [30] directs its goals to the limitations of current digital comics on using digital medium affordances and the computer screen. Article [31] explores how physical objects and augmented surfaces can be used as tangible objects of different character perspectives in interactive stories. [32] explores methods for story generation through tarot potentialities. At last [33] is concerned on interfacing the algorithm of interactive drama with the user for him to better act in the story.

Fruition problems related to software production for digital storytelling

This groups revealed itself to be the smaller category, concerning fruition problems like relating software production and how this production affects the artifact that is made through them. Description will be discriminated below, as before.

Article [34] reflects the way in which affordances from different interactive writing tools impact on how stories are told. [35] is concerned on how computational programs might help children on developing their narrative and creative writing skills. In [36] authors try to find a convincing and interactive way to promote the perception of a team in aiding the coherence in virtual stories co-creation. Article [37] explores graphical language and seeks for an interface that can invite storytellers to compose and visualize movies, images and sound environments while writing a story. Finally, [38] aims for a holistic software architecture, one that enables active engagement on meaningful collaborative narratives.

Fruition problems on interactive stories, interactive and immersive environments

This group presents works that dealt with users or participants fruition problems on interactive stories and also with interactive and immersive environments.

Article [39] investigated the convergence between aesthetics, interactivity and narrativity on interactive narratives for virtual reality. Work [40] is concerned with making characters more empathic by promoting a more emotional directed telling of interactive stories rather than a task-based mode of narration. Article [41] investigates the author-reader interaction enabled by web 2.0, which allows readers to influence authors works that uses the digital medium as a platform. [42] accesses the negligence on narratives legacy methods to transmit and enjoy digital narrative in digital games and immersive RPG based digital storytelling fundaments. Article [43] is concerned with assigning NPC's (non-player characters) credibility in video games, hypothesizing that fruition is better when NPC's personalities matches the player temper. [44] states that virtual reality allows an experience with strong potential for storytelling once design and evaluation is done with a user centered perspective. [45] is disposed in finding ways for non-disruptive decision making on interactive movies. In [46] the authors are concerned with audience attention balance, so they can be focused through the narrative and get the proper experience from the telling. Paper [47] concerns the creative use of the camera and player engagement in 3D video games. [48] is concerned with exploring ergodic dramatic possibilities, evoking emotional states in interactions between users and virtual environments. [49] is also concerned with developing the properties of autonomous NPC's for adventure games, focusing on experience, emotion and personality expressed through dialogs. Article [50] is preoccupied with story engagement and promoting laughs by audience in interactive comedy. [51] is also involved in optimizing NPC's emotional behavior, but now regarding the emotion of this agents concerning the actions they perform on their roles. Article [52] sees about controlling the dramatization in interactive stories generated and presented in a 3D animated format. [53] is concerned by the topic of persuasion, in influencing the player on following a given route in an interactive digital narrative. Article [54] is preoccupied with the fruition of visitors and tourists, investigating on how they can

become more appealing and immersive through storytelling techniques. [55] is concerned with new forms of storytelling expression through transparent interfaces that promote easy interaction and a wealthy interactive experience. At last, [56] is concerned with how interaction can enhance the dramaturgical possibilities of traditional theater and about the challenges of designers.

Theoretical problems

The works on this section deals with the subject of digital narratives in a looser way, rather than focusing on some specific or material problem. For this reason, they are grouped in this category.

Article [57] concerns how the concept of collaborative narrative evolved from print to digital storytelling. [58] explores the significance of interactive storytelling in video games that goes beyond entertainment. Work [59] concerns with how the creation of different forms of interactive narratives require different sets of abilities and techniques from those used in non-interactive narratives. Article [60] sees how interactive narratives as a new field presents difficulties on finding formal studies that shows how to create this kind of art. In [61] they discuss about optimizing Aristotle classical theories for a new digital narrative form. [62] Discusses how the director's role in interactive narratives differs from the role in a traditional scenario, like theater and movies. [63] is about combining two different narrative theories in order to form a novel model for interactive narrative using content from an animated children television series. Article [64] is concerned about new sights for the future of entertainment that are proximate to the Holodeck ideas of interactive narratives. The discussion on [65] is about the authoring problem as when bringing the story for an interaction free form. [66] discusses how the advances in informative interactive technologies facilitated the process of writing collaborative fiction. Article [67] questions suppositions on the relevance of moviemaking and theater techniques to augmented reality and separates both. [68] questions the role of stories within games, if they have primary focus, just a backdrop, or if games can easily go without them. [69] exposes the lack of professional and academic knowledge for the design of interactive narratives. The last article [70] of this group emphasizes the need for a reliable way to understand and evaluate storytelling in games that utilize rewind as a mechanic for its narratives.

4.2 Solutions

We described problems presented by the works selected. Now we will describe the solutions they proposed to solve those problems, addressing theories, methods and techniques they deployed in those solutions. Also, we divided works on categories just as before in order to classify solutions.

The first category includes articles describing works on development of systems for interactive or generative narratives creation. The second gather tests of theories, methods or techniques by implementing them on software, platforms, models or frameworks. The third category collect works that related the creation of prototypes

and or approach models. The fourth and last category consists of studies and theoretical analyses.

Development of systems for interactive and generative narratives

Solutions on this category were interested primarily on the creation or development of systems for interactive and generative narratives.

Work [10] solution was to create a system that generates automatic narrative in real time through a method called Campfire STS. Work [11] developed four authoring editors for non-programmers to generate or create interactive narratives for augmented reality mobile applications. Article [13] describes Yasmine's Adventures, an interactive platform that uses urban computational strategies to create a crossing at a Berlin square. Article [14] relates the creation of Korsakow, an open source program which can be used to create non-linear movies and which uses foundations strongly based on key words strategies. [59] reports the creation of Reading Glove, a system of tangible interactive narratives using an innovative design technique called cognitive hyperlinks. [16] develops an authoring tool for interactive fiction writers. [63] describes the creation of an interactive narrative system called Scene-Driver that takes content from a children television series in order to test narrative techniques combinations. Work [18] is about O2P2 (Object Oriented Prompted Play), an interactive system where stories are linked with objects of the diegetic world. [20] describes the implementation of LogTell-R, a system that was embedded with a conceptual model for the definition of a genre in the context of Interactive Storytelling. Article [22] concerns the creation of a computational system that condenses the essence of a book chapter into a haiku poem by using phrases selected by the user and translating them to the English language. [23] proposes an approach that creates dynamic stories based on two networks: one handcrafted network and one dynamic artificial social network created for each new story. [28] Interactive Movietelling, an application which integrate narrative generation using artificial intelligence planning and video processing and modeling to produce variations on the product using a baseline content.

Theories, methods and techniques tests using software, platforms, models or frameworks as a medium

The primarily intention of works here was to test theories, methods and techniques instead of creating the artifact itself.

First, [34] proposal was to adapt an interactive story built in a specific platform into two different other platforms. Article five [12] tests how single player game Dark Souls would behave as a multiplayer narrative using a model for multiplayer narratives and inter-player narrative interactions based on Sculptural Hypertext. [35] Uses programming language Scratch to explore the potential for children creating their own digital stories through software and also make children better understand the concept of the story arc. Article [43] provides a model for automatic NPC customization according to players temper, which information is collected before game session using Case-Based Reasoning technique. [15] presents a multi-level model for the design of interactive digital narratives that uses autonomous agents and takes on the perspective

of the author/creator, [60] implements ideas from table top RPG to manage interaction in a simple text adventure game, Article [61] reports the creation of Jeherazade, a system implemented to test the classical theories of Aristotle to new forms of digital storytelling. [17] creates The Virtual Storyteller, a framework to generate plots created by a director agent using natural text language by a narrator agent in automated stories. In article [48] they borrowed concepts from music theory to condense dramatic development on emotional states through a virtual reality installation called Beyond Mazanar. Article [19] presents a framework used to simulate a virtual brain capable of generating virtual character behaviors in real time. [50] uses HTN (hierarchical task network) which allow the direct use of characters task failures to promote more elevated interactions with the audience and more plot variations. Work [51] proposes a solution to a role cast method called OPIATE that does not consider NPC's emotion towards actions performed by a new model called EMAI that corrected the miscast problem. [66] proposes a framework to analyze collaborative narratives from a human-information interaction model. [21] presents interactive Augmented Reality design factors to mobile devices, applies narrative theories and explores real possibilities for interactive levels using the AR mobile medium. [53] provides and architecture to employ persuasion on interactive digital storytelling, influencing user's choice during fruition. Article [24] proposes a set of criteria to evaluate if a given planning algorithm fits an interactive storytelling system and presents an analysis using available planning systems. Article [26] introduces a support of vector machines applied as a method of artificial intelligence in a storytelling director to better tell the visual story. [38] design of a system that combines semi-autonomy with an interface that responds to natural user interaction through a device that is touch enabled or gesturally controlled. [29] presents The Narrator, an NLG component used for the generation of narratives in a digital storytelling system. Paper [55] describes an interactive adventure system for children called oTTomer, which is based on user's location, distributed in space and story timeline in order to provide better immersion. [56] defines requirements for making an audience interact in a theatrical play and introduce four interaction-enabling criteria for theatrical performances that use gestural interfaces. [33] discusses the ways in which the user can choose the action of a character in an interactive drama and proposes a taxonomy of interfaces used to connect the user to the algorithms that unfold the action.

General prototype creation and models of approach

Works were gathered here when they presented as their first goal the creation of more general prototypes and new models of approach. They were diverse in their nature so that's why they were joined together in a more general section.

Article [39] worked towards the creation of a Virtual Reality interactive movie prototype that promotes the experience of living the story for the user by proposing a screenwriting framework that combines the classical cinematographic structure of an interactive Hero's Journey approach. Work [40] creates an interactive video that uses Smith and Lazarus emotion cognitive theory. Article [46] presents Hopstory, an interactive location-based narrative designed with the idea to promote attention balance for the user in its scope. [67] develops a dramatic virtual experience called Three angry

man in order to verify if dramatic rules from other media fits augmented reality story designs. Article [52] presents a new model that allow variations in stories representation and interferences of the user over the story throughout fruition, while assuring coherence and a smooth narrative flow. [25] designed a novel multi-agent digital interactive storytelling framework with agents' coordination and new planning and replanning solutions. [27] propose StoryPrint, an interactive visualization of creative storytelling that that facilitates individual and comparative structural analysis on stories. Paper [30] propose Seeing thru Walls, the first location based comic story for GPS environment that can tie sensory details of the physical environment on comic frames. [31] offers a multimedia storytelling system that couples a tangible interface with a multiple viewpoint approach to interactive narratives. And to conclude this category, [32] presents the creation of a tarot-based narrative generation system that creates short movie-like story synopses, along with a tagline one might see on a movie poster.

Studies and theoretical analysis

Here we describe works that worked mainly on theoretical analysis and studies. Article [57] examined collaborative narratives in twenty-first century Italian fiction, with a special focus on Ming Wu case, which allowed an author-reader relationship leading to interference on the content. Article [58] analyzed how the threefold mimesis functions par excellence in interactive storytelling, stating that Aristotle's poetics still stands as being veritable with mimesis, being a creative imitation of action, holds cognitive function. At [41] it is examined the discourse between authors (Neil Gaiman and Jasper), their readers their contributions to stories while interacting through their website, presenting the expansion of this dynamic interaction. Work [42] discusses a new perspective on interactive digital narratives based on Table Top RPG's, proposing concepts that are different from the traditional literary or dramaturgical perspectives normally applied to interactive narrative systems. Paper [36] discuss a new concept to promote team awareness on group storytelling for entertainment, where users might rearrange stories manually or aided by some narrative algorithm which is based on dramatic arcs. [44] discusses the concept of narrativity applied to the user experience in IVE and based on participative story systems. Article [62] the director not only has the role of supervising the staging, but also overseeing the role staged by a set of autonomous characters and support for users who engage in history by controlling and commanding virtual actors. Work [47] discusses methods of controlling games by easy and intuitive interfaces and use of an automated virtual camera to increase the appeal of games for users. Article [64] made exploratory experiments on user experience in games like Façade and Fahrenheit in order to better understand this type of experience on interactive storytelling. [65] discusses the possibility of writing story pieces as input knowledge, portraying characters credible behaviors as well as interesting story events. At [49] the discussion is on NPC's equipped with an emotion engine called DEEP, which utilizes games contextual environment information and player behavior to promote meaningful, rich and varying dialogue. Article [68] describes a new term, Plai to describe both the medium and form of computer-mediated gameplay, defined in terms of staged encounters in computer-mediated environments.

Paper [54] proposes an anthological approach on digital storytelling by discussing the characteristic functionalities of narratology and of storytelling techniques for the dynamic creation of experiential stories on a sematic basis. Article [69] examines empirical methods as a route to improve the knowledge on interactive narrative design. The last work of this category [70] focusing on rewind as a form of narrative progression, discussing and building on previous work by conducting narrative interaction analysis on rewind mechanics in video games.

5 Discussion

Now that we presented the results and their classification proposed on our methodology, we will discuss how they answer the questions that lead our research goals: what is discussed about digital narratives used in fiction and entertainment, which theories, techniques and methods are used to create this kind of narratives and, which are the last developments considering the many forms or genres in which digital narratives on our scope applies?

Limitation in systems and environment for digital storytelling lead to both the creation of new systems as the creation of technical or theoretical strategies to develop solutions on the matter proposed. Strong effort to create systems to generate and develop interactive digital storytelling was a certainty. Other examples were guiding systems that interlaced real and virtual worlds to improve wanderers experience, systems that condense large amounts of texts chosen by readers to transcode it into another type of narrative (like from prose to Chinese short poems), an open source program that allows the creation of a non-linear movie by inserting key words input and so on.

Once, interactive narratives were abusive on hypertext strategies as we see on a boom from articles of the year 2004. By the time, algorithm planning and artificial agents started to acquire more space as a suitable technique because of generative systems requirements and immersive environments development.

Videogames revealed itself a very strong area for digital storytelling studies, developing and implementing different methods and techniques with solutions proposing methods and techniques to improve automated process on gaming, like making NPC's more relatable and credible to the player through frameworks and algorithm planning, creation and improvement of gaming interfaces, and theoretical discussion like the use of an automated virtual camera to make games more appealing to the user and the importance of narrations within games. There were evident efforts on trying to make games more attractive for players, by implementing techniques from artificial intelligence, techniques using psychological and cognitive methods and theories and experimental works trying to improve a single player successful game by turning it into a multiplayer game with an enhanced interaction mechanics.

An important finding to point out is the effect of the authoring platform on products, with works affecting the impact on how stories are told, help children to develop their writing skills, systems that help teams to conquer coherence in virtual stories co-creation and find a holistic architecture that enables active engagement on meaningful

collaborative narratives. That resulted a category on itself, and points towards the importance authoring software design has on the production of DST.

Some researches presented consolidated narrative models, like the ones of Aristotle poetics, Campbell Hero's Journey, table tops RPG narrative rules to implement on systems or test this type of narrative in new audiovisual systems that provides different representation and fruition, with some interesting results like the statement that Aristotle's mimesis holds cognitive function.

6 Conclusion

We discussed previously that Digital Storytelling (DST) is understood as any kind of narrative that uses the digital medium and its features to be created and reproduced. To investigate more about its definition and properties, we conducted a Systematic Literature Review on fictional Digital Storytelling for entertainment. We intended to describe the state of the art, identifying theories, methods and techniques that were available for investigation in order to try to answer proposed questions. It's a principle that digital storytelling main feature is its capacity for interactivity, like stated in previously.

We proposed the transmedia definition for narratives, because as computer simulates many machines, it is more useful to build on simple ideas to create something new. We found a systematic review on digital storytelling that wasn't helpful to us, since it had a specific scope for research and a limited definition of digital storytelling to better suit the authors research.

Applying PICO protocol to conduct the research, the outcome was a total of 61 selected articles from a total of 309, ranging from the year of 1999 to 2019, a space of time of 20 years. Then we divided the results into categories of problems and solution to separate articles and analyze what they were working on.

Limitations conducting this review are related to some shallow descriptions depicting research outcomes. Another limitation was found later on the selection phase: what are the boundaries of entertainment, since it can also be used embedded in other areas like education, forming edutainment? So, these results were sometimes included and others not, based on a criterion of whether which field it would benefit more with the articles discussion .

We found that techniques developed for a specific medium or goal can work just as well on another, and sometimes not. Also, the area of entertainment is very unstable now because is so much experimentation ongoing with technology that it is difficult to drawn some directions. The aim, it is always said to be the Holodeck age (when we will enter a holographic chamber and the virtual world will be created for our fruition as we want it, to play alone or with others), but only from this review there is no way to assert when that will happen.

For the future, it is necessary to keep following the development of technologies and the implementation of digital storytelling with these technologies.

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Towards Web Templates Support in NCL

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Abstract Ginga middleware and NCL language are standards to multimedia applications authoring for Digital TV. Some studies have indicated that NCL language is highly verbose. Such factor increases the possibility of coding errors introduced by application authors. One way to reduce them is based on reuse repeated elements on the code. On multimedia field literature, is common to use templates to active such goal. Templates describe a family of logical structured documents. Template languages insertion end up in a reduction in the number of lines of codes written and thus make the final document less error-prone. On the web scenario is common the template usage in HTML development. In this scenario, developers commonly use specific templates engines that can even run client side, such as Jinja2 and Mustache. This work aiming at bring web templates support for the NCL development. By running on the client i.e., Ginga developers can create applications with adaptable template-based content.

Keywords: NCL · Ginga · Template-oriented authoring

1 Introduction

The Brazilian Digital TV System (SBTVD) Forum proposed the Ginga middleware for authoring its interactive applications. It supports the execution of applications developed in the Nested Context Language (NCL)[1]. NCL is based on XML[2] and consists of a domain-specific language for multimedia authoring. More precisely, it focuses on specifying multimedia applications with synchronized audiovisual media and key-based user interactions. According to Soares *et al.* [2], however, its XML syntax is verbose and error-prone. They highlighted, after conducting a usability analysis, that programming in NCL may be a hard job as applications' complexity increases. Therefore, some work aims at supporting alternative formats (i.e., syntaxes) for NCL, such as JNS[3] based on JSON (JavaScript Object Notation). On way to better support, the development of NCL in the multimedia field is to promote code reuse based on templates.

[1] https://www.itu.int/rec/T-REC-H.761
[2] https://www.w3.org/XML/
[3] https://www.midiacom.uff.br/~caleb/jns/

Template for the NCL has been the object of study in several works. Among then, we cite LuaTPL[4] and Luar[5], which evaluates Lua scripts inside NCL documents. Moreover, Terças *at. al.* [1] proposes a markup language with a Lua-like syntax called sNCL. Finally, [3] and [4] present XML-based template languages for hypermedia documents, respectively, Xtemplate and TAL (Template Authoring Language). Despite these efforts, none of them obtained enough attention from NCL developers community. We take into account that, at the present moment, there is a shortage of NCL programmers.

Differently from the NCL development context, the usage of template on the web has gained more and more attention from its developers' community. We believe that such an intersection can benefit template usage in NCL development. We can cite Jinja2 and Mustache as two widely used web-template languages. They have simplistic syntax and they are spread used in the web community and frameworks. We believe that such an intersection can benefit template usage in NCL development. They have simplistic syntax and they are spread used in the web community and frameworks. On the web scenario, it has become increasingly common to run template engines on the client-side. That is because, on the server-side, the server generates a new page for every interaction with a user. Each request has to travel all the way from the client to the server. Then, this page should be returned to this user. Such behavior can significantly increase the page loading time that may lead to latency issues.

Given this context, we also define the following more specific question:*RQ1. How can we support web templates processing in NCL development?* We argue that an option to improve NCL template usage is to leverage the use of these web template-based languages in the NCL development environment, exploring the natural intersection between NCL and web developers. Therefore, one of our objectives is *to evaluate web templates usage in NCL development.* Regarding the client-side processing, we also propose *the execution of template engines at NCL Player environment* i.e., client-side. With both, we aim to bring to NCL programmers the advantages of the web development experience and client-side execution.

The remaining of this document is organized as follows. Section 2 presents the proposed approach to allow web template engines execution at both server- and client-side. Then, section 3 presents some usages of web templates usage in NCL. Finally, Section 4 discusses final remarks and the next steps.

2 NCL-formats tool

We argue that an option to improve NCL template usage is to enable the use of these web-template languages on its development. By doing that, we may take advantage of this intersection between NCL and web developers. As stated before, we indent with this perspective to bring web programmers and their knowledge to the development of NCL applications. Moreover, web template

[4] `https://github.com/robertogerson/luatpl`
[5] `https://code.google.com/archive/p/luar-template-engine/`

development programmers commonly run template engines at the client-side. This happens, because, as we mentioned in Chapter 1, the client-side processing avoids the need for updating a page any time a modification on it occurs. With that in mind, we define the objective of **Allow web template engines processing at Ginga**.

To enable such execution, we propose the NCL-formats[6] tool. It aiming at assisting the development of NCL applications based on web-template languages. The remaining of this section is organized to present it. First, we define which web-template language will be supported in our NCL development. Section 2.1 discourse about it. Then, Section 2.2 addresses execution scenarios to web templates. At last, Section 2.3 comments about NCL-formats implementation details.

2.1 Supported web template languages

In the web context, it is commonly require to take advantage of repetition elements. One example is page headers that might be shown on several pages across one website. So, a web programmer may opt to use a template to build such headers. From this need, many template languages have been developed and innumerable options are available. To define our supported languages, we define the following requirements: license should *not be proprietary*; have a *significant users base*; *support control structures*; *support template inheritance*; and being able to *run on TVD environment and on Ginga*.

Out of these four requirements, the most restrictive is the last one. In practical terms, it implies that the language should have an implementation in Lua. Such constraint eliminates a wide range of engines that targets languages direct related to the web development environment, such as JavaScript and PHP. Based on these requirements, we chose initially to support Jinja2 and Mustache.

2.2 Templates Processing Scenarios

NCL-formats is a Lua script responsible for handle all the template processing. We opt for Lua because it is Ginga's script language and its integration is straightforward. It can run on server- and client-side as well. It is important to notice that NCL-formats are self-contained and might be executed perfectly outside the Ginga environment, as a standalone tool.

In this remaining of this section, we discuss the scenarios in which templates might be executed on Ginga. On serve-side, we focus on to provide a standalone processing. Regarding running the template engine on the client-side, there are two options: *(a) extending Ginga Player* to support web template languages; and *(b) running template engine as a Lua Script*.

Standalone Template Processing This scenario emphasizes that NCL-formats can work outside Ginga. This proves to be very handy to test created templates without the need to set up a TV transmission environment. The standalone version enables developers to simulate their application on their workstation, for

[6] `https://github.com/TeleMidia/ncl-formats`

instance, making easier the creation and testing process of new template-based NCL applications. The Listing 1.1 demonstrates NCL-formats execution through command line. The Lua script receives three arguments: the padding data; the template engine to be executed; and the template file itself. NCL-formats uses the template file name to generate the outputted NCL document.

```
lua ncl-formats.lua padding.json template_engine=jinja2 template
    =slideShow_child.ncl.j2
```

Listing 1.1: Command line call to NCL-formats process Jinja2- and Mustache-based template for slideshow.

Template Processing Extending Ginga Player We talk about the first approach to execute web-templates on the client-side i.e., Ginga. By *extending Ginga Player*, it will handle, besides NCL, other formats. However, it will require modifications on Ginga specification that implies new Forum and ABNT (*Associação Brasileira de Normas Tecnicas*) discussion to release a new standard. Moreover, it takes time to current STB (set-top box) and TV implement such features. In this scenario, besides NCL documents, Ginga receives any template-based document e.g., Jinja2, Mustache. These template documents are then handled by the NCL-formats tool that will processes information from padding documents to produce the final NCL document. After all, NCL player plays the generated NCL document.

Ginga has been extended to support templates syntax. Ginga Parser checks document type and if its a padding document it delivers the padding and the template to the corresponding engine. This engine receives both the padding and the template as inputs and generates an NCL document. After all, the NCL player collects the NCL document and plays it. To aim that, a new option was added to Ginga's command line entry list. Such an option expects a template document and only validates if a padding document comes along with it. The Listing 1.2 illustrates its usage on the terminal.

```
ginga padding.json --template=slideShow_child.ncl.j2
```

Listing 1.2: PUC-Rio Ginga executing a Jinja template through command line.

Template Processing Embedded in an NCL Document Motivated by the drawbacks of extending Ginga Player we opt for a solution that embeds template processing into an NCL document. This approach does not imply any changes in Ginga as a standard. By *running template engine as a Lua Script*, Ginga receives one single NCL document responsible for setting up the environment. Note that, for this scenario, there must be a mechanism to process the given data once Ginga can only handle pure NCL documents. That is the reason we propose the use of Lua scripts to do so. Ginga middleware receives the aforementioned NCL document with three pieces of information: template document; padding document; and template engine, as properties of a media object. This

media object is the NCL-formats tool Lua script. The Listing 1.3 next details this NCL document. The NCL player starts the Lua script with relevant information as a *property* of *NCL-formats.lua* script. The script uses the passed data to generate `final_documents.ncl`. On ending the script, the Ginga player starts to reproduce `final_documents.ncl`.

```
<ncl>
...
<body>
  <port id="template-handler" component="template-engine"/>
  <media id="template-engine" src="ncl-formats.lua">
     <property name="type" value="jinja2"/>
     <property name="template" value="slideShow_child.ncl.j2"/>
     <property name="padding" value="padding.json"/>
  <media>
  <media id="final-ncl" src="final_document.ncl"/>
  <link id="link" xconnector="conBase#onEndStart">
     <bind role="onEnd" component="template-engine"/>
     <bind role="start" component="final-ncl"/>
  </link>
</body>
</ncl>
```

Listing 1.3: client-side template processing using NCL-formats.lua

2.3 Implementation Details

To work properly NCL-formats need to load some dependencies: JSON library[7], Mustache and Jinja2 implementations.

Mustache Lua implementation is the Lustache[8]. It only handles templates as string. So, in the scenario of a large Ginga application with n partials implemented, NCL-formats should read these partials (files) one by one and save them as strings and only after this conversion of data type the engine becomes able to process the template.

Jinja2's implementation is Lupa[9]. It allows templates to be loaded from a given folder, besides strings as well. In Lupa, the developer only passes one template. The engine takes care of loading any other required template, as long as it is the same directory. Jinja2 implements variables that give more control to the programmers, such as `{{ loop.index }}` and `{{ loop.length }}` that counts the number of loop iterations (starting from one) and gets back the size of an iterable, respectively. On Jinja2 it is also possible to set up variables. None of that Mustache can do. That obligates developers to either put extra information on padding documents or type it in NCL-format to generate the same NCL document. The first case is not desirable, once it would put nor only semantic-related data, but logical as well on the padding document. Such behavior breaks

[7] http://regex.info/blog/lua/json
[8] https://github.com/Olivine-Labs/lustache
[9] https://github.com/zhsso/lupa

the concept of templates itself because blends logical and semantics in one single file. The second option despite not break the rules would require different versions of NCL-formats, one for deal with each kind of template created.

3 Study Case

In this section, we present our evaluation of web templates usages in NCL development. First, we detail our the evaluation procedure. Then, we discuss slideshow examples developed om both Mustache and Jinja2 template languages.

To analyze the behavior of web-template language as template language to built NCL applications, we use the **number of lines of code** as a metric. To determine the application's total gain, the simple formula (1) below that gives the *total percentage score* is used. *TemplateLanguage* indicates the proper web-template language. However, measure the number of lines of code is not fair enough. So, taking that into account we also use the **number of instructions** as a metric.

$$Score = \left[1 - \frac{number\ of\ [TemplateLanguage]\ lines\ of\ code}{number\ of\ NCL\ lines\ of\ code}\right] \times 100\% \quad (1)$$

$$Score = \left[1 - \frac{number\ of\ [TemplateLanguage]\ instructions}{number\ of\ NCL\ instructions}\right] \times 100\% \quad (2)$$

A slideshow is a kind of presentation that changes the content displayed from time to time or after an action being triggered e.g., user press a button to go back and forth. This instance is made of twenty-one images that change every 5 seconds. The final NCL document outputted by the two languages (Jinja2 and Mustache) are the same.

The slideshow example was build taking advantage of Jinja2's template inheritance capacity. In the example, there are two template documents: one called `slideShow_base.ncl.j2` and the other `slideShow_child.ncl.j2`. Listing 1.4 and Listing 1.5 show them, respectively. `SlideShow_base.ncl.j2` works as a base template in template hierarchy and is a NCL-based code with block tags in Jinja2 syntax. A `{% block %}` element indicates code replacement. So, in this case, a `{% block medias %}` indicates another template will handle this block. Same for the block `{% block links %}` links. Logical structure is held in `slideShow_child.ncl.j2` which is a child template. It takes over blocks on its parent. Inheritance is made through `{% extend %}` statement on `slideShow_base.ncl.j2` file. Medias "block" mounts the name of each media, gather its path and set them to `id` and `src` NCL attributes, respectively. Links block, builds a link passing media objects `id` formed in media block.

```
<ncl id="slideShow">
  <head>
  <regionBase>
    <region id="main" width="100%" height="100%" zIndex="1"/>
  </regionBase>
  <descriptorBase>
    <descriptor id="ImageDes" region="main" explicitDur="5s"/>
  </descriptorBase>
  </head>
  <body>
  <port id="startSlideShow" component="image1"/>
  {% block medias %}{% endblock medias %}
  {% block links %}{% endblock links %}
  </body>
</ncl>
```

Listing 1.4: slideShow_base.ncl.j2

```
{% extends "slideShow_base.ncl.j2" %}
{% block medias %}
  {% for i in files_list[0].contents %}
  <media id="{{`image' ~ loop.index}}" src="{{ `media/' ~ i.name
      }}" descriptor="ImageDes"/>
  {% endfor %}
{% endblock medias %}
{% block links %}
  {% for i in range(files_list[0].contents | length-1)guages.
      Therefor, we are also planning to extend it. It can
      support the current %}
  <link id="{{`lMoveForward' ~ loop.index}}" xconnector="conBase
      #onEndStart">
    <bind role="onEnd" component="{{`image' ~ loop.index}}"/>
    <bind role="start" component="{{`image' ~ (loop.index+1)
        }}"/>
  </link>
  {% endfor %}
{%endblock links %}
```

Listing 1.5: slideShow_child.ncl.j2

As well as in the Jinja2 example, the slideshow made in mustache also was developed exploring inheritance. Mustache allows code inheritance through the concept of partial. Partials came from embedded Ruby (eRuby) and are used in this sense to refer to templates that cannot be rendered by themselves. The slideshow proposed example, was developed based on the following files: `slideShow.ncl.mustache`, deals with NCL code that has not become a template; `medias.mustache`, builds the media NCL elements; `links.mustache` creates each link. The code on `slideShow.ncl.mustache` document declares NCL code and calls the partials. Each partial corresponds to one file.

The head elements were removed for being the same as the Jinja2 instance. Listing 1.7 and 1.8 next exhibits, respectively, the `medias.mustache` and the `link.mustache` file.

```
<ncl id="slideShow">
  <head>
    ...
  </head>
  <body>
  <port id="startSlideShow" component="image1"/>
    {{>medias}}
    {{>links}}
  </body>
</ncl>
```

Listing 1.6: slideShow.ncl.mustache

```
{{#contents}}
  {{#index}}
    <media id='image{{index}}' src='media/{{name}}' descriptor='
        ImageDes'/>
  {{/index}}
{{/contents}}
```

Listing 1.7: medias.mustache

```
{{#contents}}
  {{#next}}
    <link id='lMoveForward{{index}}' xconnector='conBase#
        onEndStart'>
      <bind role='onEnd' component='image{{index}}'/>
      <bind role='start' component='image{{next}}'/>
    </link>
  {{/next}}
{{/contents}}
```

Listing 1.8: links.mustache

In the slide show instance above, it is seen a reduction in the number of programmed lines. Were written 36 lines of code overall, 16 of them related to template syntax while the others are in NCL. This code, when the final NCL document is generated, expands to a total of 119 lines of code. That represents a *score* of **69,75%**. From the overall number of lines, one is for inheritance and two are to delimiter the beginning and ending of which block tag. Considering, inheritance is not strictly necessary and everything could have been done in only one file we have 20 lines of code. That enlarges the score to **77,31%**. Now, considering the number of instructions the score becomes **76,92%**. And without a hierarchy structure, the score goes to **82,42%**.

On mustache, were written 33 lines of code overall which leads to a *score* of **72.27%**. If all the code were removed and replaced by one single file it would have

been coded 31 lines. In this case, the two removed lines are related to partials. Therefore, the slideshow made in mustache had a **73.95%** *score* in terms of the number of lines of code. Taking into account the number of instructions the *score* with and without hierarchy is **72.53%** and **74.73%**, respectively.

The table 1 summaries the *score* achieved in the development with both two languages.

Case	Jinja2	
	number of lines	number of instructions
w/ hierarchy	72.27%	72.53%
w/o hierarchy	73.95%	74.73%
Case	Mustache	
	number of lines	number of instructions
w/ hierarchy	69.75%	76.92%
w/o hierarchy	77.31%	82.42%

Table 1: Slideshow score summary

In both cases, it is seen a large reduction in the number of lines of code. More than that, this reduction is pretty much the same. A curious fact can be observed comparing the two cases. Using inheritance on both, the Jinja2 instance produced more lines in comparison to Mustache. That is because each block tag in Jinja2 generates 3 lines/instructions (one to denote the block on the parent template and two to mark its beginning and ending on the child template) plus one line for the extending tag. On the other hand, Mustache just requires the partial to be processed. Mustache separates one partial per file which eliminates the need for more tags.

Regarding what was mentioned in the previous paragraph, there is a drawback in the way Mustache works. For NCL applications that implies in more elaborated templates, the number of files grows equally to the number of partials used in the template. On Jinja2, a developer has free control of how much `{% blocks %}` statements he/she puts on each module.

4 Final Remarks

We asked *RQ1. How can we support web templates processing in NCL development?*. We try to answer it by arguing that we may improve by bringing web templates to NCL development. To address this question, we define the objective of **Evaluate web templates usage in NCL development** (discussed in Chapter 3). To answer this, we developed the NCL-formats tool. It aiming at assisting the development of NCL applications based on web-template languages. As discussed in Chapter 2, it can be executed standalone to generated NCL documents. We also suppose two possibilities for executing it at the client-side. Finally, to evaluate our proposal, we discuss Jinja2 and Mustache templates can support the development of some NCL. The development of such cases confirmed that web-templates can reduce code-writing independently if the metric used is the number of lines or the number of instructions in the document.

This work has limitations on both the web template evaluation and the NCL-formats tool. Our evaluation focused only on web-template languages' impact on the code itself. We did not concern the programmers. So as future work, we consider measuring the impact of our work targeting its developers. In particular, we may measure the coding time. Regarding the NCL-formats tool, it was designed to work only with Jinja2 and Mustache template engines. Therefore, future work may enlarge it to support other NCL template engines such as: XTemplate, and TAL; as well: other NCL formats, such as jNCL, NCL-ltab and RAW NCL.

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Multi-Platform TV Templates to support Ginga And HbbTV Development

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Abstract This project aims to provide a new authoring tool that focuses on interactive digital television issues in order to achieve high performance based on the benefits offered by interactivity. The objective with *Multi-Platform TV Templates* is to obtain a multiplatform tool with the option of creating applications to run on the European HbbTV and Latin American Ginga standards, and accessible through a web interface, this is of great importance since it offers the possibility of Boosting the development of more and better interactive applications using various platforms within the world market, it contains 5 implemented and pre-designed templates, each with a different format, model and presentation, which the user can choose according to their needs. In addition, it is sought that developers feel encouraged to continue contributing to the technological growth of digital terrestrial television, through a new tool that allows them to create interactive applications online simply and transparently to the programming language known to the developer.

Keywords: Ginga · HbbTV · Interactive TV · Template-oriented authoring · Reuse

1 Introducción

La Televisión Digital Terrestre (TDT) constituye un cambio tecnológico en la industria televisiva. Ella permitió aumentar la capacidad del canal de transmisión, facilita la convergencia de transmisión de datos y brinda la posibilidad de interactividad lo que permite a los usuarios convertirse en un miembro activo dentro de la programación, un aspecto que no podía ser ejercido en la televisión analógica. Además, implica un mayor aprovechamiento y optimización del espectro radioeléctrico, transmitiendo un mayor número de canales dentro del mismo ancho de banda, ayudando a tener una mejor calidad de imagen y sonido.

La interactividad permite emitir información adicional a los contenidos de televisión, para lograr esto se carga en el decodificador del usuario esta información, la cual se puede consultar en cualquier momento, dando la posibilidad al espectador de acceder al contenido cuando lo desee. La ventaja más relevante

de la interactividad consiente en poder acceder a un gran conjunto de servicios públicos y privados por medio del televisor. Existen dos formas de interactividad una local sin necesidad de canal retorno y otra interactividad completa, donde el usuario si debe disponer de una conexión a internet para conectarse con el proveedor de TV mediante el canal de retorno.

Existen varios sistemas de interactividad han sido desarrollados a nivel mundial y están siendo explotados de acuerdo a los requerimientos y necesidades de cada país o región[3]. Los de interés para este estudio son: el Ginga[2] y la tecnología HbbTV[3].

Ginga es el middleware utilizado para la ejecución de aplicaciones que se desarrollan bajo el estándar ISDB-Tb, es una especificación abierta, con facilidad de aprendizaje y permite la producción de contenidos interactivo, impulsando al desarrollo de la televisión comunitaria, y brindando un libre acceso a la información, educación y servicios sociales por medio del televisor.

HbbTV, por otro lado, trabaja con el estándar DVB, combina las emisiones de televisión (*Broadcast*) con servicios de banda ancha (*Broadband*) para de esta manera proporcionar al usuario servicios de entretenimiento por medio del televisor. La televisión híbrida es capaz de proveer un servicio de televisión y de contenido Web a través de banda ancha.

En el presente trabajo se estudia los proyectos basados en Ginga y HbbTV. Mas precisamente, nosotros creamos una herramienta generación de código de las aplicaciones interactivas desarrolladas en cualquiera de estos sistemas, y poder integrar de forma sencilla el concepto de multiplataforma.

Para presentar esta herramienta, el resto de este documento se organiza de la siguiente manera. La sección 2 presenta la herramienta. A continuación, la Sección 3 presenta nuestra evaluación con los programadores. Finalmente, la Sección 4 presenta nuestros pensamientos finales y nuestro trabajo futuro.

2 *Multi-Platform TV Templates*

En el presente trabajo se estudia los proyectos basados en Ginga y HbbTV para el desarrollo de aplicaciones interactivas, dando mayor prioridad a la herramienta *Template Generator* [1] que dispone de plantillas prediseñadas desarrolladas en lenguaje Ginga-NCL, y a partir de la cual se pretende crear una herramienta multiplataforma que integra dos sistemas de interactividad, Ginga y HbbTV para brindar la posibilidad de generación de código de las aplicaciones interactivas desarrolladas en cualquiera de estos sistemas, y poder integrar de forma sencilla el concepto de multiplataforma, creando un impulso y motivación a los desarrolladores, a seguir mejorando e innovando tecnológicamente dentro de la industria de la televisión digital terrestre. Además, dispondrá de acceso a la web mediante una plataforma online, que facilite a los desarrolladores a crear aplicaciones en el lugar y la hora que deseen, sin necesidad de instalación de programas adicionales simplemente con acceso a una conexión de internet, y tendrán la posibilidad de

[3] `https://www.hbbtv.org`

descargar el código en formato ZIP para el manejo y posibles modificaciones que deseen realizar.

La interfaz de desarrollo de aplicaciones interactivas esta disponible en la web[4]. Dentro de la ventana principal se puede apreciar un bloque de presentación, que contiene el nombre de la herramienta y una breve descripción de funcionamiento, como se muestra en la Figura 1. Los botones de las cinco plantillas que se han tomado como base del proyecto *Template Generator* [1], a cada una de las cuales se puede acceder para realizar la edición de contenido, cada botón consta de una imagen ilustrativa asociada a la plantilla cuando se desliza el mouse por encima.

Figure 1: Diseño de la Interfaz de Inicio

En las siguientes secciones discutimos los Plantillas y algunos detalles de implementación.

2.1 Plantillas

La herramienta dispone de 5 plantillas implementadas y prediseñadas, cada una con un formato, modelo y presentación distinta, las cuales el usuario puede escoger acorde a sus necesidades.

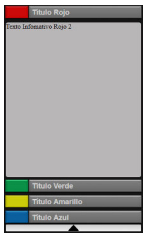

Figure 2: Plantillas 1

[4] http://hst.com.ec/MultiplatformTVtemplate/principal.html

Figure 3: Plantilla 2

Figure 4: Plantilla 3

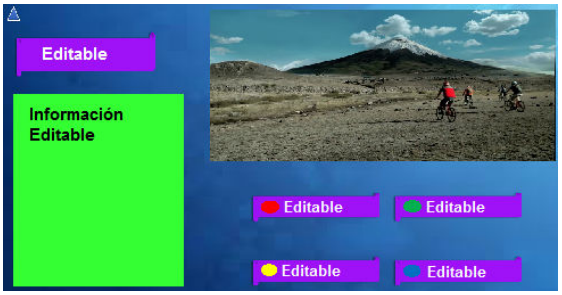

Figure 5: Plantilla 4

Figure 6: Plantilla 5

En la Tabla 1 se muestran las principales características de las plantillas desarrolladas:

Plantilla	Formato	Diseño	Características
#1	Acordeón, Sobre el video	Sin redimensionamiento de pantalla	Permite texto, tablas e imágenes
#2	Ticker, Sobre el video	Sin redimensionamiento de pantalla	Ocupa poco espacio en la pantalla
#3	Texto vertical con menú	Redimensionamiento de pantalla	El video se muestra por completo
#4	Texto vertical con imagen	Redimensionamiento de pantalla	Permite texto, imágenes y paginado
#5	Formatos combinados	Submenú principal y submenús secundarios	Flexibilidad para organizar la información

Table 1: Características de las plantillas.

2.2 Detalles de Implementación

Nosotros usamos la lenguaje de programación PHP para las plantillas que tienen la opción de cargar imágenes se presenta el código empleado para cumplir con este requerimiento. Después se detallan los formatos permitidos para cargar las imágenes, y se especifica el lugar en donde serán almacenadas. El nombre se lo asigna de manera permanente, y las imágenes a elección del usuario son cargadas en el servidor para posteriormente emplearlas en las plantillas correspondientes.

Para el desarrollo de las aplicaciones que serán ejecutadas en este sistema se trabaja con el lenguaje Ginga-NCL. En desarrollo de las aplicaciones interactivas en el sistema HbbTV se utilizan los mismos lenguajes y estructura que de diseño web: HTML, JavaScript, CSS, pero se añadieron declaraciones necesarias para la ejecución de aplicaciones HBBTV.

El usuario tiene la opción de descarga del código de la aplicación que haya desarrollado tanto para Ginga como HbbTV, la herramienta utilizada para realizar esto se usa JSZip, una librería JavaScript que permite generar fácilmente archivos ZIP. Puede permitir que los usuarios seleccionen y descarguen imágenes de una galería y generar archivos Zip estructurados.

3 Evaluación

Para evaluar el funcionamiento de la interfaz, se realizó pruebas de generación de aplicaciones interactivas utilizando nuestra herramienta *Multi-Platform TV Templates*, el desarrollo de aplicaciones se enfocó esencialmente en aspectos como: educación, salud, turismo, deportes. En la Figura 8 se muestra el ingreso de información sobre temas de deportes para la ejecución de la plantilla 1.

Figura 8 Ingreso de información (deportes) Plantilla 1 Las Figuras 9, muestran la aplicación generada y en funcionamiento, se puede observar cómo se relacionan los campos ingresado en la pantalla de ingreso de información, con los campos de la plantilla interactiva ya en funcionamiento.

Figura 9 Aplicación interactiva a partir de plantilla 1 (Opción Azul) Análisis de pruebas de usabilidad. Para el diseño de la aplicación "MULTIPLATFORM

Figure 7: Estructura HTML

TV TEMPLATE" se realizan pruebas según la escala de Likert, lo que ayuda a tener información de la respuesta del usuario en cuanto a la dificultad, navegación, diseño, entre otras, al hacer uso de la interfaz. Para realizar la prueba se toma una muestra de 16 personas y se hace una encuesta de 16 preguntas, enfocándose en los siguientes ámbitos de usabilidad: Contenido, navegación, tiempo de respuesta, utilidad y satisfacción, manual de usuario y aprendizaje.

Figure 8: Estructura HTML

Sección 1 (Contenido): Se evalúa criterios del contenido gráfico dentro de las pantallas y el impacto visual, en la Figura 10 a) se observa que el 69% y el 25% de los usuarios encuestados respondieron que están completamente de acuerdo y de acuerdo respectivamente con su criterio en cuanto a que diseño

de la interfaz es amigable y tiene un impacto visual positivo, el contenido que ofrecen las plantillas es adecuado, los textos e imágenes son claros, dimensión adecuada, visibles. Por lo tanto, el 94% de las personas encuestadas tuvieron un impacto positivo en cuanto a este aspecto.

Sección 2 (Navegación): Se evalúan criterios en cuanto a la ubicación del usuario dentro de la interfaz y cómo se relaciona con las funciones que se presentan, en la Figura 10 b) se observa que las personas encuestadas mostraron estar completamente de acuerdo y de acuerdo en un 50% y 44% respectivamente en lo que respecta a que la interfaz es intuitiva, les resulta fácil la navegación dentro de las pantallas, y opinan que la organización de la información es adecuada, entre otros. Se tiene un 94% de aprobación en esta sección, porcentaje que puede aumentar realizando capacitaciones dirigidas a los usuarios acerca de interactividad en la televisión digital y la forma de navegar con el control remoto.

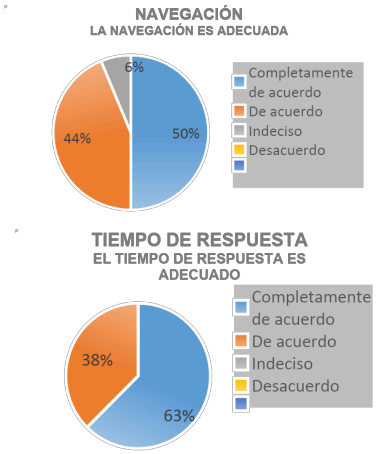

Figure 9: Evaluación de la Aplicación: a) contenido y b) navegación

Sección 3 (Tiempo de respuesta): Se evalúa el criterio del usuario al percibir el tiempo de respuesta de la interfaz, es decir el lapso que se demora en ejecutar desde que el usuario manda una orden hasta que se cumple, en la Figura 11 a) se observa que se tiene un 100% de respuestas favorables en cuanto al tiempo de respuesta del sistema, divididas en 62% personas que están completamente de acuerdo y 38% de personas que están de acuerdo, con lo que se puede asegurar que el usuario no percibe un tiempo de respuesta prolongado que afecte a sus requerimientos, por el contrario, con este resultado se tiene que los usuarios se encuentran satisfechos en lo que respecta a esta sección.

Sección 4 (Utilidad y satisfacción): Se evalúa la opinión del usuario en cuanto a servicios de utilidad y si desearía volver a utilizar el sistema, en la Figura 11 b) se observa que el 81% de las personas encuestadas están completamente de acuerdo y el 19% de acuerdo, respecto al criterio de que los servicios y contenido

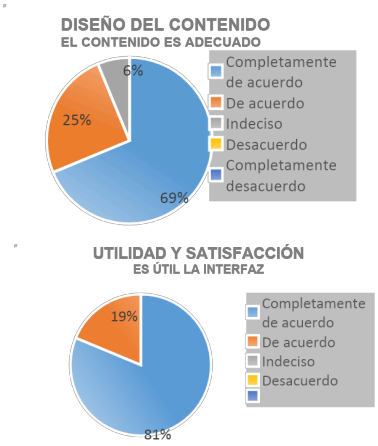

Figure 10: Evaluación de la Aplicación: a) tiempo de respuesta y b) utilidad y satisfacción

que brinda la interfaz son de utilidad, estos servicios son las opciones de ayuda y de simulación de cada plantilla. Por lo tanto, se tiene una aprobación del 100% de las personas encuestadas en cuanto a esta sección.

Sección 5 (manual de usuario y aprendizaje): Se evalúa si el usuario necesita de un manual para hacer uso de la aplicación y si le resulta fácil el aprendizaje de la misma. En la Figura 12 a) se muestra que el 37% de las personas encuestadas están completamente de acuerdo en hacer uso del manual de usuario, 38% muestran estar de acuerdo, esto representa el 75% de las personas, por lo que en primera instancia sería indispensable del uso de esta ayuda, este porcentaje puede ir disminuyendo conforme el usuario se familiarice con la interfaz y a partir de capacitaciones orientadas a la televisión digital, además se tiene que un 6% de la población se mantiene imparcial y el 13% de los encuestados considera que no es necesario el uso de un manual. Por otro lado 69% y 31% de los encuestados muestran estar completamente de acuerdo y de acuerdo respectivamente en que la mayoría de la gente está en la capacidad de aprender a utilizar el sistema de forma rápida y fácil como se muestra en el Figura 12 b).

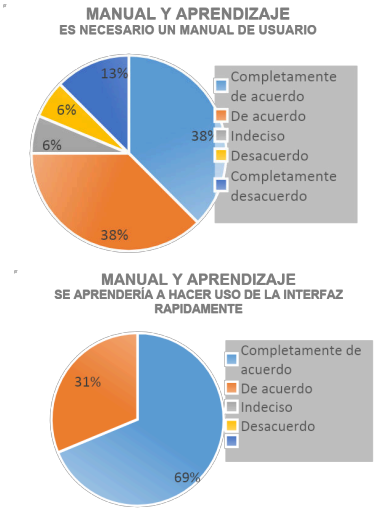

Figure 11: Evaluación de la Aplicación: a) Manual de usuario y b) Aprendizaje rápidamente.

4 Consideraciones Finales

Con el desarrollo de *Multi-Platform TV Templates* se logró obtener una herramienta online gratuita que permite la creación de aplicaciones interactivas de televisión digital a partir de plantillas prediseñadas, 5 han sido implementadas en este proyecto, el usuario está en la libertad de escoger el tipo de plantilla en la que desea desarrollar su aplicación, a partir de una interfaz de usuario intuitiva que ofrece servicios de utilidad para su correcta ejecución. La plataforma se encuentra en un servidor web que se lo puede acceder desde cualquier parte porque tiene un dominio público, por este motivo es una excelente herramienta para desarrolladores de aplicaciones interactivas que quieran experimentar con sus primeros diseños de aplicaciones en TV, tanto para las plataformas Ginga como para HbbTV. Basándose en los resultados obtenidos, la mayoría de usuarios se mostraron conformes en cuanto a servicios, contenido y tiempo de respuesta que brinda la aplicación, todos los encuestados están dispuestos a volver a utilizar la herramienta, sin embargo, existieron comentarios en cuanto a mejorar el diseño y navegación de la interfaz, que sea más sencillo y se trabaje en generar contenidos cada vez más llamativos y visuales.

Adaptar a *Multi-Platform TV Templates* las funcionalidades que otorga LUA, para el caso de Ginga, con el fin de que las aplicaciones interactivas puedan implementar algoritmos de cálculos, manejar conexiones a servidores Web vía TCP, conectarse con bases de datos y contar con un canal de retorno necesario para la interactividad completa. Mejorar el diseño de contenido y navegación de la herramienta *Multi-Platform TV Templates*, para lograr que los elementos visuales sean más atractivos y llamativos para el usuario. Adaptar la aplicación

para que sea posible ejecutar en cualquier navegador todas las funcionalidades, ya que actualmente la herramienta se ejecuta correctamente en Mozilla Firefox, para otros navegadores en algunos casos genera ciertos problemas.

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Integrating an IoT protocol to Ginga CC WebServices

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Resumo Among the new features established in the standards for data encoding and broadcast specifications for digital broadcasting published by the SBTVD forum in 2018, there is the specification of Ginga CC WebServices — a HTTP REST server to promote interaction between external devices and the DTV environment and integration of broadcast and broadband system. This paper proposes adding one feature to Ginga to ensure the interactivity of devices that incorporate the Internet of Things. We present a comparison, considering metrics of implementation complexity, performance, and compatibility with Ginga CC WebServices, of the four preeminent protocols used in IoT: MQTT, CoAP, AMQP and DDS. Finally, we advocate the adoption of CoAP protocol and present an early proof-of-concept implemented in a real commercial DTV enviornment. However, the adoption of any of those protocols is necessary to maintain the Ginga middleware initial proposal which is to stimulate digital and social inclusion in order to reduce the inequality of access to information existing in Brazilian society.

Keywords: Middleware Ginga · Internet of Things · Integrating Broadband-Broadcast · CoAP.

1 Introdução

Em 2018, o Fórum do Sistema Brasileiro de TV Digital (SBDTV)[1] estabeleceu as novas normas referentes à codificação de dados e especificações de transmissão para radiodifusão digital. Essas normas, publicadas pela Associação Brasileira de Normas Técnicas (ABNT) definem novas funcionalidades para o *middleware* de interatividade Ginga que visam permitir a integração entre conteúdo provenientes da radiodifusão terrestre com conteúdos obtidos via internet. Deste modo, foi estabelecido um novo nível de aderência às normas para os dispositivos DTV compatíveis com o SBTVD, denominado de Ginga Perfil D ou Ginga-IBB (*Integrated Broadcast and Broadband*). Um dos novos componentes que permitem essa integração é o Ginga CC WebServices, especificado pela norma ABNT 15606-11 [2], que prevê a implementação de um servidor REST HTTP. As novas funcionalidades levam em consideração alguns dispositivos atuais como *SmartTVs*

[1] http://forumsbtvd.org.br/

e dispositivos móveis, porém não dão atenção a dispositivos inteligentes que não exigem interação com usuário.

O crescente número de dispositivos conectados à internet constituem a ideia de Internet das Coisas (IoT), conceito que se refere a objetos físicos que vêem, ouvem, pensam e executam trabalhos em conjunto a fim de compartilhar informações e coordenar decisões [4]. Esse ideia abrange diversas novas áreas como casas inteligentes, cidades inteligentes e indústria 4.0. As *Smart Homes* oferecem uma melhor qualidade de vida ao introduzir o controle automatizado de aparelhos e serviços de assistência. Elas potencializam o conforto do usuário usando a consciência de contexto e restrições pré-definidas com base nas condições do ambiente doméstico [5]. Um usuário pode controlar eletrodomésticos e dispositivos remotamente, o que permite que ele execute tarefas e monitore sua residência sem estar em casa [14,15].

O objetivo do Ginga foi fomentar a inclusão digital e social a fim de diminuir a desigualdade de acesso à informação existente na sociedade brasileira, viabilizando a cidadãos de menor poder aquisitivo ou escolaridade o direito de acessar, produzir e distribuir conhecimento [7]. Por este motivo, o *middleware* deve continuar se atualizando a fim de incorporar o estado da arte em comunicação e distribuição de informação. Estado atual que inclui a Internet das Coisas.

Considerando a inclusão de protocolos de comunicação IoT ao *Middleware* Ginga, muitos cenários interessantes de uso poderiam ser concebidos. Por exemplo, considere um usuário que possui uma lâmpada LED Wi-Fi conectada em uma televisão inteligente através do Ginga CC *WebServices*. No início da transmissão de um filme a emissora de TV pergunta ao usuário se ele deseja ativar o modo imersivo, e caso o usuário permita, a emissora pode controlar a lâmpada a fim de imergir o usuário no filme. Outras possibilidades seriam o controle de um ar condicionado ou controle de caixas de som externas. Este cenário é apenas uma das possibilidades de integrar dispositivos inteligentes ao *middleware* Ginga e caracterizam aplicações *mulsemidia (multi sensorial media)* [3].

Além de aplicações de *mulsemidia* voltadas ao entretenimento e imersão, a inclusão de IoT ao *middleware* permite explorar outros cenários de integração na rede doméstica com o ambiente DTV. Por exemplo, (i) *Smartbands* carregadas pelos usuários poderiam se comunicar com a TV para informar variações nos batimentos cardíacos para outros moradores da residência diretamente na TV ou até mesmo acionar serviços de emergência; (ii) sensores localizados no quarto do usuário poderiam detectar quando ele acorda pela manhã e ligar automaticamente a TV já em seu programa matinal favorito; (iii) um programa de culinária transmitido pela emissora poderia ter uma aplicação que se comunica com uma geladeira inteligente para verificar quais dos ingredientes necessários para a receita que está sendo preparada o usuário possui e quais precisará comprar; (iv) um programa de televendas pode procurar quais outros produtos inteligentes o usuário possui para realizar *marketing* direcionado ou evitar oferecer um produto que ela já possua, entre outros.

Além da interação da TV com dispositivos domésticos, as APIs do Ginga CC também poderiam ser utilizadas para fazer gerenciamento e atualização de

firmware de dispositivos externos e até mesmo reconfiguração de módulos de hardware de dispositivos que utilizam lógica programável [11]. Deste modo, poderiam ser criados ambientes inteligentes nos quais as emissoras de TV gerenciassem as atualizações de hardware/software dos dispositivos IoT conectados a TV através da rede doméstica. Com isso o contexto de TV digital poderia ser estendido aos demais dispositivos permitindo atualizações de funções de hardware, como decodificadores de mídia, demoduladores, métodos de criptografia para módulos de segurança, etc [12].

Apesar das vantagens em incorporar protocolos IoT ao *middleware* Ginga, existe uma série de questões práticas que dificultam sua implementação. Dispositivos de DTV são considerados dispositivos embarcados, apresentando restrições de memória e processamento. Além disso os dispositivos de DTV realizam outras atividades prioritárias em paralelo que não podem ser impactadas por essa nova funcionalidade — do que serve uma TV capaz de se comunicar com a geladeira se ela não for capaz de reproduzir vídeo em tempo real adequadamente? Por fim, há a questão do custo, pois a adição de protocolos ou bibliotecas proprietárias a um dispositivo de DTV pode aumentar significativamente o custo de produção, sendo necessário buscar alternativas gratuitas ou *open-source*.

Considerando as possibilidades habilitadas pela adição do IoT e as peculiaridades do ambiente de DTV, este trabalho analisa os principais protocolos de comunicação IoT a afim de identificar o que melhor se adéqua a esse cenário. Como prova de conceito foi implementado um simples servidor IoT integrado ao *middleware* Ginga de um dispositivo DTV comercial real utilizando o CoAP, o protocolo que parece mais promissor entre os analisados. Testes de regressão e *smoke tests* mostram que a prova de conceito introduzida não impactou no comportamento e na performance do dispositivo de DTV.

O restante do artigo está organizado da seguinte forma. A Seção 2 discute trabalhos relacionados. A Seção 3 apresenta os protocolos IoT mais difundidos. A Seção 4 discute qual o protocolo mais adequado para ser integrado ao Ginga CC *WebServices*. A Seção 5 descreve uma prova de conceito utilizando o protocolo CoAP. Por fim, a Seção 6 apresenta as considerações finais.

2 Trabalhos relacionados

A integração de dispositivos inteligentes ao dispositivo DTV por meio do *middleware* Ginga já vem sendo discutida e implementada por alguns autores. De Lucena et al. [9] apresentam o GingaOSGi, uma arquitetura que permite o registro e a descoberta de serviços na rede OSGi, bem como oferece mecanismos que possibilitam uma comunicação bidirecional entre os dispositivos da rede OSGi e o dispositivo DTV. Desta maneira, aplicações NCL podem controlar dispositivos presentes no ambiente. Abreu e Santos [3] apresentam uma arquitetura baseada no conceito de âncoras temporais da NCL para gerar efeitos sensoriais de forma automática utilizando técnicas de reconhecimento de som ambiente, caracterizando assim uma aplicação *mulsemidia*. Já Pereira et al. [13] propõem a integração entre aplicações Ginga-NCL e dispositivos da IoT ao apresentar

uma infraestrutura de softwares que integra e interopera o *middlewares* Ginga, por meio de seu ambiente Ginga-NCL, e M-Hub, um *middleware* IoT.

A solução proposta neste artigo difere das demais por estar atrelada ao Ginga CC *WebServices*, novo componente proposto em 2018 a fim de possibilitar a integração entre *broadcast* e *broadband*, que expõe uma API REST acessível a qualquer ambiente de execução como Ginga-NCL ou Ginga-HTML, bem como por aplicações nativas do ambiente DTV e por aplicações executando em dispositivos externos. Deste modo, a solução proposta é mais abrangente e não está restrita a linguagens de programação especificas.

3 Protocolos para Internet das coisas

Há diversos protocolos e variações de protocolos existentes para IoT, além de pesquisas no âmbito acadêmicas e comercial para otimizar esses protocolos. Esta seção apresenta quatro protocolos de mensagens amplamente aceitos e emergentes para sistemas IoT: AMQP, CoAP, DDS e MQTT.

3.1 AMQP

AMQP [2] é um protocolo M2M leve, desenvolvido por John O'Hara no JPMorgan Chase em Londres, Reino Unido em 2003, e é um protocolo aberto de internet para mensagens de negócios [10]. O AMQP é composto por várias camadas, o nível mais baixo define um protocolo eficiente, binário e ponto a ponto para transporte de mensagens entre dois processos em uma rede. Acima disso, a camada de mensagens define um formato de mensagem abstrato, porém com codificação padrão concreta. Todo processo compatível ao AMQP deve ser capaz de enviar e receber mensagens nessa codificação padrão. O AMQP usa o TCP como um protocolo de transporte padrão e TLS / SSL e SASL para segurança. Deste modo, a comunicação entre o cliente e o *broker* é uma conexão orientada.

3.2 CoAP

COAP [3] foi desenvolvido pelo IETF (Internet Engineering Task Force) e foi projetado para interagir facilmente com HTTP para integração com a *Web*, além de atender a requisitos especializados como suporte a *multicast*, sobrecarga muito baixa e simplicidade para ambientes restritos. Ao contrário do REST do HTTP, que está vinculado ao TCP, o REST do COAP está vinculado ao UDP que apresenta menor sobrecarga. O COAP utiliza 4 tipos de mensagens: *confirmable*, *non-confirmble*, *reset* e *acknowledgment*. Usando uma combinação dessas 4 mensagens, o COAP pode alcançar comunicação confiável. Assim como o HTTP, o COAP também utiliza instruções GET, PUT, POST e DELETE.

[2] `https://www.amqp.org/`
[3] `https://coap.technology/`

3.3 DDS

Data Distribution Service (DDS) [4] é um protocolo de registro e inscrição para comunicações M2M em tempo real que foi desenvolvido pelo *Object Management Group* (OMG). Em contraste com outros protocolos de mensagens como MQTT ou AMQP, o DDS se baseia em arquitetura sem *broker* e usa *multicasting* para trazer excelente Qualidade de Serviço (QoS) e alta confiabilidade para suas aplicações. Sua arquitetura de publicação-subscrição sem *broker* se adapta bem às restrições de tempo real para comunicações IoT e M2M [4]. O DDS suporta 23 políticas de *QoS* que variam entre critérios de comunicação como segurança, urgência, prioridade, durabilidade e confiabilidade.

3.4 MQTT

O MQTT [5] é um protocolo de mensagens leve baseado no princípio de publicar mensagens e inscrever-se em tópicos. Vários clientes se conectam a um *broker* e se inscrevem ou publicam em tópicos de interesse. Vários clientes podem se inscrever nos mesmos tópicos e obter as informações que desejarem. O *broker* MQTT oferece uma interface simples e comum para que dispositivos se conectem. Isso significa que caso haja clientes que enviam mensagens assinadas para um banco de dados, torna-se simples adicionar novos sensores ou outra entrada de dados ao banco de dados, servidores web e assim por diante.

4 Selecionando um protocolo

Para selecionar um protocolo a ser integrado ao Ginga CC *WebServices* considerou-se dois fatores: (i) complexidade de implementação e desempenho do protocolo; e (ii) facilidade de integração com o Ginga CC *Webservice*.

4.1 Complexidade e desempenho do protocolo

As *SmartTVs* podem ser consideradas dispositivos embarcados. Em sua maioria utilizam sistemas operacionais com *kernel* Linux. Esses dispositivos já possuem diversos serviços integrados e para que a proposta de adoção de um novo servidor IoT seja bem recebida pelos fabricantes de *SmartTvs* é necessário levar em consideração o impacto do servidor no sistema como um todo, pois há restrições de memória e processamento. Além disso, o protocolo escolhido deve levar em consideração a realidade da banda larga brasileira, pois apesar de ter aumentando sua abrangência nos últimos anos, ocupando a 6ª posição no mercado de banda larga mundial em números absolutos em 2017 [6], ainda está atrás da média mundial com relação a qualidade e velocidade [1].

Naik [10] realizou uma análise comparativa entre os protocolos MQTT, CoAP, AMQP e HTTP a fim de realizar uma escolha efetiva de protocolo IoT. A análise

[4] `https://www.dds-foundation.org/`
[5] `http://mqtt.org/`

comparativa é realizada sobre diversos outros estudos e aponta que o CoAP possui menor sobrecarga por tamanho de mensagem, menor consumo de energia por recurso requerido e menor largura de banda por latência. Contudo o MQTT apresenta apenas uma pequena diferença nesses quesitos. Já o AMQP apresenta um consumo de energia, banda e sobrecarga maior devido à realização de outras operações de provisionamento, confiabilidade e segurança.

Chen and Kunz [8] apresentam um comparativo de desempenho dos protocolos CoAP, MQTT, DDS e UDP utilizando três métricas quantitativas: consumido por largura de banda, latência e perda de pacotes. Por serem protocolos baseados em TCP, MQTT e DDS apresentaram zero perda de pacotes mesmo em redes degradadas, porém apresentam alta latência nesse mesmo cenário. Já os protocolos CoAP e UDP padrão apresentam perda de pacotes, porém baixo consumo de banda e latência em qualquer tipo de rede.

4.2 Facilidade de integração com o *middleware* Ginga

O Ginga CC *WebServices* prevê a implementação de um servidor REST HTTP que opera sobre a pilha TCP/IP. Também prevê a implementação do *Simple Service Discovery Protocol* (SSDP) para descoberta do receptor de TV digital por dispositivos conectados a rede local. As mensagens SSDP são semelhantes às do HTTP, porém utilizam UDP como o protocolo de transporte subjacente, assim como o CoAP. Em seu trabalho, van der Westhuizen e Hancke [16] aponta que MQTT e CoAP são protocolos leves que consomem pouca bateria comparado a outros protocolos. Os autores consideram que o CoAP é mais adequado para se comunicar com sistemas projetados para HTTP, que é a realidade da maioria dos sistemas comerciais. Esse também é o caso do Ginga CC *WebServices*.

4.3 Escolha

Ao considerar os dois fatores levantados e a realidade da conectividade brasileira, os autores deste trabalho sugerem a adoção do protocolo CoAP devido a seu desempenho de baixa latência e consumo de banda mesmo em redes degradadas. Outra possibilidade, caso opte-se por uma opção baseada em protocolo TCP, o DDS apresentou a mesma qualidade com melhor desempenho que o protocolo MQTT, porém ambos não são baseados no protocolo HTTP o que pode dificultar sua integração com o Ginga CC *WebServices*.

5 Prova de Conceito

A fim de validar a proposta apresentada, os autores integraram um servidor CoAP ao Ginga CC *WebServices* parcialmente implementado em um dispositivo DTV comercial. A Figura 1 ilustra o diagrama de sequência da prova de conceito desenvolvida.

O servidor CoAP é iniciado juntamente com o servidor HTTP, utilizando o mesmo endereço de IP, porém em porta diferente. Foi implementada uma rota

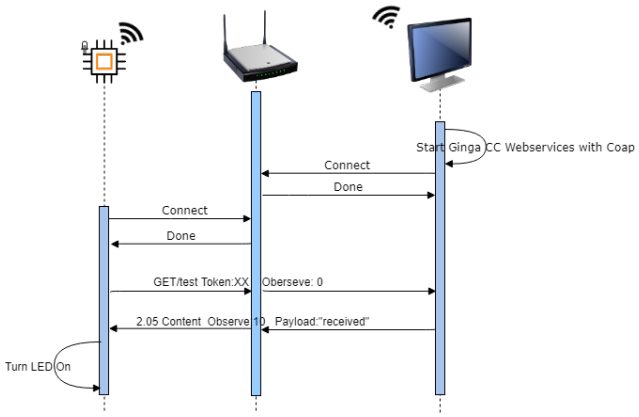

Figura 1. Diagrama de sequência.

para fins de teste no servidor CoAP para que um dispositivo externo recebesse uma determinada resposta ao fazer uma requisição. O dispositivo DTV foi conectado a rede Wi-Fi local. Foi utilizado um módulo Wi-Fi de desenvolvimento de baixo custo como cliente CoAP externo com um LED vermelho conectado em seus pinos na prova de conceito. O módulo foi programado para que enviasse uma requisição utilizando o método GET para o servidor CoAP logo após conectar-se a rede WiFi local. Por fim, o módulo acendia um LED vermelho ao receber uma resposta especifica do servidor CoAP. Logo após o dispositivo Wi-Fi se conectou a rede, o LED acendeu, validando assim, a implementação do servidor CoAP integrado ao Ginga. Foram realizados testes de regressão e *smoke tests* na versão do *middleware* Ginga modificada e os testes não detectaram diferenças no comportamento ou na performance, o que demostra que a incorporação do servidor CoAP não impactou significativamente no uso dos recursos do sistema do dispositivo DTV comercial.

6 Considerações Finais

O principal objetivo deste artigo é fomentar a ideia de adoção e integração de um protocolo de internet das coisas ao Ginga. Deste modo, o *middleware* continuará evoluindo e seguindo seu propósito de estimular a inclusão digital e social a fim de reduzir a desigualdade de acesso à informação na sociedade brasileira. O artigo se embasa em pesquisas realizadas sobre os principais protocolos de IoT e propõe a adoção do CoAP levando em consideração o cenário brasileiro atual de banda larga e apresenta uma prova de conceito para demonstrar sua viabilidade. Porém, uma proposta para melhor definição do protocolo a ser aderido seria implementar ou utilizar servidores existentes dos protocolos citados neste artigo em $SmartTvs$ de diferentes fabricantes a fim de medir o desempenho de cada um em diversos casos de usos reais. Um revisão sistemática sobre o desempenho de protocolos de IoT faz-se necessária para maior embasamento teórico.

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Plataforma de remix como estratégia de promoção do envolvimento com conteúdos noticiosos

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Abstract. A Internet é um motor indispensável para a democratização do consumo de conteúdos audiovisuais, com particular enfoque nos últimos anos para os conteúdos em formato de vídeo. Nesse sentido, diferentes plataformas, iniciativas e movimentos contribuem efetivamente para estimular a produção e disseminação de novos conteúdos, no contexto de uma Cultura de Remix muito presente. Consumidores de notícias passam a assumir o papel de coprodutores recriando conteúdos ou produzindo novas interpretações para as notícias atuais, sejam estas recriações de cariz cómico (incluindo os *memes*), documental, satírico ou outro. Neste estudo, procurou-se analisar quais as ferramentas tecnológicas que agilizam este processo de cocriação e especificar e implementar uma plataforma tecnológica para a remixagem de conteúdos noticiosos em vídeo. Esta plataforma online, designada Clip.it, foi desenvolvida em colaboração com um grupo de media jornalístico de referência português, no âmbito do programa de financiamento Google Digital News Initiative, com o objetivo de disponibilizar aos seus leitores a possibilidade de participarem na produção de conteúdos, através da criação de *remixe*s das notícias veiculadas pelo grupo de media. Neste artigo é descrita a plataforma Clip.it, analisando o seu processo de conceção, implementação e avaliação. Nesta etapa, procurou-se compreender de que forma a disponibilidade de tal plataforma poderá agilizar e incrementar o envolvimento dos leitores com as notícias através da promoção de práticas de cocriação de conteúdos. A plataforma foi avaliada por 70 participantes que a utilizaram para criar conteúdos a partir de vídeos de notícias disponibilizados. Os resultados permitem perceber quais os temas, formatos de conteúdo e elementos preferidos pelos avaliadores na criação dos seus vídeos de *remix* e de que forma a existência deste tipo de plataformas poderá contribuir para um maior envolvimento dos públicos com o conteúdo noticioso.

Keywords: vídeo, cultura de remix, notícias, plataforma de edição, cocriação, comportamento do utilizador.

1 Introdução

As evoluções nas plataformas e no próprio comportamento dos utilizadores da Internet permitiram o aparecimento de um novo papel para os utilizadores, passando a um papel ativo na produção de conteúdo [10]. A evolução para a Web 2.0, conforme a classificação proposta por Tim O'Reilly, correspondeu a essa mudança de comportamento, definindo o ambiente digital como um espaço de publicação, criação e interação.

Por meio de *blogs*, redes sociais e outros canais, o utilizador é estimulado a divulgar as suas próprias opiniões corporizando-as através de textos, imagens ou vídeos que produz ou que recria. A construção desses conteúdos, apesar de o indivíduo estar constantemente imerso em grandes grupos, acontece de maneira individualizada. Ou seja, cada um tem acesso a um conjunto vasto de informações sobre as quais pode refletir e selecionar para criar o seu próprio conteúdo. A criação de conteúdos pelo utilizador pode assim ser feita por "colagem" individualizada a partir de um ambiente diverso de conteúdos disponíveis [7].

Os aspetos que moldaram este cenário contribuíram efetivamente para a descentralização da produção de conteúdo e para a emergência de hábitos de curadoria enquadrados numa "Cultura de Remix" [5]. O ato de "remixar" pode ser classificado como um ponto de vista pessoal, corporizado num formato de conteúdo, daquilo que os indivíduos veem, ouvem e leem [4]. Trata-se da apropriação de um conteúdo existente para o desenvolvimento de algo novo, muitas vezes com outros significados.

Nesse contexto, a Internet é também um repositório de ferramentas que se tornaram facilitadoras do processo criativo. *Softwares* de edição e programas voltados à manipulação de imagens, por exemplo, contam com os recursos necessários para quem deseja produzir um conteúdo próprio sem, necessariamente, ter algum tipo de conhecimento específico. E foi no sentido de observar o comportamento dos utilizadores no âmbito da Cultura de Remix que o SocialiTV, grupo multidisciplinar do Digimedia -Universidade de Aveiro, em parceria com a Cofina Media e o apoio do Google Digital News Initiative, criou e disponibilizou uma plataforma voltada à edição de conteúdos em vídeo. Nomeada Clip.it, a ferramenta oferece um ambiente simplificado para a edição de vídeos a partir de conteúdos noticiosos.

O objetivo principal deste artigo é contextualizar a solução e mostrar, a partir da observação de um grupo de utilizadores, como os mesmos se comportam mediante este tipo de tecnologia. Os resultados aqui apresentados mostram que tipo de conteúdo é produzido pelo público, destacando aspetos como o estilo, género e os elementos complementares utilizadores (infografias, textos, sons). Procurou-se, ainda, perceber se este tipo de ferramenta pode promover uma maior aproximação dos públicos ao conteúdo noticioso.

Depois da seção introdutória, este artigo está estruturado da seguinte forma: a seção 2 apresenta o estado da arte referente à Cultura Remix; a metodologia é abordada na seção 3, junto com os resultados da avaliação e a discussão. Por fim, as conclusões são apresentadas na seção 4.

2 Estado da arte

Para Lessig [5], a Cultura Remix é um dos elementos-chave do processo criativo contemporâneo. Quinze anos após os primeiros estudos de Lessig estas práticas continuam muito presentes, como se pode verificar pelo sucesso de um dos formatos atuais, os *memes*. O formato, enquadrado na lógica de *remix*, relaciona-se diretamente com a apropriação de conteúdo pelos utilizadores, pelo que Blackmore [2] apelida estas práticas de Cultura do Meme. Cultura, no sentido em que quando é produzido um *meme* (uma imitação personalizada) algumas caraterísticas do conceito inicial são levadas adiante. Por sua vez, outros *remixes* poderão ser feitos a partir deste podendo levar a que o processo aconteça repetidamente até que ideias novas ganhem vida própria [2].

Os *memes* desempenham um papel importante no contexto comunicacional por abordarem factos atuais, sendo frequente a sua associação a temáticas políticas. A associação a temas considerados "sérios" pode ser uma quebra de barreiras, uma vez que a prática era conhecida como radical, sobretudo antes da popularização da Internet [1]. Neste sentido, estas práticas, ao envolverem mais utilizadores, têm o potencial de impulsionar a relação com a informação e o seu consumo. Envolver o público é justamente uma preocupação dos grandes *media*. Tal cenário fez alguns dos principais meios mundiais, como a BBC e CNN, adotarem estratégias voltadas para incentivar o espectador a participar ativamente nos seus canais. A CNN[1], por exemplo, criou o iReport em 2006. Inicialmente, o projeto estimulava o envio de materiais noticiosos por meio de uma secção específica do site. A iniciativa evoluiu, ganhou uma secção própria e colocou o público à frente de algumas notícias [9]. A participação dos utilizadores/espectadores não ficou restrita ao envio de materiais em vídeo, áudio ou foto, foram incentivadas práticas de cocriação de conteúdo. Estas práticas têm sido crescentemente impulsionadas inclusivamente com a disponibilização de plataformas e ferramentas tecnológicas de suporte.

2.1 Plataformas e tecnologias de suporte a práticas de remix

O aumento do número de plataformas que suportam e agilizam a criação de *remixes* de conteúdo será resultado e consequência do crescimento da procura pela criação deste tipo de material. No YouTube, a facilidade oferecida para consumir, realizar o *upload* de conteúdo e interagir com os vídeos faz do site um "sistema inteligente de *remix*" [3]. A simplicidade de todo o processo, incluindo a facilidade do processo de compartilhamento é, segundo, Fagerjord [3], a chave do sucesso.

Para além da plataforma mais popular, podem-se identificar outras mais específicas e orientadas à criação de vídeos. A plataforma colaborativa hitRECord[2], fundada em 2004, permite aos utilizadores a partilha de diferentes formatos de conteúdo, como vídeos, textos e áudios, constituindo um repositório de materiais criados pelo próprio utilizador. Para além do repositório, a plataforma promove a criação colaborativa de projetos audiovisuais, disponibilizando, para isso, um ambiente específico para a edição dos mesmos. A plataforma, utilizada por artistas, *designers*, escri-

[1] Rede de televisão norte-americana especializada na transmissão de notícias 24 horas por dia.
[2] Criada pelo ator e diretor norte-americano Joseph Gordon-Levit.

tores, guionistas e outros profissionais da área de audiovisual, conta com 700 mil subscritores. É possível lançar desafios, estimulando os subscritores a fazerem vídeos sobre determinados temas. Estas práticas são suportadas por estratégias de gamificação podendo, ainda, gerar vertentes comerciais. A plataforma conta com uma equipa de curadoria que analisa as produções. Caso alguma delas seja do interesse da equipa de curadoria, o conteúdo é comprado, revendido e os artistas recompensados por meio de um esquema de partilha de receita. A partir de contribuições pontuais e feitas por indivíduos com habilidades específicas, a plataforma facilita o que Levy [6] apelidou de inteligência coletiva.

Muito embora haja um grande volume de *remixes* em vídeo, esse hábito não é exclusivo dos conteúdos visuais. Também ao nível da criação de conteúdos áudio se verificam práticas de *remix*. Plataformas de edição como a TalkRadio oferecem estúdios *online* para quem deseja gravar conteúdos, editá-los e depois disponibilizá-los.

3 Plataforma Clip.it

A plataforma Clip.it é uma iniciativa desenvolvida em colaboração entre a Cofina Media, líder no segmento de *media* de Portugal, e o grupo Social iTV da Universidade de Aveiro com o apoio do programa Google Digital News Initiative.

No âmbito do projeto procurou-se desenvolver uma solução para estimular a criação de *remixes* de conteúdos noticiosos a partir de vídeos disponibilizados pela Cofina. A plataforma disponibiliza conteúdos em vídeo partilhados pela empresa de media (ex. reportagens) e permite aos utilizadores criarem novos conteúdos pela junção/edição desses conteúdos em vídeo, mas, também, pela inclusão de animações, títulos, efeitos sonoros ou músicas. Os vídeos gerados são publicados no YouTube e na própria plataforma podendo ser partilhados nas redes sociais pelos seus criadores. Finalmente, a plataforma permite à empresa de media destacar os vídeos de maior popularidade ou qualidade nos seus próprios jornais ou canais de media online.

3.1 Tecnologias, Processos e Arquitetura

A plataforma Clip.it recorre a uma base de dados única e centralizada (mysql), que é administrada pelo sistema interno – *backend*. A plataforma foi desenvolvida em React.JS sendo a comunicação entre *frontend* e *backend* baseada em PHP suportado pela framework Laravel, exclusivamente por meio de uma API REST desenvolvida especificamente para esse propósito.

Devido à natureza do sistema, o *backend* foi desenvolvido primariamente utilizando uma abordagem orientada a eventos. O *frontend* realiza chamadas ao *backend* por meio da API, que, por sua vez, gera eventos a partir das ações executadas. Alguns deles resultam em tarefas assíncronas, que produzem efeitos apenas posteriormente, muito depois do término da comunicação entre as duas entidades. Essas tarefas são colocadas numa fila para execução posterior como é exemplo o envio dos vídeos para publicação no YouTube.

Para além dos módulos referidos, foi desenvolvido especificamente para o projeto um motor com o intuito de permitir a *renderização* dos vídeos criados pelos

utilizadores. Esse motor foi desenvolvido em Node.JS utilizando-se primariamente a biblioteca ffmpeg.

Por forma a otimizar recursos e garantir a melhor performance, as operações de *render* são realizadas num servidor virtual distinto do servidor Web. Neste servidor, são armazenados o resultado da *renderização* e os arquivos utilizados no processo.

Seguidamente, descrevem-se as principais áreas funcionais e funcionalidades da plataforma Clip.it.

3.2 Áreas funcionais

A plataforma apresenta duas áreas fundamentais, a página inicial (ver figura 1) que serve de montra aos conteúdos *remix* criados pelos utilizadores e de maior popularidade e um editor de vídeo que permite criar e editar os vídeos. Na página inicial são destacados os últimos vídeos criados ou os que estão a alcançar maior popularidade nas redes sociais onde foram publicados. O utilizador pode, ainda, pesquisar por temas ou palavras-chave.

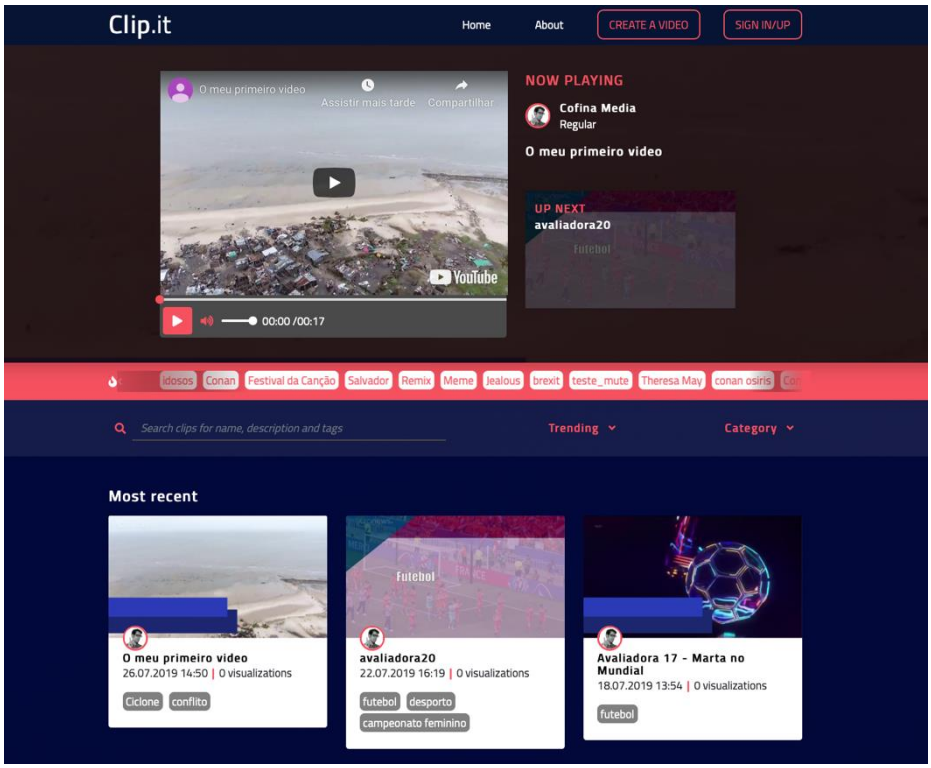

Figura 1. Página inicial da plataforma Clip.it.

Os utilizadores registados têm acesso ao processo de criação de conteúdo, disponibilizado pelo editor (ver Figura 2). Este processo exclusivamente gerido num editor online que é executado no *browser* (sem necessidade de instalação de softwares

ou plug-ins) inclui os seguintes passos: i) escolher os *clips* de vídeo; ii) incluir elementos complementares à composição, como títulos, *stickers/gifs* animados, músicas e efeitos sonoros; iii) finalizar o vídeo e submeter para render, e; iv) partilhar nas redes sociais. Por forma a garantir a integridade dos conteúdos gerados pelos utilizadores incluem-se, ainda, mecanismos de aprovação ou rejeição (pelos administradores da plataforma) dos vídeos criados.

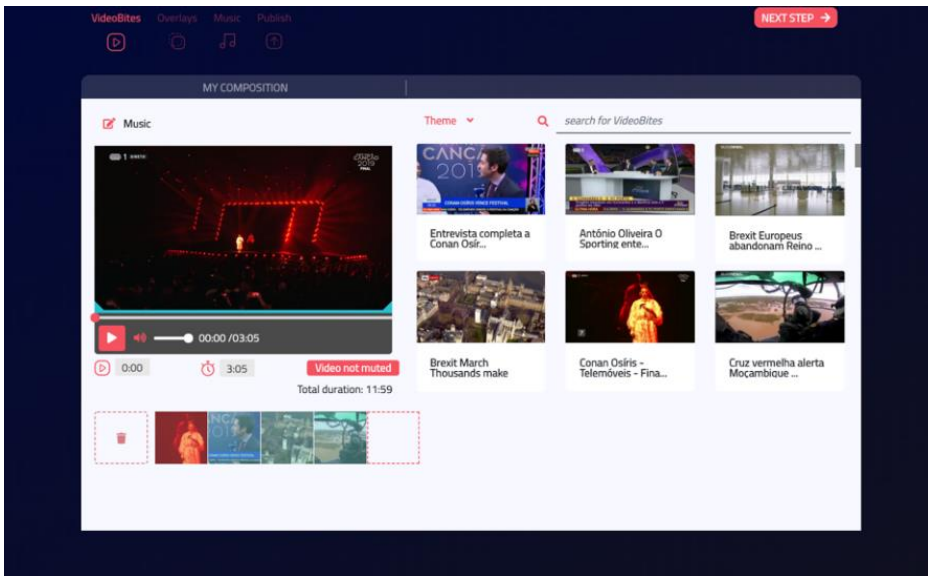

Figura 2. Editor da plataforma Clip.it.

Os vídeos produzidos são também disponibilizados na página inicial do Clip.it sendo a sua "performance" nas redes sociais monitorizável numa área de administração reservada a moderadores da Cofina ou na própria área de gestão do utilizador.

3.3 Metodologia de avaliação de uso

Após o desenvolvimento da versão preliminar da plataforma avançou-se para uma avaliação com utilizadores. Esta seção apresenta a metodologia adotada para analisar o comportamento e a produção de *remixes* a partir do uso de uma plataforma construída especialmente para este fim. O objetivo central compreendia uma avaliação de usabilidade da plataforma e a identificação de hábitos e preferências dos utilizadores quanto aos tipos de vídeo a editar, nomeadamente no que diz respeito ao género, estilo e recursos utilizados para a sua produção.

A avaliação foi realizada com um grupo composto por 70 estudantes do 1º ano da Licenciatura em Novas Tecnologias da Comunicação (NTC) da Universidade de Aveiro. Os testes foram aplicados em abril de 2019. O desafio foi proposto pelo professor numa aula, tendo depois a maioria do trabalho sido desenvolvido autonomamente fora do espaço e tempo de aula. A aula de lançamento do desafio compreen-

deu uma breve apresentação do funcionamento da plataforma, seguido de um convite ao registo dos utilizadores na plataforma.

O desafio apresentado aos alunos sugeria a criação de uma narrativa audiovisual de tema e estilo livres a partir de 45 *clips* jornalísticos divididos por temas macro: i) mundo; ii) desporto e iii) entretenimento. Para cada temática macro foram selecionados assuntos da atualidade. Os vídeos disponibilizados compreenderam os seguintes assuntos: a) Mundo: Ciclone Idai em Moçambique, Brexit e Faixa de Gaza; b) Desporto: corrupção no futebol e rivalidade de clubes; c) Entretenimento: Festival Eurovisão da Canção e gravidez de Meghan Markle.

O desafio do exercício sugeria que os estudantes adotassem um género específico para o conteúdo de remix: comédia, informação documental, controvérsia, musical ou artístico, entre outros e definia algumas orientações: i) os vídeos deveriam ter entre 1 e 3 minutos; ii) não era permitido usar mais de 26 clips, e; iii) o vídeo deveria ser editado integralmente na plataforma, sem adição de qualquer elemento extra (exceto elementos textuais) que não fizesse parte da estrutura disponível.

No decorrer do trabalho de realização dos vídeos, os estudantes foram partilhando relatos, os quais foram importantes para a deteção de problemas, melhorias e correções. Foi necessário, por exemplo, fazer correções no sistema de *render* para garantir a publicação dos vídeos e outras correções para melhorar a estabilidade e compatibilidade com diferentes *browsers*.

3.4 Conteúdos produzidos

Foram criados 70 vídeos, que totalizam 108 minutos e 20 segundos (média de 1'50" por vídeo). Os alunos utilizaram 262 clips no total, uma média de 3,74 por trabalho.

Os temas mais escolhidos (gráfico 1) para a tarefa foram de "entretenimento", preferido de 50% dos estudantes. Em segundo lugar ficou o tema "notícias internacionais" (25,7%), seguido de desporto (17,4%) e um *mix* de mais de um tema (7,14%).

Além do tema, foi também analisado o género adotado pela narrativa. Nesse sentido, a maioria optou pela comédia (54,9%). Em contrapartida, 30 estudantes (42,86%) optaram por transmitir informações de cariz mais sério. Um estudante (1,43%) produziu um conteúdo mais reflexivo e outro (1,43%) trouxe uma abordagem séria, porém não-noticiosa.

Em relação aos elementos disponíveis (gráfico 2) para enriquecimento da narrativa, houve uma grande incidência de uso. Os títulos e os oráculos, por exemplo, foram utilizados 103 vezes, uma média de 1,47 por vídeo. Das opções disponibilizadas na biblioteca da plataforma Clip.it, o título que continha uma animação (e que estava disponível desde início da avaliação) foi o favorito (foi utilizado 49 vezes).

Os *stickers/gifs* animados também foram bastante utilizados nos vídeos. Foram utilizados 161 no total, uma média de 2,3 por trabalho. A este nível verificou-se uma grande assimetria entre os trabalhos apresentados. Enquanto alguns estudantes utilizaram um número elevado de stickers, outros optaram por não colocá-los nos seus trabalhos (como exemplo, o recorde de uso foi de 26 num único vídeo). Assim, ao efetuar o cruzamento entre o género da narrativa e a quantidade de elementos utiliza-

dos, verifica-se que os vídeos de comédia continham mais animações e até mesmo títulos que os demais.

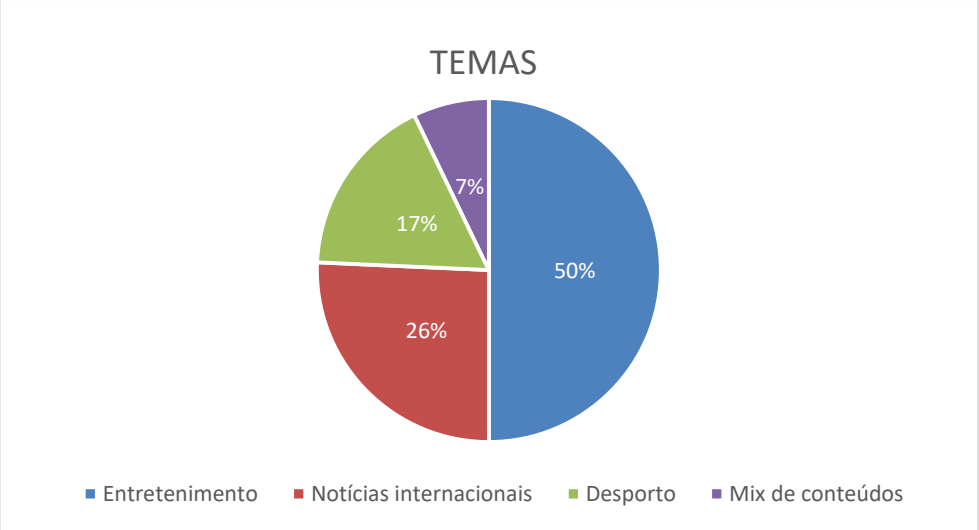

Gráfico 1 - Temas de preferência dos alunos.

Em relação aos efeitos sonoros e às músicas, os alunos optaram por inserir este tipo de complemento 101 vezes, uma média de 1,44 por vídeo. Por fim, 31 estudantes não utilizaram a função "mute", que permite silenciar os clips escolhidos para a narrativa para, por exemplo, permitir o uso sem mistura sonora das músicas.

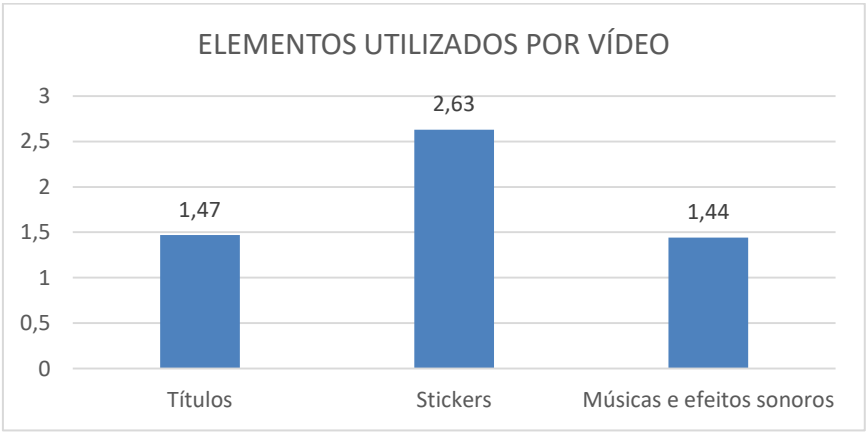

Gráfico 2 – Número médio de elementos utilizados nos vídeos.

3.5 Sugestões de melhoria

Procurou-se, ainda, recolher sugestões de melhoria para a plataforma, tendo sido mais frequentes as seguintes sugestões: i) aumentar a quantidade de vídeos que integram a biblioteca da plataforma; ii) incluir a possibilidade de realizar fade nos vídeos e no áudio; iii) possibilidade de adicionar conteúdos livres, como músicas e animações.

4 Conclusões

Este trabalho teve como objetivo identificar o comportamento do utilizador num ambiente de promoção de práticas de *remix*. Com base no teste feito à plataforma Clip.it, observou-se que a ferramenta foi capaz de estimular a produção de conteúdo próprio a partir de materiais já disponibilizados, independentemente do tema. Reforça-se a perspetiva associada à Cultura Remix, na qual o indivíduo tem interesse em fazer colagens utilizando conteúdos preparados por outros autores [7].

A análise ao tipo de conteúdos produzidos permite perceber que o género de comédia foi predominante, género muito popular também na cultura *meme*. Os resultados parecem corroborar a ideia que tratar assuntos considerados sérios de uma maneira descontraída passou a ser habitual na Internet. Entende-se que os utilizadores possam preferir a comédia por ser uma forma eficiente de aproximar as notícias das suas próprias realidades. O humor pode ser classificado, então, como um mecanismo capaz de criar e manter laços [8].

Verificou-se, ainda, que elementos mais divertidos, como *stickers* e títulos com aspetos gráficos semelhantes aos *memes*, foram utilizados com maior frequência nos vídeos de comédia. As demais criações, de géneros que não de comédia, receberam menor número de elementos adicionais. Contudo, os vídeos de outros géneros incluíram um maior número de *clips*. Verifica-se, então, que os utilizadores que criaram vídeos de cariz noticioso preocuparam-se mais com a sequência lógica da narrativa e com a qualidade imagética do que com possíveis complementos distratores. Tal organização deixa claro que o intuito dos estudantes, criadores de *remixes* noticiosos, era transmitir algum tipo de informação a partir de seus vídeos – e não apenas entreter.

De um modo global verificou-se que plataformas como a Clip.it permitem aos utilizadores criar conteúdos em vídeo de forma simplificada. Os utilizadores têm preferência pelo género de comédia, no entanto, verificou-se um número relevante de vídeos de base noticiosa. Os resultados permitem antecipar que este tipo de plataformas, possibilitando aos utilizadores integrar criativamente elementos que encontram, por exemplo, na cultura meme, tem o potencial de aproximar os utilizadores às notícias, mesmo que o fim último seja parodiar as mesmas.

Para uma melhor compreensão do impacto deste tipo de plataformas enquanto instrumentos de aproximação dos leitores às notícias e aos meios de informação, o trabalho futuro prevê uma avaliação no terreno com diferentes utilizadores da versão final da plataforma Clip.it.

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Interfaces e Interacción ·

Interfaces e interação ·

Interfaces and Interaction ·

Implementación de un sistema Brain Computer Interface para permitir el uso del control remoto de la televisión a personas con deficiencias físicas

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Abstract. El presente trabajo muestra la implementación de un mando a distancia que permite controlar las principales funciones de la televisión a personas que tengan alguna deficiencia motora en sus extremidades superiores y no puedan acceder a tomar con sus manos un control remoto, colaborando de esta forma con la inclusión y accesibilidad digital. Para alcanzar este propósito se utilizó un casco Brain Computer Interface BCI, que permite la interacción cerebro-máquina mediante señales electroencefalogramas no invasivas, sin causar daños ni molestias en la salud. Se diseñó una metodología adecuada para que mediante señales cognitivas con movimientos de la cabeza y expresivas con algunas expresiones del rostro se consiga cambiar de canal, subir o bajar volumen, prender o apagar la TV. Para conseguir la integración entre el casco BCI con la televisión se realizó una interfaz gráfica en el entorno de desarrollo Processing que reconoce las señales que genera el dispositivo y mediante un controlador de Arduino emite las señales de las funciones de cualquier control remoto de TV. Además, se plantea como futuros trabajos alcanzar un funcionamiento óptimo para utilizar más funciones del control remoto, por ejemplo, acceder al menú o participar de aplicaciones interactivas en la TV.

Keywords: Brain Computer Interface, señales electroencefalogramas, discapacidad motora, televisión inclusiva.

1 Introducción

El concepto de Brain Computer Interface BCI nace con el objetivo de crear una nueva interfaz que permita a las personas con discapacidades motoras controlar dispositivos electrónicos (PC, Smartphones, Smart TV, etc.) u otras aplicaciones que les sirvan de ayuda en la vida diaria y les proporcionen mayor independencia, estas discapacidades motoras pueden ser enfermedades degenerativas en las que se pierde progresivamente la capacidad de movimiento como la Esclerosis Lateral

Amiotrófica ELA (Amiotrófica), distrofia muscular, o por algún tipo de trauma generalmente provocadas por accidentes que reducen sus capacidades motoras y producen (parálisis muscular, lesión cerebral o de medula ósea, amputación de algún miembro, etc.)
La inteligencia artificial busca la posibilidad de que un ordenador simule el proceso de razonamiento humano y sea capaz de aprender, una de las aplicaciones que se emplea para este fin es los sistemas BCI, que traducen las intenciones del usuario en comandos de control, en este caso para que pueda controlar funciones del dispositivo que el usuario este utilizando para ver la TV, un video en internet, Smart TV, ordenador personal, desde algo tan sencillo como cambiar de canal o subir el volumen, así como funciones más complejas en las que el usuario pueda participar en aplicaciones interactivas de video, realizando búsquedas, teniendo más información de la programación, accediendo a su cuenta de Facebook, Twitter, YouTube, realizando compras a través de su TV, etc. Todo esto sin necesidad de tener un control remoto a la mano, tan solo utilizando un casco que interpreta nuestros pensamientos o censa movimientos de nuestro rostro, ojos, cejas o en general cualquier movimiento de nuestro cuerpo, por las señales eléctricas que estos generan en nuestro cerebro.

2 Análisis Sistema Brain Computer Interface

Brain Computer Interface (BCI) no es una ciencia nueva, su estudio empezó en 1929, siendo la primera prueba de señales electroencefalogramas (EEG), y fue usada principalmente por médicos y científicos para investigar el funcionamiento del cerebro. Avanzando con el estudio se procedió a descifrar las señales EEG, y poder conocer las intenciones, de tal forma que una persona pudiera controlar determinados dispositivos a partir de su actividad cerebral.
Así, se define BCI, como un sistema de comunicación que monitoriza la actividad cerebral y traduce determinadas características, correspondientes a las intenciones del usuario, en comandos de control de un dispositivo. Bajo esta definición, los sistemas BCI pueden resultar muy útiles para las personas dependientes de avanzada edad o con graves discapacidades y por tanto llega a ser un nuevo canal de comunicación. (Hornero, Corralejo, & Álvarez)

2.1 Dispositivos BCI existentes en el mercado

Neurosky: Dispositivo basado principalmente en el estudio de las señales EGG por medio de biosensores, algoritmos biométricos de electrocardiograma (ECG), permiten el monitoreo y el análisis de una gran gama de bio-señales cardio que en otros dispositivos no se encuentra disponible. (Neurosky, 2018)

- Emotiv: Dispositivo que maneja señales electroencefalograma generadas por el cerebro humano, permitiendo la visualización y manejo de estas señales. (EMOTIV, 2018)
- g.Nautilus: Dispositivo enfocado específicamente a lo clínico y médico,

desarrollado por investigadores, ingenieros. (g.tec, 2018)

- Mindball: Dispositivo que analiza las señales Alfa y Theta mediante un juego donde se manipula la tranquilidad y relajación de las personas. (ALVY, 2018)

2.2 Métodos usados por BCI

BCI se encuentra basado en una variedad de métodos invasivos y no invasivos los cuales registran la actividad y funcionamiento cerebral, dentro de estos están: electroencefalograma (EEG), electrocorticografía (ECoG), magnetoencefalografía (MEG), tomografía por emisión de positrones (Positron Emission Tomography, PET) o imágenes de resonancia magnética funcional (functional Magnetic Resonance Imaging, fMRI). Por ello, el método más empleado para el registro de la actividad cerebral en sistemas BCI es el EEG, ya que se trata de una técnica sencilla, no invasiva, portátil y de bajo costo. (Hornero, Corralejo, & Álvarez, 2012)

2.3 Estructura General de sistemas BCI

Los sistemas BCI se encuentran conformadas por un modelo funcional genérico mostrado en la Figura 1, donde se ve el funcionamiento y proceso básico del sistema.

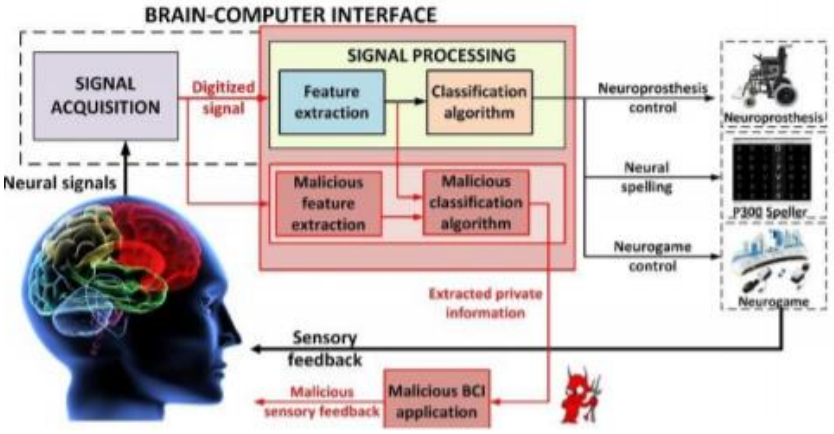

Fig. 1. Estructura General de un sistema Brain Computer Interface (BCI).

Adquisición y acondicionamiento de la señal (Signal Acquisition): registro y procesado de la actividad cerebral del usuario.
Procesado de señal (Signal Processing): recibe la señal digitalizada transformando en comandos que el dispositivo entiende de la señal recibida. Dentro de este proceso la señal atraviesa por varias etapas como es: filtración de ruidos, obtención, extracción y traducción de características.
Aplicación o Interfaz de control (Application or control interface): bloque funcional que recibe los comandos de control y realiza las acciones

correspondientes en el dispositivo a través del controlador del mismo. (Gutiérrez Martinez, Cantillo Negrete, Cariño Escobar , & Elías Viñas, 2013)

3 Herramientas utilizadas para el diseño e implementación de la interfaz de control

3.1 Hardware y Software del proyecto

Por parte del Software se desarrolló en dos entornos o IDE's, siendo la primera parte la comunicación entre el dispositivo y computador donde se usó el entorno de "Processing", contando con una interfaz visual y conectividad entre varios entornos de desarrollo y dispositivos. La segunda parte se desarrolló en entorno de "Arduino", donde se realizó la programación de las funciones de los botones y las señales que serán enviadas hacia la Televisión. Además, se utilizó para la emisión y recepción de las señales infrarrojas librerías que Arduino brinda en su página GitHib. (Adafruit, Recepción y decodificacion IR)
Por la parte del hardware se usó: Arduino Mega, receptor infrarrojo VS1838B, el que permite la decodificación de los botones del control remoto, el receptor LED IR el que emitirá la señal hacia la televisión dentro del proyecto. (Adafruit, Envio de codigo IR)

3.2 Descripción de la estructura del sistema implementado

El sistema implementado está conformado en cuatro etapas como se muestra en la figura 2.

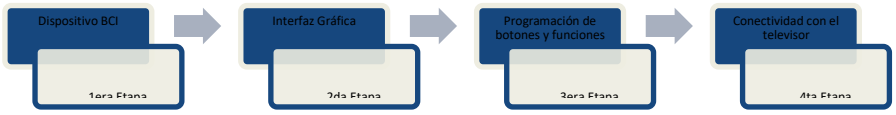

Fig. 2. Etapas de la estructura del proyecto implementado.

3.3 EMOTIV y su entorno gráfico (1er Etapa)

El dispositivo BCI para las señales EEG que se usó dentro del proyecto es el EMOTIV EPOC +, debido a su mayor confort, un promedio de 14 sensores que permite la adquisición de la señal, conectividad inalámbrica evitando cables que moleste al momento de usar, y su precio no muy elevado en consideración con otros dispositivos del mercado. El dispositivo EMOTIV EPOC+ cuenta con su software propio, el que se puede descargar desde la página oficial (EMOTIV), donde al momento de instalar brinda una serie de pestañas o modos con herramientas para la familiarización y funcionamiento del dispositivo. La interfaz principal del EMOTIV contiene 5 pestañas o modos de reconocimiento, estos modos son: estado señal (status signal), modo expresivo, modo afectivo, modo

cognitivo, y emulador de mouse. Dos modos (expresivo, cognitivo) cuentan con la configuración EmoKey, donde se configura alguna expresión del rostro o movimiento en una acción programada, como por ejemplo enviar un carácter, número, o cualquier combinación del teclado (ctrl+, alt+, entre otros). (EMOTIV)

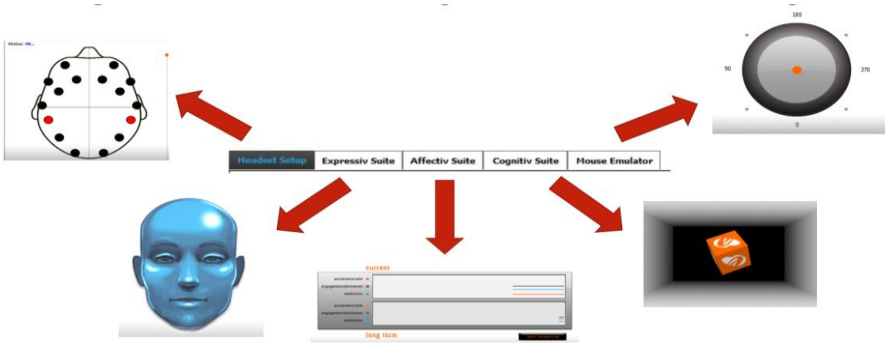

Fig. 3. Modos o pestañas de la interfaz de EMOTIV.

3.4 Interfaz gráfica "Processing" (2da Etapa)

El Dispositivo BCI se comunicará con la computadora, y para este proceso se realizó una interfaz gráfica que contenga los botones de un control remoto representando las acciones enviadas. Esta interfaz se desarrolló en el entorno de "Processing", este entorno permite un desarrollo de interactividad e interfaces gráficas, contando también con la comunicación con otros entornos de desarrollo.

3.5 Arduino (3era Etapa y 4ta Etapa)

En la tercera etapa el entorno "Arduino" nos ayudará con la conectividad hacia la Televisión, donde se programará todas las funciones de los botones del control de una televisión y se instalará las librerías para el envió de la señal infrarroja.
En la etapa final sobre el televisor, el propio Arduino brinda sus módulos que son utilizados con el receptor y emisor para la comunicación con cualquier televisor que tenga un receptor infrarrojo.

4 Metodología e implementación de los gestos y movimientos del dispositivo

Para determinar la metodología adecuada se realizó un análisis que incluye varias pruebas preliminares para conocer los gestos más comunes que se implementarán dentro del proyecto, sin embargo, se conoce que los gestos en cada persona pueden ser diferente y en especial las personas discapacitadas, por ejemplo, algunas personas solo pueden realizar un guiño izquierdo o derecho, y si sufren

discapacidad se tendrá que tomar en cuenta que movimientos o gestos pueden ejecutar con mayor facilidad. Para esto se realizó pruebas con los gestos o movimiento y se determinó que tan preciso es la señal emitida en el momento de la acción, se procedió a calificar con tres términos calificativos: verdadero, falso o falso positivo y al final observando los resultados que se muestra en la Figura 4, tomar las decisiones de cuales son más exactos y precisos o tienen la respuesta deseada en ese momento.

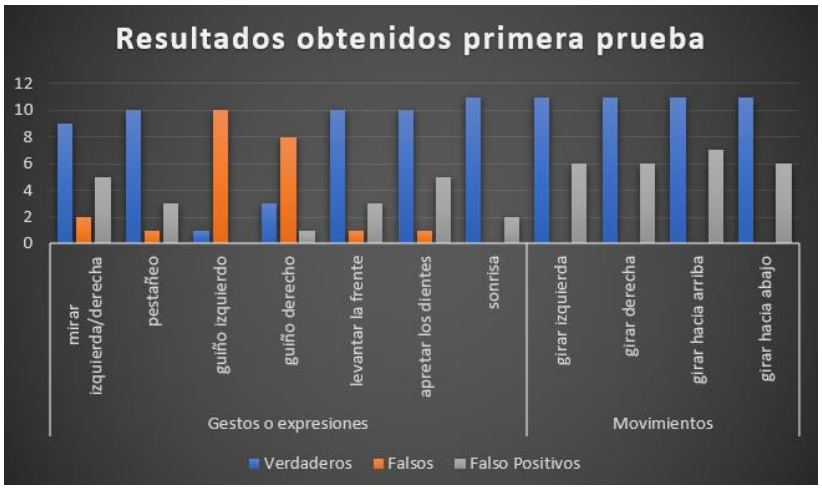

Fig. 4. Resultados de los gestos y movimientos del dispositivo BCI.

Conocido los resultados de los movimientos se visualiza que se tiene gestos que son más fáciles en la detección y otros gestos que no se logra detectar por su dificultad para ejecutarlos, además se puedo detectar que con los movimientos de cabeza se obtuvo una buena respuesta, para estos movimientos se requiere de un tiempo de entrenamiento (5 o 10 min. aprox.) para una mayor exactitud en la detección, mientras que también se puede entrenar al dispositivo para conocer las expresiones naturales y expresiones forzadas.

En base a los resultados dados luego de realizar las pruebas, se definió los gestos que representarán cada botón dentro de la aplicación, tomando en cuenta que pueden varia o cambiar, al momento de tener integrado el proyecto completo (tabla 1).

Tabla 1. Gestos y funciones de los botones del control remoto.

BOTONES	MOVIMIENTOS/GESTOS
Volumen +	Girar hacia arriba
Volumen -	Girar hacia abajo
Canal +	Girar hacia derecho
Canal -	Girar hacia izquierdo
On/off	Guiño derecho o izquierdo
Menú	Levantar la frente
Flecha arriba	Girar hacia arriba
Flecha abajo	Girar hacia abajo
Flecha izquierda	Girar hacia derecho
Flecha abajo	Girar hacia izquierdo
Mute	Mirar izquierda o derecha
Back	Dientes
Ok	Pestañar
Activar funciones colores	Sonrisa
Botón rojo	Girar hacia izquierdo
Botón verde	Girar hacia abajo
Botón amarillo	Girar hacia derecho
Botón azul	Girar hacia arriba

5 Análisis de Resultados

5.1 Implementación final

Una vez realizado el análisis correspondiente de todo lo que va a formar parte de la implementación, tanto software como hardware, los gestos y movimientos de la cabeza que se van a usar dentro de nuestro proyecto se procedió a la implementación de cada uno de los componentes y dispositivos en un solo proyecto, como muestra en la Figura 5.

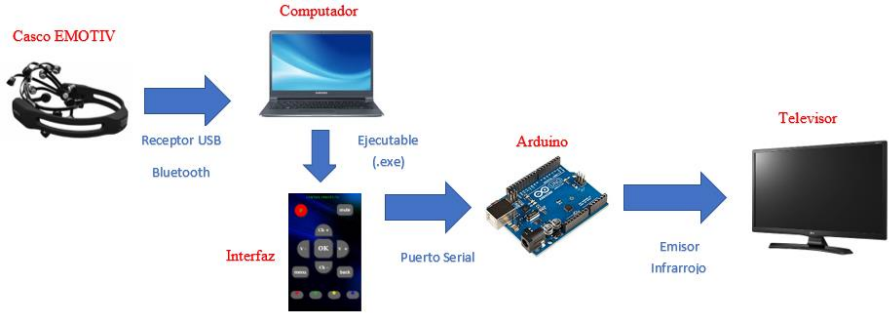

Fig. 5. Proyecto implementado en su totalidad.

Visualizando la figura anterior, el dispositivo EMOTIV se comunicará con el computador por medio de un receptor USB propio, la interfaz realizada en "Processing" y exportada a una aplicación ejecutable se comunicará con el arduino donde estará el programa decodificado y con las acciones de los botones para ser enviada al televisor.
La interfaz realizada en "Processing", cuenta con una apariencia de un control remoto de televisión, contando con los botones principales (volumen, canal, apagado, mute, menú, back entre otros) y representando la acción de cada botón.

Fig. 6. Interfaz gráfica para la visualización de las acciones realizadas por la persona.

5.2 Análisis de pruebas de usabilidad

Para la aplicación del proyecto completo con todos los componentes y sus etapas conectadas, se procede a realizar pruebas basadas en la escala de Likert (A. Sánchez, 2002), teniendo en cuenta que esta escala nos permitirá conocer la satisfacción, comportamiento con el proyecto, el agrado de su interfaz entre otros.
Con la realización de las primeras pruebas se trata de conocer si existen problemas o cambios de lo planteado inicialmente, es decir si los gestos son los indicados para cada acción, por tanto, se tomó un grupo de 10 personas, entre niños, jóvenes

y adultos. Se colocó el casco BCI y con el proyecto integrado, se realizó las pruebas de usabilidad, y mediante la encuesta se pudo conocer su comodidad, veracidad en su ejecución, facilidad de aprendizaje, entre otros factores que se pudo obtener. Se representará los resultados en gráficos para ser analizados y conocer donde se debe optimizar o tratar de mejorar.

La Figura 7, nos muestra un resultado donde se llegó a ver que el casco luego de un tiempo aproximado de 1 hora de uso llega a dar un poco de incomodidad con algunas personas, pero no necesariamente a todos, debido a que muchas veces las esponjillas de los sensores se resecan y eso causa la molestia pero se llega a solucionar hidratando nuevamente los sensores. Mientras que en la parte de entrenamiento y ajuste de sensibilidad de los gestos y movimientos se tuvo una gran aceptación por las personas, donde se les explico que se necesita tiempo en el modo cognitivo para llegar a entrenar al casco y unos pequeños ajustes de sensibilidad en el modo expresivo.
La Figura 8, nos muestran el resultado del aprendizaje y la ejecución de los gestos dentro del proyecto, y así se conoció la dificultad de utilizar muchos gestos y movimientos, generando el problema de que la persona no podía memorizar todos estos gestos. También se pudo visualizar que muchos gestos generan acciones no deseadas y por ende no un funcionamiento óptimo del proyecto.
Los resultados que se muestran en la Figura 9, sobre la presentación de la interfaz gráfica, el tamaño de las letras botones, entre otras características de presentación, dieron una respuesta aceptable, teniendo varias opiniones de algunos cambios como son el tamaño de la interfaz, agrandar un poco las letras que contiene la ventana de la interfaz; pero en contexto se tuvo una buena aceptación de la implementación.

Fig. 7. Resultado de la comodidad, tiempo y ajuste del casco EMOTIV.

Fig. 8. Resultado del aprendizaje y ejecución de los gestos o movimientos en el proyecto.

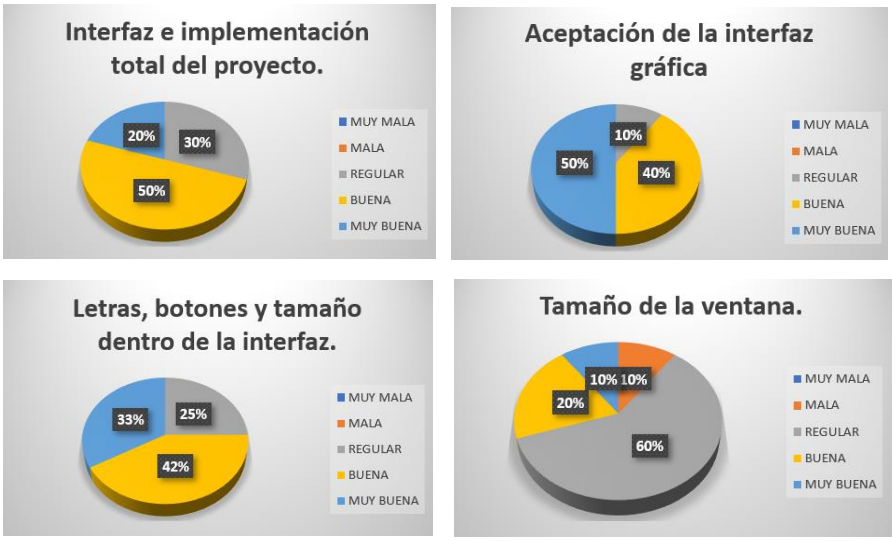

Fig. 9. Resultado sobre la visualidad del proyecto, interfaz gráfica e implementación física.

6 Discusión

Las pruebas con todo el proyecto implementado se realizaron entre hombres y mujeres, donde se probó los gestos y movimientos ya predeterminados, para tener resultados, opiniones y comentarios al momento de probar el proyecto, y conocer los problemas que existe y poder solucionar. Un problema fue los falsos positivos que se tenía al momento de realizar los gestos, donde sin tener intención de manipular el dispositivo ya recibía gestos, para ello se realizó una validación y activación del control, con esto se logró evitar los falsos positivos que se producían inicialmente.

La validación o activación está compuesta por dos movimientos de la cabeza, movimiento o giro a la izquierda + movimiento o giro a la derecha, con estas dos acciones el control remoto de la aplicación entrará en función, contando con un tiempo de 15 segundos que fue determinado con las primeras pruebas, dentro de este tiempo se permite realizar cualquier acción con la televisión. Terminado este tiempo deberá volver a realizar los movimientos de activación para poder nuevamente utilizar la televisión.

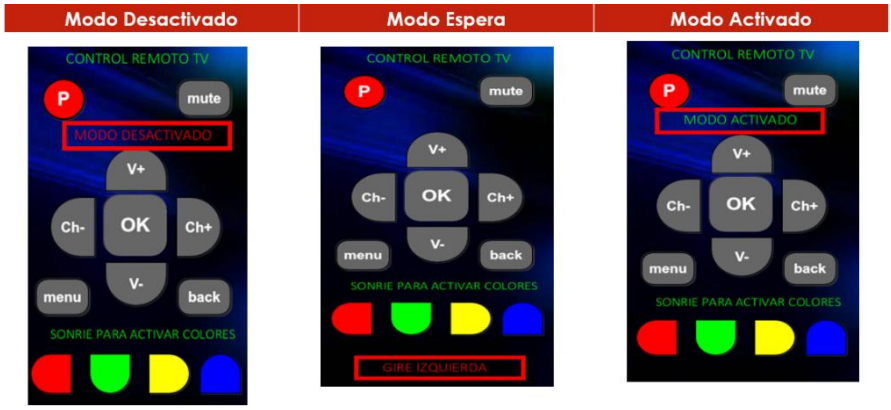

Fig. 10. Interfaz gráfica final con los cambios y avisos finales.

Además, con lo encuestado y mostrado en la Figura 9, se visualizó que tener demasiados gestos es algo difícil para el usuario, por lo tanto, se minimizó los gestos a los principales para tener un uso con menos errores y visualizar si el proyecto funciona correctamente.
Realizado las pruebas con los gestos ya minimizados y la activación que se propuso para minimizar los errores, se procedió a realizar las pruebas finales y analizar los resultados mediante preguntas a las personas que tuvieron puesta el casco y utilizaron el proyecto.

Table 2. Botones principales con gestos o movimientos principales

BOTONES	MOVIMIENTOS/GESTOS
Volumen +	Girar hacia arriba
Volumen -	Girar hacia abajo
Canal +	Girar hacia derecho
Canal -	Girar hacia izquierdo
Prendido (On) /Apagado (Off)	Guiño derecho o izquierdo

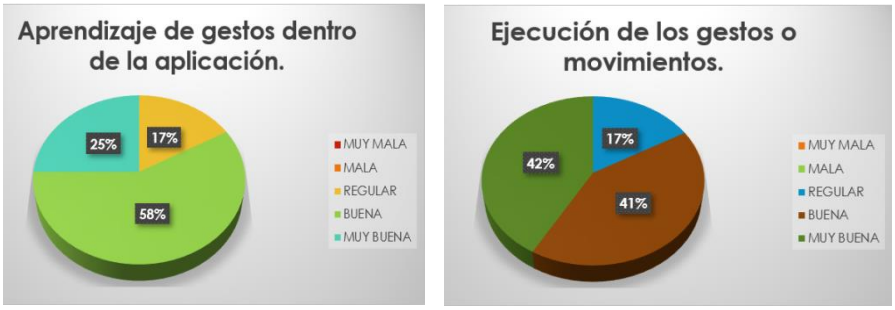

Fig. 11. Resultado del proyecto final con los cambios y gestos minimizados.

Como se puede visualizar, los resultados finales fueron mejores; las personas pudieron realizar con mayor facilidad las acciones con el proyecto, y el uso de gestos no fue de mucha complicación dentro de las pruebas.

7 Trabajos Futuros

Para trabajos futuros se plantea crear una interfaz que pueda llegar a controlar otros dispositivos como son PC, smartphones, etc., dando facilidades para personas que se les dificulte el manejo de estos dispositivos por alguna deficiencia motriz.

Otro trabajo futuro que tenemos es desarrollar una aplicación interactiva para TV, que defina una metodología adecuada con el fin de reducir los botones del control remoto a botones básicos o principales, y por ende ayudar a reducir los gestos que se encuentran definidos en este trabajo, debido a que entre más gestos se encuentre utilizando, más errores o señales falsa puede producir el casco.

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Stimulation strategies to prompt natural voice interactions with the TV

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Abstract. The technical components of Voice User Interfaces (VUI) are giving promising steps towards interaction scenarios based on natural language solutions rather than simple voice commands. The adaptation of these systems for each usage context requires a deep training process of the Natural Language Understanding component with the support of human collaboration.
Among the several phases involved in the training process, the first step, aimed at gathering a significant number of distinct "natural" phrases/expressions for each action to be addressed by the system, needs to be tackled very carefully.
To be successful in collecting a significant number of phrases related to the intents to be made active in the system, it is important to stimulate participants in a way that promotes diversity on the uttered phrases. This task demands a methodology that allows participants to be triggered in an abstract way, avoiding them to be directly influenced by the stimulus presented to them.
This paper reports on different stimulation strategies to prompt participants (either in group or individually) to utter distinctive phrases associated with a natural language interaction with a TV set. The elicitation process that was designed was based on visual stimuli which included representative still frames of video content and TV system user interfaces (showing content or apps), pictograms and comics. Preliminary results show that, in general, the use of this kind of techniques can originate more diversified and relevant phrases.

Keywords: Voice User Interfaces, Natural Language Interaction, Television, Taxonomy, Visual Stimulus, Pictures.

1 Introduction

Voice User Interfaces (VUI), integrated in TV consumption scenarios, are paving the way towards supporting the interaction on natural language rather than simple voice commands. However, reaching this goal requires a deep training process of the Natural Language Understanding (NLU) component with the support of human collaboration.

During an interaction by natural language, the user can make use of a wide set of words and expressions to reach a certain goal, implying that the NLU responds correctly to a wide diversity of possible words and phrases sustaining the interpretation of the users' real intentions. This is especially relevant because for someone interacting with a VUI, saying something like "I'm in the mood for watching a funny movie" or "Show me a movie that makes me laugh" (or any other similar phrase), should be interpreted by the system as a simple intent like "search for comedy movies". However, when interacting with participants collaborating in the training phase it is important to avoid constraining their answers with the presented stimulus in order to gather the aimed diversity of words and phrases. Whit this aim, pictures (drawings, photographs, icons, etc.) has been pointed as a particularly valuable visual stimulus to generate spontaneous phrases, with more variability [1, 2].

This paper reports on elicitation methods based on different types of pictures that were used to collect words and phrases to populate and train the NLU component of a natural language processing (NLP) system for a TV broadcaster's set top box (STB) for a Portuguese context. With the results here presented, we intend to contribute to survey visual stimulus for phrase collection for such systems and better understand which can be better suited for particular actions related with the television context.

After this introductory section, this paper is structured as follows: Section 2 presents information concerning NLU training and strategies based on visual stimuli to collect words and phrases to populate and train the NLU component and Section 3 presents the methodology. Section 4 presents the experiments, results and discussion and conclusions and future work are presented on Section 5.

2 NLU Training

The NLU is the NLP component that deals with the complex challenge of responding to inputs that do not follow well-defined rules, converting them into a structured form that the remaining system understands, being able to respond to - that is, it refers to the reading and understanding of words and phrases in order to extract intents in the application domain [3, 4]. The main reason for this complexity is that people can express an intention in a wide variety of ways [5, 6].

Training is a fundamental step for the good performance of a natural interaction language voice system. In this process, it is important to consider the domain for which the NLP service is being developed and that the more variance of utterances the better the NLP is trained [7]. Also, in order to train system models based on machine learning, large amounts of data need to be collected [8].

In order to increase the amount of data for training of NLU, researchers are turning to crowdsourcing which presents advantages as expedition, individuality of people, and low costs [8, 9]. While presenting these benefits, one of the challenges about this type of data is its naturalness and variety [1]. To address it, research has been using and evaluating several elicitation techniques as the use of pictures which presents the great advantage of not biasing people by putting words into their mouths [9]. In some contexts, pictorial stimuli have already proved to be capable of generate more sponta-

neous and natural utterances, with more variability [1]. In this framework, one aspect not addressed in the reviewed studies is the use of different types of pictures and the potential different results that they can generate.

3 Study Design

In this project, the ultimate aim was to train the NLU of an interactive TV (iTV) system and improve its performance with the goal of developing a fully functional Natural Language Interaction system in a Portuguese context. Taken this in consideration, the used visual stimuli were related with the users' actions in the iTV context. This section begins by presenting the domains and intents considered, continuing with an overview of the visual stimuli used to collect words and phrases to populate and train the NLU component and ending with the general description of the data gathering stages.

3.1 Domains and intents

The first step on our research was to identify a set of domains and intents related with the television context. Voice interaction is perceived to be more likely to be used with more complex instructions, requiring more steps for its completion, being that cognitive or physical actions (many clicks on the remote). However, the most frequent actions inherently associated with an iTV system were also considered. Based on these criteria, the domains and intents considered as priority were: **Channels browsing -** change to a specific channel by name; **Tv content search -** search a content by name/title; search content by thematic; search channels by thematic; trending content search; **Automatic TV-recordings -** access to last contents of a channel; **Navigation -** access to TV STB (Set-top Box) menus**;** access to the EPG (TV Guide) of a channel**;** see what the content is; continue watching; **Video Club -** see contents of a certain type (recent, highlights); **Apps -** search TV-apps by type**;** Open TV-apps saying its name or when asking some content; **YouTube -** search content**;** search content of a pre-existent category (recent videos, more popular, etc.

3.2 Visual stimuli used for data gathering

For the purpose of this research, the following visual stimuli (and their potential advantages) were considered (Fig. 1): **1) Frames of video content -** only the video content is presented, with no other information as the channel logo; **2) Frames of the user interface of the iTV system (contents or apps) -** real images that are thus easily recognized; **3) Pictograms -** representations of TV content using icons, simplified drawings, with a high level of abstraction; and **4) Comics -** can introduce a context to the participant, in an abstract way, by its storytelling nature.

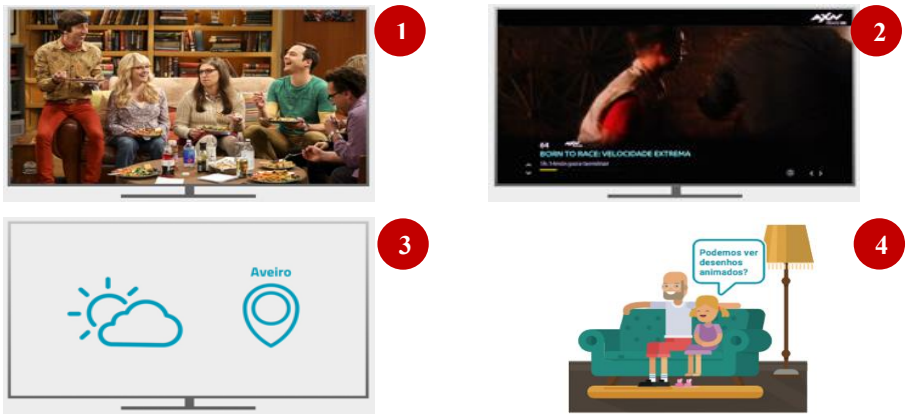

Fig. 1. Frames of video content

3.3 Data gathering stages

The gathering sessions took place in three phases. The first phase took the form of a *vox populi* (vox pop) performed individually and in groups, and the next two phases (phase two and three) were supported in group sessions of two to three people in a laboratory simulation of the interaction with the system via a TV remote with a microphone. The planning of the various phases as well as the development of the visual stimuli and the dynamization of the data gathering sessions was always carried out in an ongoing perspective, with the outputs of the previous phases being considered for the design of the following phases.

4 Experimental procedures and results

In this section, we present the experimental procedures and corresponding results of the two gathering first phases. These two phases had an exploratory nature in what regards the domains and intents and the visual stimuli-based methodologies.

4.1 Phase one: Vox pop

For the vox pop approach different visual stimuli were used according to the domains and intents one wished to train. For example, frames of video content were used for the collection of popular TV shows, while pictograms were used for the collection of phrases to train the intent related with content search by thematic. To prevent the user from forgetting that he was interacting with the TV, a dialogue balloon with the word "television" was presented together with the visual stimulus.

Three sessions were held between July and August 2018, 2 sessions in group (one group of 2 individuals and another of 3 individuals) and 1 session individually. The

sample included adults, teenagers and children. All the vox pop sessions were audio recorded.

4.1.1 Experimental procedure

Each session consisted of 30 tasks related to 4 of the domains and intents previously established (search a content by name/title, search content by thematic, Apps - Open TV-apps saying its name or when asking some content, YouTube - search content of a pre-existent category), which used video-frames of films and series (10), pictograms (12), TV system frames with app content (4), and comics (4).

At the beginning of each session, participants were informed that the objective was, in addition to gathering phrases for training a voice interaction system using natural language, to analyze various methodologies to collect phrases with different visual stimuli. The tasks (grouped according to the different visual stimuli) were presented on a tablet and for each task participants were asked to verbalize at least one sentence (although they could create more). When pleased with their performance, the participant(s) could move on to the next task. The person who accompanied the dynamization of the vox pop had the role of introducing the task, giving the necessary explanations at the beginning of each methodology and instigating a brainstorm without influencing the sentences generated by the participants.

4.1.2 Results and discussion

In total, 205 phrases were collected, with the individual session generating 29 sentences and the two groups' sessions generating a total of 176 sentences (an average of 35 sentences per person).

In the group approach, the participants sometimes said more than one sentence for each task, which did not happen in the individual sessions. However, since all people can potentially speak at the same time in a group, it happened that sometimes participants, instead of saying complete sentences, simply made changes in the sentences of other participants or, when interrupted, left the sentences incomplete. One way to overcome this problem can be using a mediation device allowing participants to share complete, isolated and independent sentences. Another issue to improve is related to the way the tasks were presented. At this stage, the tasks were presented on a tablet, but it would be a better option to show the images on a larger screen, such as a monitor or a TV.

In overall and considering the number of phrases instigated by each stimulus, the collected number of phrases was higher in pictograms, that allowed a higher level of abstraction, followed by comic chats, and lastly by the video-frames. Within the frames, the number of phrases was slightly lower when presenting only video content (movies and series) than with apps. The Comic Chat tasks took more time to be explained and raised great doubts in the participants. It will not be the best options if the collection procedure was to be extended to a larger number of participants. For these reasons, it was decided to exclude this methodology on the subsequent phases.

4.2 Phase two: simulated lab interaction with the system via a TV remote with a microphone

Based on the information gathered in the previous phase, another set of sessions was carried out with groups of 2 to 3 people in a lab context. Stimulated by the images presented in a monitor, the participants used a TV remote control with a microphone to record the sentence they wanted to say. Although the system was unable to react to the participant's request, this pseudo-interaction had the advantage of approaching them to a more realistic scenario than the one used in phase one. It also helps to reduce the level of noise and the number of overlapped phrases.

The sessions of approximately 30 minutes each took place between October and December of 2018. In order to allow a broader coverage of the various domains and their related intents, presented in 3.1, three sets of tasks (A, B and C) were defined, each including 15 images related to the following intents: Search content by thematic (T1 and T2) Open app saying its name or when asking some content (T3 and T4); Search TV apps of a certain category (T5); Access EPG of a channel (T6); Access to contents of the last days of a channel (T7); Search a content by name (T8) ; Access to TV STB Menus (T9 and T10); Ask for a trending content (T11); Search channels by thematic (T12); See contents of a certain type on VideoClub (T13); Search content of a pre-existent category (T14); Change to a specific channel (T15). For example, T1 was related with asking for action movies in set A, asking for musicals in B and asking for romance movies in C.

For each set, two versions for some of the associated tasks were created. In this way, 6 groups of tasks were prepared: A1, A2, B1, B2, C1 and C2, where 1 indicates that all the stimuli presented were based on frames of the user interface of the iTV system and 2 refers to an alternative stimulus which was created for some of the tasks when we considered that it would be a reliable option. As a result, T1, T2, T3, T4, T6, T12, T14, T15 had a pictogram alternative and T8 e T11 had as alternative frames presenting only video content. This means that T5, T7, T9, T10, and T13 were presented in the same way both in groups with number 1 and 2, that is, as Tv system frames. Considering the close to reality simulation, in this phase the dialogue balloons were removed, because they were considered not relevant to understand the images and their goal (**Fig. 2**)

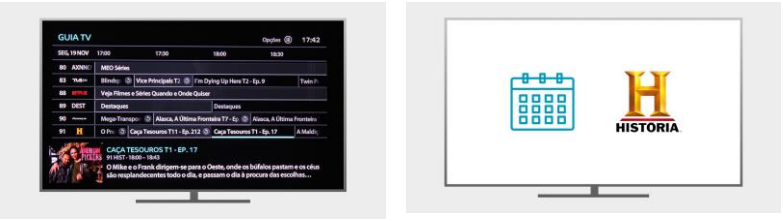

Fig. 2. Examples of stimulus presented in task 6 for A1 (left) e A2 (right)

The sample consisted of 18 groups (16 composed of 2 participants and 2 by 3 participants), and each group of tasks was repeated 3 times. In total, 38 participants took

part in the study, ranging in age from 17 to 46 years old, 55.3% were male and 44.7% were female. Of the 38 participants, 89.5% reported having a Pay-Tv service.

4.2.1 Experimental procedure

The contextualization of the study, the explanation of the procedure and the presentation of the tasks were carried with the support of a multimedia presentation that also included demonstration videos. The sessions followed the following steps: 1- Welcome of the participants with the offer of a snack and a drink; 2 - Presentation and contextualization about the study; 3 - Explanation of the general procedure (participants were told that the dialogue with the TV should be as natural as possible and that they could discuss ideas with each other; the phrases should start with "Television ... "; there are no right or wrong answers and that creativity will be valued); 4 - Completion of tasks (each session consisted of a set of 15 images and participants should say “next” to move to the next image); 5 - Fill in a characterization questionnaire. In addition, the person who was organizing the test session was responsible for registering opinions of the participants on what they consider to be important in an ILN context, which domains/intents they would most often use and other observations or failures during the test.

4.2.2 Results and discussion

In total, 1882 sentences (49.52 sentences per person) were collected, of which 1862 (49 sentences per person) were unique. The TV system frames allowed to collect 1342 sentences, stimuli based on pictograms allowed to collect 403 sentences and video frames 137 sentences.

Task 8 generated the higher number of sentences (157), with the stimuli being presented with TV system frames (81 sentences) showing better results than the stimuli with video frames (76 sentences). The stimulus based on TV system frames that generated most sentences was presented on task 15 and the stimulus based on pictograms that generated most sentences was presented on task 3. The stimuli that generated most phrases and with a higher-level of complexity by the participants evoked interest and/ or personal knowledge in the subjects presented (Football, YouTube, movies). In turn, stimuli that generated fewer sentences were referred to by participants as topics that were unknown or uninteresting to them.

Comparing the performance in the tasks where different stimuli were presented, it was possible to conclude that in some cases pictograms performed better than TV system frames but in others the opposite happened. However, it was possible to conclude that TV system frames allowed to collect a higher number of sentences, being clear that the abstraction inherent to the pictograms sometimes limited the reaction of participants. After the first participant saying a sentence, the other (or remaining) feels that the right answer has already been said (Pictionary game-like effect) and usually was unable to generate more sentences. However, this “Pictionary effect” does not happen when participants have a deep knowledge associated with the shown pictograms (e.g. a football club logo generates a large number of sentences from a

fan, a "baby" pictogram generates sentences about movies and children channels). On the contrary, the TV system frames offered more visual affordances. Even though the most obvious word in the interface was said in the first sentence, there were usually other words or images that other participants could use to generate sentences. This may also justify the fact that in tasks where video content frames were used as an alternative to tv system frames the former had worse performance.

5 Conclusions

The collection procedures carried in this study allowed to gather important insights for future similar activities. First, we can say that images can often be adopted as objects that allow to transmit in a clear and unambiguous way the context in which the user is expected to interact and additionally to present scenarios sufficiently open to generate a great diversity of phrases (our study showed that the number of repeated sentences in phase 2 was very small). Considering the visual stimuli, pictograms showed to be less efficient when participants did not have a deep knowledge about the subject that the stimuli represented although, in other cases, their higher level of abstraction allowed them to perform better than other stimuli. Participants were also more creative when the content was known, and they had the needed information to create multiple phrases.

In addition, the simulated interaction environment revealed to be a more dynamic way to generate reaction from participants when compared with vox pop. It should be emphasized that the phases here presented were carried out with small groups in order to identify general aspects, being part of a general process of optimization of a methodology. The points discussed are therefore not intended to represent a sample, but rather to gather a set of assumptions that ultimately aim at improving the training process, and which include all the process from the analysis of training methodologies to the simultaneous identification of general traits and specifications that must be taken into account.

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Towards Proactivity Behaviours in Voice Assistants for the TV Ecosystem

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Abstract. Intelligent Personal Assistants (IPAs) are increasingly present in people's daily lives, with natural language interaction allowed by voice assistants improving the user experience. In the television ecosystem, the integration of voice assistants is also enabling the interaction with media devices in a globally more satisfying way. Additionally, the inclusion of proactive behaviours is considered to be one of the key factors for the improvement of the user experience. To better understand this dimension of voice assistants, the present article analyses the proactivity concept and examples of voice assistants that incorporate proactive behaviours. Also, voice assistants have been analysed in the television ecosystem and it was realized a lack of systems presenting a real proactive behaviour able to assist users in a television context. Next steps of our research will be to design, prototype and validate a voice assistant that proactively assists the user in a television setting.

Keywords: Intelligent Personal Assistants, Natural Language Interaction, Proactivity, Proactive Behaviour, TV Ecosystem

1 Introduction

The future of usability is based on the reduction of the effort of interaction between the user and the system, with a target on advanced solutions requiring zero interaction cost [1]. One of the solutions for reducing the effort of user interaction is based on Intelligent Personal Assistants (IPAs), which not only help with daily tasks, but also reduce the number of interactions with the device at stake when searching for information. The inclusion of artificial intelligence supported by Big Data in IPAs has contributed to a change in how these systems perform tasks and search for information, and how users buy products, interact with businesses, and consume content [2]. These technological advances have enabled IPAs to evolve from reactive to proactive agents, able to act in advance, making autonomous decisions (without user intervention) relevant to user needs [3], including proactively giving information

about traffic and weather conditions before the user leaves home. Since IPAs have had significant penetration in several areas, especially voice assistants, the scenario of integrating a proactive voice assistant into the actual TV ecosystem (social and technological media landscape associated with both audiovisual and TV fields [4]) seems to be interesting given its potential to add value to the user experience and reduce the interaction effort.

In this context, this paper aims to provide a survey on the concept of proactivity and examples of voice assistants that incorporate this kind of behaviours, to be able to design a proactive voice assistant suited to the TV ecosystem. Following this introductory section, the article is structured as follows: section 2 presents the features and challenges of an IPA; proactivity in voice assistants is covered in section 3; section 4 presents the state of proactivity in a television context and some insights on future research in this topic; and final considerations are presented in section 5.

2 Intelligent Personal Assistants: features and challenges

IPAs are based on software agents that assist users in their daily tasks by presenting information (relevant and personalized content) in an intelligent way [5]. Through more dynamic interactions and derivation of unscheduled responses [6], IPAs allow users to reduce their cognitive load [5]. In addition, IPAs may use machine learning and Big Data to provide proactive recommendations from contextual data [6]. Recommendations are used to facilitate selection and support decision-making when users are faced with large amounts of information, such as products or restaurants [7]. This is only possible through personalization, matching the availability of content, products and relevant services to the user to his corresponding interests, characteristics and needs [8].

2.1 Features

IPAs enable the management of daily tasks, such as booking of hotel rooms, shopping and scheduling meetings [9]. To make this possible, IPAs combine various features:

Context-awareness - The context consists of information about the user's circumstances, which includes information about external environments (e.g.: time and place) and detected user activity (e.g.: devices used, places visited, times and day of the week) gattered, for instance, by mobile devices [10], which may influence the decision making when requesting services [11] and/or content.

Integration - One of the tasks of an IPA is to reach and manage other devices. As such, integration with other technologies and devices is crucial. This integration allows, through the Internet of Things (IoT) and cloud, the user to access collected measurements, daily tasks and stored information from anywhere. One of the key benefits of this is improving the context-awareness of a device [12].

Adaptability - IPAs are capable of being trained and to make use of machine learning to complete tasks using initial or learned knowledge. Learning ability is important for a system to be autonomous and adaptable as it allows an IPA to perform

behaviours based on its experience [13]. It can deliver better results as it adapts [12] and is customized to the user.

Anthropomorphism - In terms of IPAs, anthropomorphism is "a conscious mechanism wherein people infer that a non-human entity has human-like characteristics and warrants human-like treatment" [14, p. 2854]. Studies have validated that anthropomorphic IPAs provide more efficient communication [15]. However, their degree of anthropomorphism may vary depending on the interface provided to the user [16].

Multimodality - Ability to obtain inputs and/or provide outputs in more than one way [17], providing the user with various modes of interaction (vocal, textual and graphic). The voice interaction mode has greater weight in the IPAs market compared to other modes of interaction (graphical, textual), and this type of IPAs are named voice assistants. It is used at both input and output levels because it reduces the cost of human-computer interaction. A study conducted by [18] found that 72% of users of digital assistants use voice search.

In addition to the features highlighted above, there are some features that provide complementary functionality to an IPA, such as autonomy (works without human intervention, autonomously delivering information to the user), reactivity (only reacts to clear requests for user information) and proactivity (predicts unmet needs of users) [12]. In section 3 the concept of proactivity will be discussed in more detail.

2.2 Challenges

When talking about IPAs there are some associated challenges. In this article we discuss privacy and security and natural language processing (NLP).

Privacy and security - Both IoT and the cloud can be managed by IPAs and as such, the problems associated with these technologies are reflected in the IPAs. The IoT devices share to the cloud user data and such data is vulnerable to being used in various fields such as advertising and marketing, raising concerns about privacy [12]. Security is another inherent challenge for IPAs as it is not clear what is being recorded by the devices. Assuming the IPA is not always recording, it still listens to the user to be able to execute commands [19] or hear wake-up words. This can raise concerns about wiretapping, which is, logically, perceived as a threat to user privacy.

NLP - It is easy for humans to understand language, but it is a rather complex task for machines. Since a term can have different classes (noun, adjective, verb) and meanings, there is still a huge effort to define words. NLP techniques themselves were insufficient to give meaning to words. However, Big Data has provided breakthroughs in this area, using sequences of speech excerpts to analyse words [20]. Additionally, another of the recognized challenges is the evolution and emergence of new words. Machine training and learning may be insufficient for NLP due to this challenge [21]. Developing IPAs requires progress in the areas of speech recognition, speech analysis, common sense-based reasoning, conversation support, conversation context awareness, simulation of human speech and human gestures and movement [22].

The NLP challenge is a key issue to the authors of this paper since the continuation of this study focuses on the idealization of a proactive IPA for the TV ecosystem,

whose main mode of interaction is the voice. Accordingly, the examples discussed in sub-section 3.2 and section 4 will be of voice assistants.

3 Proactivity in Voice Assistants

Unlike reactive behaviour IPAs, that only respond to clear users' requests, IPAs that present proactive behaviours predict users' unmet needs by analysing their context, preference patterns and behaviours, and automatically providing personalized content [23] without the user's request. The proactive approach thus uses contextual user information to make relevant recommendations when confronted with an appropriate situation [11]. However, it also presumes the analysis of user behaviour and subsequent data synthesis [24]. The data comes from browsing history, purchase history, click behaviours, search patterns [8] and location.

3.1 Proactive behaviours: types and principles

The user's trust in an IPA is directly related to its ability to perform autonomous tasks [25]. Both awareness and understanding of (semi) autonomous behaviour are crucial to building trust with the system. An IPA can highlight two types of proactive behaviours: **1) task-focused proactivity:** provides assistance for a task that is already being performed by the user or is already planned; **2) utility-focused proactivity:** assists the user with a set of tasks and not just with a specific task [26].

The relevance of the proactive behaviours on an IPA depends on the value they add to the user experience. An IPA is only helping the user if it considers his focus as well as his short and long-term needs. According to [26], to guide the development of proactive behaviours in IPAs, nine principles reflecting user centrality and experience must be considered: **1) Competent -** within the knowledge and skills for which the IPA has been programmed and trained; **2) Unobtrusive -** does not interfere with the attention or activities performed by the user without being requested; **3) Transparent -** intelligible to the user; **4) Safe -** reduces the negative consequences, in the opinion of the user; **5) Anticipatory -** able to understand the opportunities and short and long term needs of the user; **6) Valuable -** provides information according to the user's interests, needs and tasks; **7) Pertinent -** Vigilant regarding the environment and current situation; **8) Controllable -** exposed to analysis with user control; **9) Deferent -** gracefully unimposing.

3.2 Examples of proactive voice assistants

Most of the services available today allow search and browse with reactive behaviours, however, in recent years, several systems with proactive behaviours such as Google Assistant and Microsoft Cortana have emerged in the market. Increasingly, proactive voice assistants are being adapted in a variety of contexts, including home, personal, education, health and business. Within some of these contexts the following assistants can be observed:

Google Assistant offers proactive suggestions and personalized information to help the user keep track of everyday tasks, given the context (time and location) and recent interactions with the assistant. The assistant can send notifications such as flight delay alerts, reminders of where the user parked his/her car, personalized music and podcast recommendations, and notifications of nearby activity [27].

Google Maps, like Google Assistant, already shows proactive behaviours in its driving mode feature. Using location history and recent web searches, Google Maps predicts the user's destination (**Fig. 1**) and sends notifications about traffic conditions, accidents, and road works [28]. In addition to notifications, Google Maps offers faster alternative route proposals if traffic conditions are not favourable or have changed.

Microsoft Cortana is a desktop-driven voice assistant with reactive and proactive behaviours. The assistant can proactively manage the user's calendar, for example, if it is 8pm and the user's boss sent an email to arrange an urgent meeting for the following day at 7am, Cortana will alert the user that an appointment has been made that needs his attention and that he should set the alarm and change his morning routine for the next day [29]. Cortana's proactivity is also reflected in its autonomous creation of content lists (out of five categories: books, film and TV, recipes, restaurants, and shopping) (**Fig. 2**) based on Microsoft Edge searches made by the user [30].

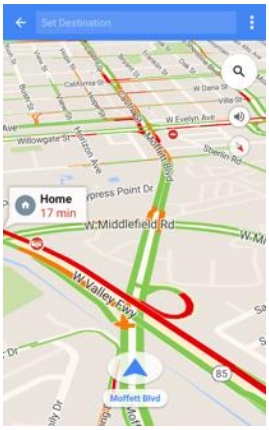

Fig. 1. Proactive behaviour in Google Maps driving mode[1]

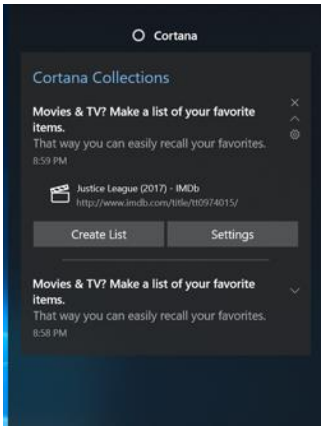

Fig. 2. Cortana collections (proactively created)[2]

Erica is a proactive voice assistant for Bank of America, which offers banking assistance to users. It analyses the user's financial data and offers real-time proactive advice for managing and optimizing their expenses, such as suggesting that they reduce credit card usage and/or pay a debt [31].

[1] Retrieved from: https://searchengineland.com/google-maps-for-android-gets-driver-mode-feature-to-anticipate-your-next-stop-240157, last accessed 2019/9/2

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4 Towards a Proactive Voice Assistant for the TV ecosystem

Voice assistants have had significant penetration in several areas, but there are few of them on the television ecosystem. Systems such as LG Voice Mate, Google Assistant, Xfinity and Alexa allow to search for TV content, without the need to use a remote since the user can interact by voice with the TV. From the analysed voice assistants, two different behaviours related to searching can be observed. For example, when the user says "Quentin Tarantino" : **i)** the voice assistants display all content from amongst the various Smart TV apps, such as YouTube videos, and content stored on the television containing that word in the title (observed in LG Voice Mate and Google Assistant); **ii)** the voice assistant, after searching the content available on the Set-Top Box and other app's, shows movies directed by Quentin Tarantino and other content related to the director (observed in Xfinity and Alexa). Furthermore, it appears that in the television ecosystem, these voice assistants, do not show proactive behaviours, only reactive behaviours.

In this framework there is a window of opportunity for the implementation of a proactive voice assistant supporting an advanced way of interaction with the TV ecosystem. The following steps of this research will be to develop and test a set of prototypes allowing to mirror proactive behaviours in the television context, such as:

a. automatically detecting that the viewer may have fallen asleep and on the next user interaction ask if he/she wants to continue seeing the TV program;
b. automatically detecting that a new viewer is in front of the TV and suggesting a new TV show. This could, for instance, help to avoid small children to be faced with unappropriated content being watched by their parents or others living in the same house, like violent or adult content;

Focus groups will be held to identify the modalities of interaction which, in addition to voice, will be implemented in such prototypes, namely text and/or graphic, and to better identify the challenges, difficulties, advantages and disadvantages of voice assistants with proactive behaviours for the TV ecosystem. It seems important to analyse, for example, how the system should interrupt content to provide proactive information and how privacy concern issues could be diminished. In addition, it is aimed to make a field trial with a fully functional prototype to validate the adopted solutions and to research the main question: if the proactive behaviours have the potential to create "empathy" with the system, taking the natural language interaction in the TV ecosystem to a new level.

5 Final considerations

Despite the great evolution of voice assistants and associated technologies (artificial intelligence), it has been found that there are few systems with proactive behaviours. Voice assistants exhibit mainly reactive behaviours, such as searching for specific content requested by the user and its related content. Furthermore, it was found that

many of the systems titled proactive are merely reactive since they only react to user requests and do not anticipate their needs.

To idealize a voice assistant there are some features that should be taken into consideration: the environment and circumstances in which the user is in (context-awareness), the integration with other devices/systems (integration), the ability to adapt as it interacts and learns with the user (adaptability), presenting characteristics similar to humans (anthropomorphism), and the possibility of various forms of interaction (multimodality). Along with these features, proactivity is touted as an asset because it allows for the displaying of content without user requests, taking initiative and predicting user requests. In the future, it is intended to create a proactive voice assistant for the television ecosystem, which will provide proactive suggestions/recommendations in this context (TV). A focus group will be held to validate possible proactivity scenarios in the television ecosystem and to analyse the advantages, disadvantages, challenges and difficulties inherent to these types of (proactive) behaviours in voice assistants.

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Enhancing the Architectural Requirements of an AT Software Framework through iTV Ecosystem

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Abstract. TV is one of the most popular media broadcasters in people's homes around the world. Its rapid technological evolution has led to what we today call interactive TV (iTV), a concept that extends the possibilities of using the TV. Nevertheless, applications' features available through conventional remotes are inaccessible, for example, to people with physical/cognitive limitations. Assistive Technology (AT) is a research area focused on designing and developing applications to this audience. An example of an AT-based solution is IOM (an acronym for *Interface Óculos Mouse*), an alternative interaction device for people with motor limitations that uses the head movements to afford access to the computer. However, to create applications that use devices (such as IOM), in scenarios other than the original one, it is necessary to provide tools that assist in the development process. Reusable software frameworks can achieve this objective by encapsulating essential functionalities for using these devices. Design techniques to this type of solution point to the development of a set of applications, from a given domain, under different usage contexts, to evidence the essential functionalities that should be exposed by the framework. This paper highlights the framework's requirements gathering in the iTV scenario, through the IOM4TV application's development and evaluation. It is a solution designed to use IOM in the context of iTV. To this end, the article initially presents related works to delineate state of the art within this research area. Following this, the paper focuses on IOM4TV's design, development, and testing steps. Finally, the article lists the main features perceived in this context of use, which can be applied in the conceptual modeling of the proposed software framework.

Keywords: Interactive TV · Assistive Technology · Framework · Prototyping · Software Design.

1 Introduction

Television (TV) is one of the most popular media streaming equipment present in homes around the world. This fact can be perceived, for example, in Brazil, where only 2.8% of residences did not have TV sets [12]. The technological advances of this device have led to what we know today by interactive TV (iTV). This new reality considerably broadens the possibilities of TV use, beyond its original function, allowing the development of different interaction experiences through specific software applications [35].

An application used in the iTV ecosystem is the +TV4E platform, a solution that uses TV to broadcast content related to public and social services in a personalized way for seniors, featuring this content embedded in regular television programming [32]. Nevertheless, applications' features available through conventional remotes are inaccessible, for example, to people with physical or cognitive limitations. In this sense, it is estimated that one billion people suffer from some form of limitation [38]. In Brazil, according to [15], 23.9% of the population suffers from some kind of disability. Of this total, 7% of people reported motor disability.

Assistive Technology (AT) is the research area concerned in proposing, designing, developing, and evaluating solutions that improve the people's quality of life with physical/cognitive disabilities [10]. An example of an AT-based solution is the IOM project (acronym for *Interface Óculos-Mouse*, in Portuguese). This project invests in a device development, focused on people with motor limitations, which allows controlling the mouse's actions using head movements [21]. Designed initially to provide computer access to people with physical disabilities, studies and the development of applications using IOM, have demonstrated its applicability to the other demands, additionally to its original purpose.

Thus, for an AT to be used in different contexts, it is interesting to have tools that abstract the essential features available on the device, to simplify the construction of applications that manipulate it. This goal can be achieved from general reusable software frameworks, such as component libraries or software frameworks. In this context, there are methodologies for the development of this type of general structure, through the identification of common properties and functionalities in different applications. According to this approach, creating various systems from a specific domain, but in different usage contexts, helps to identify these properties.

This paper describes the development and evaluation of one of the applications developed to address the requirements of the IOM framework. IOM4TV is a solution that uses this device to control an application running on the iTV ecosystem [6]. The remaining of the paper is organized as follows: Section 2 presents the context in which the work is inserted. Section 3 presents the methodology used for the theoretical foundation in this work. Chapter 4 highlights IOM4TV de-

velopment process. Finally, Section 5 presents the main results achieved, besides indicating the sequence of the work.

2 Theoretical Background

2.1 Interactive TV in the AT scenario

The working scenario of conventional TV focuses on presenting content to its viewers since there is no interaction between people and TV. The non participatory format depends directly on the content model that acts as intermediaries for audience interaction, such as advertising or movies, for example [1]. Interactive TV (iTV) broadens this scenario by considering a second fundamental concept in this process: interactivity [33].

This new concept, introduced in the TV usage model, involves two elements: the form of communication and the media environment used. The combination of TV interaction concepts provides the possibility to obtain a more appropriate user experience, where content is distributed according to users' specific habits and preferences. In turn, [27] presents an analysis of interactive accessibility of digital TV in Brazil, considering the informal, formal, and technical levels. Based on W3C guidelines and recommendations for interactive digital TV, the article outlines a set of recommendations applicable to this scenario.

GUIDE (Soft User Interfaces for Older People), in turn, is a solution that takes a natural multi-modal interaction approach to provide its users with an intuitive way to control TV-based applications [8]. Using different modes of interaction, GUIDE aims to be a solution that simplifies TV control for people with physical limitations. The main goal is that older people can avoid errors or react to an incorrect interaction situation by using a conventional remote control. The work of [29] introduces a platform that aims to provide an accessible environment through custom control devices and a TV-based user home interface. The paper analyzed specific problems and individual needs faced by people with disabilities to interact with digital tools and access online services via television sets. As a result, it was possible to improve accessibility issues of existing solutions for this audience.

2.2 Assistive Technology (AT)

According to the [37], about one billion people currently have some physical limitation, an amount that produces a growing need for solutions that simplify their daily tasks. Assistive Technology, or simply AT, is a research area dedicated to the design, development, and testing of such solutions. Formally, the term AT is originated in 1988 in the United States of America (USA). It was defined as a legal element within the country's law, known as Public Text 100-407, which makes up the American Disabilities Act (ADA) [18]. Based on the criteria set by the ADA, define AT as: A wide range of equipment, services, strategies, and practices designed and applied to alleviate the functional problems encountered by individuals with disabilities [14], apud [11].

Several classifications have been proposed to categorize the developed AT. One of them divides the solutions according to the cost and the functioning of the resources used in its construction [17]:

1. Low-Level AT: simple, non-electric and low-cost devices;
2. Medium-Level AT: electrical devices, but without computational resources;
3. High-Level AT: solutions that use specific software and/or hardware.

The use of High-Level AT, specifically, may gather several fields of study, depending on the application's requirements. Among the High-Level AT, there are solutions that invest in the development of assistive games [7] [24] [19] or control of specific environments, for example [25] [36]. There are also works that develop solutions to provide access to computers for people with different disabilities [2] [22] [16] [9]. Specifically in the latter category is the IOM, an alternative interaction device for people with motor limitations [31].

Although initially designed for computer access, the evolution of studies, and the development of applications that use this device extend its applicability to the other demands, in addition to its original purpose. Thus, for an AT (like IOM) to be adopted in different contexts of use, it is interesting to provide some tools that abstract the main features and functionalities available in the device. This goal can be achieved from general reusable software structures that allow more straightforward generation of software solutions.

2.3 Constructive Aspects to Software Reuse

A software development process consists of work activities set that must be performed to create some software artifact [28]. Each activity usually has a set of actions associated with it, while each of these actions has a collection of tasks that identify what needs to be completed, what artifacts to produce, quality factors, and checkpoints for tracking project progress. One of the most commonly used development processes currently in use is reuse-based. It is directly related to the concept of general software frameworks, where applications are built from their extension or customization. These structures are cooperative classes that can be adapted to build applications in a given domain, reducing the effort to implement them [3] [20].

In this context, various types of software can be created depending on the project's need. A communication protocol, for example, consists of a set of rules governing the data exchange between applications or computer systems. An Application Programming Interface (API) is another possible artifact, a conceptual collection of methods that describes services or features provided by some app. A component library, in turn, is a piece of code called to run specific functions. A software framework can be viewed as a set of libraries required to perform a more broad operation. It encapsulates API behaviors into more complex implementations, allowing them to be used more flexibly through extensions, configurations, and inversions of control [4].

There are approaches to developing such reusable software. These methodologies rely on identifying common properties and features in a family of applications [20] [30]. The recognition of such characteristics can be achieved by developing multiple applications in a specific domain, but in different usage contexts. Fig. 1 presents the patterns for designing reusable components [30].

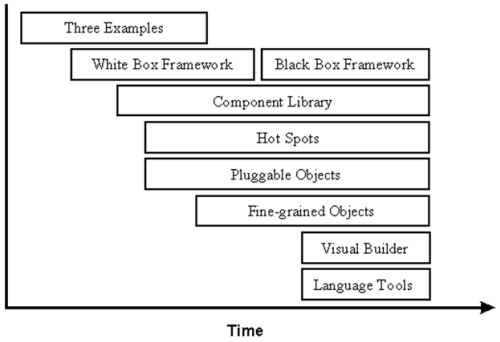

Fig. 1. Patterns for building reusable software structures. Source: [30].

The technique starting point is to create at least three application examples. The paper highlights one of three applications foreseen by the first pattern, aiming to raise the requirements of an AT-based application in the iTV context.

3 An AT-based Solution for the iTV Ecosystem

3.1 Projects integrated by IOM4TV

The +TV4E platform is a iTV solution conceived to turn its target audience (seniors) into users, and not just passive viewers [34]. The idea is to provide the elderly, access to information related to public and social services. The main goal is to present relevant content to these users while they are watching TV. +TV4E prevents its users from missing the current TV program by interrupting the broadcast program so he can watch the video suggested by the platform and then return to the point where the TV show stopped. The platform also has a library that stores the recommended videos and uses its recommendation system to suggest this content according to the user's profile.

The current version of the IOM consists of an eyeglass frame with built-in sensors. IOM uses an accelerometer to capture the movements performed by its users. This data is used as input, then sent over a serial connection and finally converted to cursor movements on the computer screen. Data interpretation is based on an internal communication protocol, necessary for the proper understanding and treatment of data exchanged on both sides of the communication. To trigger click events, IOM version 1.0 adopts the Dwell time technique, i.e.;

it simulates clicks when the device remains stationary for a configured period. The gadget is also accompanied by a setup application to customize parameters for the proper equipment use.

3.2 IOM4TV Application

IOM4TV is designed to support IOM within the +TV4E platform. In addition to the IOM, the following elements need to be interconnected: a TV set as the primary device responsible for displaying the app content. A set-top-box (STB) decoder that connects to the TV, transforming an external signal into a displayable format. An external computer used to connect to the IOM and convert head movements to cursor movement. In addition to the physical devices, two software components were to enable interaction, as can be observed in the architecture highlighted in Fig. 2.

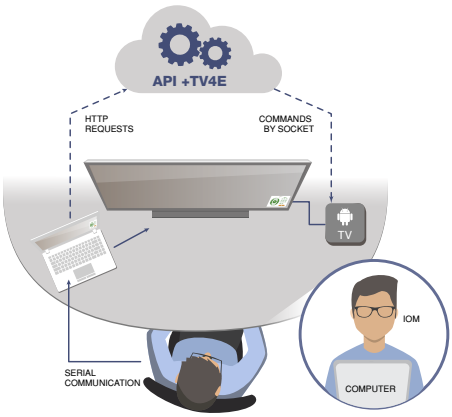

Fig. 2. IOM4TV's architecture.

+TV4E API component act as a Web Service (WS), an intermediate layer of software that receives data from the IOM's interface, and translates it to commands on the iTV system. The WS receives HTTP (Hypertext Transfer Protocol) POST calls and triggers instructions to be executed over the STB. The second software component is the interface that interacts directly to IOM. A specific Graphical User Interface (GUI) was developed to promote the interaction between IOM users and the iTV application. When the click occurs on any interface button, a function, responsible for sending the HTTP request is triggered. This function sets up the HTTP request, and then send the request to the WS execute its function. As soon as it receives this call, the WS communicates with the STB, executing the user's requested operation.

Web-based Prototype Two different approaches were used for this operation. The interaction method used in the first developed interface was based on the IOM's standard operating approach. In this version, the user traverses the interface using the cursor performing continuous head's movements. When the user stops moving the cursor in a position for a period of time somewhere in the interface, the click action is triggered at the specific position where the cursor is located. This interface has been developed using web tools (HTML, CSS and AJAX). The interfaces evaluated in both testing rounds are highlighted in Fig. 3 (a) and (b).

(a) Web-based v1. (b) Web-based v2. (c) Event-based.

Fig. 3. IOM4TV's prototype interfaces.

Event-based Prototype The development of the previous interface motivated the development of another kind of interaction. This version detects IOM's specific motion events to simplify the application usage and reduce discomfort caused by the motion required to traverse the interface. The IOM firmware has been modified to allow its use through motion events. Four movement possibilities have been defined: up, down, left, or right. From this firmware change, a second interface was developed using listeners classes that expect predefined events to occur to trigger some functionality. This interface was implemented in Java (Fig. 3(c)).In this prototype, the moving process triggers functionality using the four basic movements. Assuming that the initial focus is on the "OK" button, when the user moves his head to the right, focus shifts to the next available button in that direction. This form of movement allows the user to move around the interface. Upon reaching the desired button, performing the upside-down motion triggers the action related to the selected button.

3.3 Evaluation, Results and Discussion

Three different evaluations cycles were executed with the IOM4TV. First, two rounds of user testing were performed on the web-based version, using the Self-Assessment Manikin (SAM) [5] and AttrakDiff [13] assessment tools. The goal was to check user emotions through SAM, as well as to measure User Experience

(UX) through AttrakDiff. These two rounds involved five participants over 55, two men and three women. This number of testers was based on the theory that the best results come with no more than five users running the fewest possible activities [23]. In the first round, the test environment was organized in a University computer lab, with no concerns to reproduce the context in which a user would use IOM4TV. In turn, an occupational therapist guided the second testing round. His main concern was to make the environment attractive, making it look like a traditional TV room, with a comfortable sofa, intimate décor, mood lighting, and pleasant temperature.

Regarding SAM, the Satisfaction aspect reached the highest possible score in both experiments. This positive assessment may be linked to the sense of usefulness that the elderly felt when participating in the tests. On the other hand, the Excitement dimension obtained opposite results in the two test rounds. Such result indicates the users were very anxious during the first experiment, while they were more relaxed when performing the second test. Thus, the fact that users already know the type of interaction affects this dimension. Finally, the Feeling of Control dimension reached a median score in the first round of testing, revealing usability issues with application interaction. In the second experiment, the results demonstrate the participants were more confident using IOM4TV, reflecting on the improvement of this item's evaluation. In turn, Attrakdiff results show that the Pragmatic and Hedonic Quality scores in the first round were 1.91 and 2.19, against the 2.43 and 2.51 ratings in the second series, demonstrating a significant improvement in both aspects measured by the instrument. A second relevant data generated by AttrakDiff highlights the scores given to opposite adjective pairs. Following the Portfolio chart's trend, the word-pairs analysis results showed improvements in the second round of evaluation. However, the same keyword pairs with lower scores were ranked neutral/negative again. The observations made about the web prototypes, allowed us to perceive problems related to both the application interface and the device's usage. Specially the need for more explicit visual and audible feedback (when possible). The first round results led to the interface evolution, as can be seen in Fig. 3 (a) and (b). The main changes were related to the simplification of the control interface. Numeric buttons have been deleted to make the interface as clean as possible. The fact that there are few open channels available in Portugal led to this decision. In addition, visual feedback has been enhanced to give users more control sensation.

The third test cycle was applied to the event-oriented interface. Its functionalities were initially evaluated only at the development testing level. Thus, two types of evaluation were performed at the application development level: Unit tests on the implemented classes; and IOM4TV functional testing in a development environment. Despite this, these tests were relevant because, although performed by experts, they reflected in an efficient form of interaction, in situations where the user interface is small, such as the virtual remote control proposed. Also, aspects related to alternative click triggering presented effective results in the iTV context.

4 Requirements for iTV Ecosystem

As previously highlighted, this work is part of a project that aims to identify recurrent characteristics and needs in different applications in a specific application domain. Thus, some initiatives have already been developed using IOM as an interaction object in other usage contexts, such as controlled environments [26] or games [7]. In this work, the IOM4TV prototypes' allowed to collect requirements related to the IOM's usage in the interactive TV scenario. Among the main points raised, we can highlight the following.

Setup features, including essential tasks that should be addressed initially, such as methods for identifying, connecting, and configuring the main functionality available on the interaction device. It is also necessary to consider the aspects relative to the communication protocol that must exist between the device and applications. *Feedback information*, such as visual, that was resolved in the application using enhanced interface colors and user-assisted messages. This change was motivated by the need to provide information about the performed functions, such as changing channels or accessing the video library, for example. Another elicited requirement was the use of an *alternative interaction mode* (for example, a voice module) to trigger specific events, such as clicks. This request was recurring from users during testing, making it a relevant requirement for future releases.

The *operation by events*, although still in the development stage, this features has been presented as a very relevant contribution, since it opens up a range of possibilities for the development of applications that use this behavior. Another related point was the development of interaction interfaces using different technologies: one based on Web technologies; and the other use object-oriented programming. This reinforces the understanding that a possible *conceptual framework* should be developed regardless of the technology used in the final implementation. Besides, issues related to simplifying the selection of clickable targets is a requirement to be addressed. Provide methods that simplify the detection of *user click intention* when utilizing standard device operation. This issue is addressed most simply when the event mode is used. Allowing the application to be inserted directly into the TV screen is an essential requirement in the context of iTV as it simplifies the use of solutions by eliminating the computer from this usage scenario.

Concerning the development process, it is necessary to strengthen end-user participation by allowing them to cooperate more actively in the assistive solution design process. In terms of testing, critical factors such as execution environment, familiarity, and interaction tools directly influence the final result achieved.

5 Conclusion and Future Work

This work is part of a larger research project that aims to propose a software framework focused on the development of AT applications for people with motor

restrictions. The project applies development techniques that seek to identify recurring characteristics and needs in a family of applications from a specific knowledge domain. In this sense, IOM4TV is one of the applications developed for this purpose. Its development and evaluation process aimed to collect the essential requirements related to the interactive TV scenario.

In this context, this paper specifically introduced IOM4TV, a software solution for controlling an iTV application through IOM. Software components were developed to perform device integration with +TV4E: A Web Service responsible for translating commands triggered by IOM virtual control into STB functions; And three virtual remote control interfaces used to user interaction with the application.

Although IOM4TV web-based prototypes have been positively rated in both SAM and AttrakDiff, improvement points were observed, specifically related to the interaction of IOM with the application and usability itself. The second control interface created uses an event response based approach. Although not tested with end-users, development tests have shown that the event interaction approach is promising as it simplifies interaction. The development process of these control interfaces allowed eliciting a series of requirements that may be incorporated into the IOM framework design. Some of these features corroborate assumptions that have already appeared in other scenarios of using IOM. On the other hand, new functionalities were also found, specifically related to the iTV ecosystem, which should also integrate the proposed solution.

Following this work, it is expected to perform functional tests with the event-based solution. Ideally, these tests should also include an evaluation with people with physical disabilities in the upper limbs to get feedback from those users. This new round would allow the two modes to be compared more effectively. Regarding the research project, it is expected to meet the requirements obtained with the IOM4TV, with the elements observed in the contexts of use of other IOM devices. From these elements, a conceptual architecture for the IOM framework will be designed. Sequentially, it is expected to implement it through some programming language. The initial idea is to implement these requirements as microservices so that you can choose what functionality is needed for the context of each specific application under development.

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Testing, Usabilidad y Experiencias de Usuario ·

Teste, Usabilidade e Experiência do Usuário ·

Testing, Usability and User Experience ·

Colaborações Possíveis Entre IHC, UX e Comunicação Para Fruição de Sistemas Audiovisuais Sob Demanda

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Resumo. Com a disseminação das Novas Tecnologias de Informação e Comunicação, ocorreram mudanças na apresentação e na fruição dos conteúdos audiovisuais, acentuadas com o surgimento de serviços de vídeo sob demanda, como Netflix, Amazon Prime e Globo *Play*. A recepção, antes considerada passiva e unidirecional, passou a ser mediada por interfaces computacionais, englobando hardware, software e elementos gráficos. Três áreas, antes distintas, se dedicam a estudar a interação, produção e fruição de conteúdos: a Experiência de Usuário (UX), Interação Humano Computador (IHC) e os Estudos de Mídias, enquanto Comunicação. Este artigo analisa conceitos, recomendações e processos pertinentes a essas áreas e como elas podem contribuir para o desenvolvimento de interfaces e conteúdos adequados às exigências da audiência desses sistemas sob demanda. Conclui-se que UX, IHC e a Comunicação podem potencializar a fruição de modo a gerar vínculos entre produção, recepção e interação ao considerar elementos antes inerentes apenas às áreas separadamente.

Palavras-chave: IHC, Experiência do Usuário, Comunicação, Netflix, Amazon Prime Video, Globo Play.

1 Introdução

O desenvolvimento das Novas Tecnologias de Informação e Comunicação (NTIC), e do uso em diversos setores e áreas, especialmente na produção audiovisual, vêm acompanhado de diversos estudos sobre o uso, impacto e convergências tecnológicas. Mudanças sociais, culturais e técnicas afetam a forma como se interpreta e produz a informação. As mídias e modelos de difusão tradicionais estão convergindo para novas tecnologias e novos modelos de disseminação de conteúdo [1]. A via de mão única, onde o indivíduo receptor assumia um papel passivo diante da mídia, recebendo as

informações unidirecionalmente, cede espaço para um indivíduo com postura ativa e com poder de escolha, graças a digitalização [2].

A convergência, descrita por [2], também impacta nos conteúdos, além das mídias de suporte, como televisão, rádio e computadores. Surge todo um conjunto complexo de conteúdos que agora ganham novos formatos e novas opções de interatividade, focados no engajamento do indivíduo. Os novos conteúdos podem ser reproduzidos em multi plataformas, baseadas em software e diferentes interfaces de interação. Como exemplo, podemos citar os filmes e séries disponibilizados através de aplicativos de streaming, que podem ser visualizados em TVs, smartphones, computadores ou tablets.

Recentes lançamentos e evoluções de serviços de streaming, como Amazon Prime e Apple TV+, indicam uma consolidação deste canal de distribuição de obras audiovisuais, filmes e séries, majoritariamente. Somado a já tradicional Netflix, essas plataformas de distribuição representam uma alternativa adicional para produtores e desenvolvedores de conteúdos audiovisuais.

Características comuns dessas plataformas, a interação, busca e navegação pelas obras são elementos novos para a produção e fruição audiovisual. Em relação às mídias tradicionais, como televisão e cinema, a experiência de fruição difere em vários aspectos. Inicialmente, a inexistência de uma grade de programação, seja da televisão ou dos horários do cinema, demanda um planejamento por parte dos indivíduos que assistem a obra. A relação simbólica com o canal de distribuição difere na escolha e quantidade das obras a serem assistidas, e na relação social que os programas representam.

Além disso, a interface passa a desempenhar um papel central na interação. É por intermédio dela que os indivíduos se relacionam diretamente com as obras, escolhendo o que assistir e quando. A navegação requer princípios de usabilidade e compreensão do valor dos programas que podem determinar o sucesso de uma série ou filme.

A partir dessas mudanças na forma de acesso e consumo da fruição audiovisual, há uma mudança de foco em todo processo de fruição audiovisual. Como resultado, interfaces e softwares de distribuição de conteúdo sob demanda passam a desempenhar papéis tão relevantes quanto o conteúdo em si. Com as NTICs, a difusão, divulgação e interação desses conteúdos são realizadas por softwares específicos, com papel fundamental na fruição e compreensão do conteúdo por parte do consumidor. Desta maneira, interfaces mal projetadas podem comprometer a compreensão da informação e frustrar a navegação no aplicativo, gerando ruído no processo de comunicação. Autores têm proposto que as interfaces de interação sejam consideradas no processo criativo audiovisual para minimizar problemas de acesso e compartilhamento das informações [3].

Estes conceitos são novos no processo comunicacional de produção audiovisual. No entanto, são amplamente estudados em áreas como Experiência do Usuário (UX) e Interação Humano Computador (IHC). Os termos usabilidade e interação homem-computador (IHC) são usados para caracterizar as interações entre o homem e sistemas computacionais, relacionando como essa interação pode ser melhorada de forma a potencializar a eficiência, tanto do indivíduo em manusear o sistema, como do

sistema, em se adequar às necessidades do indivíduo [4]. Em ambas as áreas o foco está na criação de interfaces gráficas do usuário e como elas podem ser melhoradas e adaptadas para melhor atender as necessidades, tanto do indivíduo que irá usá-la, como do hardware [5].

A relação entre interface gráfica do usuário com os indivíduos e sistema é diretamente ligada à interação e à comunicação que esses dois irão realizar para a resolução de uma determinada tarefa. Nesse sentido, as áreas da IHC e usabilidade são destinadas e focadas para a melhoria das interações diretas entre os indivíduos e os sistemas, apontando recomendações, comportamentos, heurísticas e diretrizes que melhorem essas interações e assim possibilitem uma boa experiência para o indivíduo [6].

A experiência do usuário (UX), expande a noção de uso do produto para diferentes, e variados pontos de contato com o cliente [7]. O ponto de contato não é restrito a uma interação direta com os produtos, mas compreende todo um processo, desde a definição da necessidade, a procura pelos modelos, preços e marcas adequadas, até a compra e utilização do produto no dia a dia. Para o contexto audiovisual, ela se inclui nos moldes de apresentação e representação dos produtos desde sua forma de publicidade até a percepção satisfatória de uso pelo cliente, tornando os pontos de contato com o produto audiovisual uma relação positiva. Dessa forma, a UX busca melhorar todas as formas de relação e uso com os produtos, fomentando desde uma boa propaganda publicitária, até uma interface amigável que possibilite ao usuário uma boa fruição dentro do sistema até a sua relação positiva com o produto de forma geral.

Incorporar esses conceitos no processo comunicacional da fruição de sistemas audiovisuais sob demanda pode evitar problemas relacionados a conteúdos indesejados ou experiências ruins de interação com a interface. Dessa forma, elementos de UX e IHC podem ser incorporados durante todo ciclo de fruição no sistema, visando uma melhor experiência durante todo o processo de comunicação e interação com o produto.

Este artigo analisa os três principais serviços de streaming atualmente disponíveis no Brasil, Netflix, Amazon Prime e Globo Play, visando identificar como a UX e IHC podem contribuir para a produção de obras audiovisuais adequadas às ferramentas disponíveis nessas plataformas. Como resultado, sugere-se que as plataformas de vídeo sob demanda (streaming) trabalhem com a integração dos conceitos de IHC, UX e Comunicação enquanto estudos de mídias para abrangerem mais os pontos de contato do usuário com o produto a fim de potencializar toda a experiência.

2 User Experience (UX)

Este trabalho aborda o conceito de experiência do usuário, visando sua aplicação em produção e sistemas de fruição audiovisuais sob demanda e em como a UX pode servir de apoio à criação de uma experiência agradável para o usuário. Pressupõe-se que a UX pode oferecer recomendações e técnicas de melhoria para os processos de comunicação e interação tanto dentro de sistemas como fora deles. Nesse sentido, a UX é pertinente para o desenho de experiências que atingem não somente a carac-

terística funcional, mas também subjetivas gerando relações dos streamers quando se dispõe a passar horas assistindo suas séries favoritas e para isso é preciso interagir com uma interface que necessita ser simples e funcional a ponto de não tirar o foco do conteúdo audiovisual.

Em 1990, enquanto trabalha na Apple, o cientista cognitivo Donald Norman percebeu que a relação do indivíduos com um determinado artefato digital ia além da relação da interação dialógica entre o homem e o computador, ultrapassando o meio físico ou virtual e caminhando para uma relação emocional e de utilidade da tecnologia. Tal relação se iniciava antes mesmo da compra, e se estendia até após o uso. A partir dessa percepção, Norman cunhou o termo User Experience (UX), onde descreve algo maior que apenas uma interação, compreendendo uma relação íntima do indivíduo com um produto ou serviço, e que pode ser aplicado a diversas áreas além da computação [7]. A ideia de Norman era que a experiência com um produto, ou serviço de forma geral, ia além do seu uso, incluindo as etapas de escolha, compra, transporte, montagem e o uso em si, sendo todas essas etapas, momentos decisórios de uma boa experiência ou não para o indivíduo. Assim, as diversas etapas de uma experiência, como a pré-assinatura de um serviço de streaming como a Netflix, estágio em que o potencial assinante pode usufruir do serviço gratuitamente durante o período de um mês (com opção de cancelamento sem cobrança de taxas, se feita dentro do referido prazo), da personalização de perfis e criação de playlists, uma fluida fruição do sistema, um conteúdo que é atualizado periodicamente, a discussão pós-fílmica (também para séries e documentários) com a comunidade, e, não só estágio da assinatura e fruição do conteúdo específico, fazem parte de uma experiência maior do usuário com o produto.

É importante colocar que a experiência do usuário se baseia em uma estética de experiência, e não do objeto, logo, ela busca a projeção de uma experiência que vai além do objeto e não se concentra apenas em características do design do artefato em si, como por exemplo, o design de interface de um sistema. A projeção da experiência do usuário é uma atividade complexa e multidisciplinar que vai desde a psicologia até a arquitetura da informação, abordando diversos fatores que tornam a jornada do usuário junto ao produto uma relação afetiva ou não [8]. Com isso, o trabalho desempenhado pela UX é analisar todo esse cenário objetivo e subjetivo das necessidades humana e de mercado, para assim, desenhar a melhor proposta de experiência possível para o indivíduo [9].

3 IHC

A Interação Humano Computador surge com base na Psicologia Cognitiva, com fundamentação na Engenharia Cognitiva, da necessidade de sistemas que ajudem as pessoas, que não necessariamente sejam especialistas em computação, fornecendo explicações de como está acontecendo determinada tarefa, e previsões do que poderá acontecer durante a interação [10-11]. É uma área que está na intersecção da Ciência da Computação e Ciências Sociais e que detém relevância, uma vez que seus interesses visam formas de melhorias em interfaces de diversas plataformas digitais a fim de

aprimorar a funcionalidade dos sistemas na comunicação com os seus usuários, estudar e definir métodos para que os sistemas ou dispositivos sejam de fácil utilização, eficientes, eficazes e que possibilitem conforto aos indivíduos que irão utilizá-los [12] (AGNER. 2006), de forma segura, trazendo rápidas respostas de feedback ao usuário, beneficiando assim, a interação, visto o ambiente o qual está inserido durante o uso da interface.

O estudo [13] diz que a interfaces deixa de ser restrito apenas a hardware e software e passa a incluir aspectos cognitivos durante a interação, visando o usuário, a interação humano computador surge com a proposta de abraçar todo o processo de interação dos usuários com sistemas computacionais, se preocupando com o design, avaliação e implementação de sistemas interativos respeitando os fenômenos cognitivos, culturais, sensoriais, intelectuais e ambientais que possam ocorrer durante o uso.

[14] define que a usabilidade satisfatória de interfaces seguem cinco atributos: aprendizagem, memorabilidade, eficiência, satisfação e errors; onde cada um deles influenciará no desempenho do software com o usuário. Para o autor, a interação deve ser de fácil aprendizagem de modo com que o usufruidor se lembre facilmente de como executar determinada tarefa, e satisfatória, trazendo conforto e prazer durante o uso. Quanto aos erros, devem ser tratados de forma imediata para que não comprometam a eficiência produtiva do sistema.

Com o avanço da tecnologia, os softwares passaram a oferecer diversas outras possibilidades de interação, como a realidade virtual e aplicações multimídia, dando um maior leque de ações que podem ser alcançadas com a IHC, tornando a área desafiadora. Um dos desafios é de como produzir interfaces para um grupo onde aspectos cognitivos e motivacionais são tão diversificados. Deve-se levar em conta também os fatores ambientais onde o usuário está inserido, o conforto, a sua saúde, a ergonomia da máquina, entre outros fatores, visto que também influenciam a experiência e usabilidade.

4 Netflix, Amazon Prime e Globo Play

Devido às múltiplas formas de apropriação de um dispositivo e do conteúdo televisivo, foram recriadas e ampliadas também as práticas em consumir conteúdos por seus usuários. Detentores da escolha, o público pode optar por assistir à programação de acordo com a grade de cada canal, ou utilizar serviços de vídeo por demanda, ou através de serviços de streaming, entre outras formas.

Diante do acesso a conteúdos audiovisuais através das mídias digitais e da internet, surgiram os chamados serviços em streaming – uma espécie de locatário virtual, acessado mediante aplicativos ou plataforma on-line, em que os usuários dependem de um catálogo em que oferta uma programação incessante – e a partir dele, escolhe o que assistir, não sendo necessário o armazenamento do conteúdo pelo usuário em seu dispositivo, mas transmitido a partir de dados contínuos através do stream, reproduzindo conteúdo, de acordo com a conexão com a internet.

Com o surgimento dos principais serviços de streaming, podemos considerar três empresas vigentes que ganham destaque no segmento audiovisual: Netflix, Amazon Prime e Globo Play. Uma vez o usuário pagando por uma assinatura mensal, é concedido em qualquer um destes serviços, assistir a quantidade de conteúdos que quiserem, em qualquer lugar, a qualquer hora e nas mais diversas telas que possuem conexão à internet, com total liberdade em sua reprodução, pausa e continuidade para assistir ao conteúdo.

Líder de mercado nos serviços de streaming, com entorno de 81 milhões de membros distribuídos em mais de 190 países, a Netflix beneficia mais de 125 milhões de horas de programas de TV e filmes, incluindo séries originais, documentários e longas metragens na sua plataforma. O serviço é, dentre os três, o mais importante, por corresponder com número significativo de programas originais, na abrangência internacional e elevado número de usuários comparada aos serviços similares dos seus concorrentes.

Logo atrás, a Amazon Prime cresce em popularidade de forma compassada, porém contínua. Sendo a primeira a oferecer a chance de download do seu conteúdo para o usuário, oportunizando o assistir do conteúdo audiovisual no dispositivo sem uma conexão com a internet, o que promoveu uma vantagem sobre a Netflix, que ofertou esta possibilidade aos seus usuários apenas em 2016 e exclusivamente para smartphones. Em vantagem, contudo, o serviço da Amazon Prime contempla seus usuários com o conteúdo extra, existente em sua loja, que vende uma variedade em produtos, incluindo livros, games, música e outros artigos. Embora a Amazon não revele o número de assinantes do serviço, estima-se que este esteja presente em de 25% a 40% das residências norte-americanas.

Provocada por diversas mudanças no âmbito da distribuição e fruição dos produtos audiovisuais, a Rede Globo buscou adequar-se e atender à essas demandas voltada às múltiplas plataformas que dissipam conteúdo e interatividade, apresentando então o Globo Play, seu próprio serviço de streaming com conteúdo audiovisual sob demanda. Considerando como foco o ampliar da audiência e o público que transita pelas novas mídias digitais, uma vez com seu próprio serviço de streaming, a emissora passa a atender uma nova plataforma de distribuição multimídia, acessada por múltiplas telas, estimulando novas práticas do consumo audiovisual sem abrir mão do alcance do seu conteúdo.

Diversas são as estratégias vinculadas aos serviços no âmbito da distribuição e fruição dos produtos audiovisuais, tornando-se necessária a reconfiguração do processo produtivo. Uma delas, comum às três streamings anteriormente citadas, é a criação de um conteúdo audiovisual original e não mais somente acervo ou exibição, a fim de conduzir seu conteúdo sempre para algo novo que justifique a permanência dos assinantes em suas plataformas. Quanto mais originais os serviços promovidos, mais oportuno o atrair de novos assinantes e o manter do vínculo.

5 Estudo de caso: navegação em sistemas de *streaming*

Algo que pode ajudar no entendimento do uso da IHC e da UX aplicados em processos de produção audiovisual, é a realização do estudo de caso no qual investigamos os principais serviços de streaming do mercado no Brasil: Netflix, Prime Video e Globo Play. Neste estudo, verificamos e identificamos os principais problemas de usabilidade durante a navegação do usuário na interface do aplicativo. No contexto deste estudo, serviços de streaming podem ser entendidos como sistemas de distribuição e fruição de conteúdo audiovisual em ambiente digital conectado. Ou seja, o usuário contrata o serviço através de assinatura mensal, e obtém acesso a diversos tipos de conteúdo via internet, sendo os mais comuns filmes, séries e músicas (podcasts), ficando disponíveis através de aplicativos em diversas plataformas como computadores, dispositivos móveis, TVs e video games.

Para entender a influência dos serviços de streaming no mercado, podemos destacar o caso da Netflix, que mostrou-se um forte aliado no combate a pirataria, quando passou a disponibilizar temporadas completas de seriados em uma data de lançamento única. Devido o sucesso desse modelo de negócio, outras grandes empresas começaram a desenvolver suas próprias plataformas de streaming, com isso, gerando competitividade e requerendo diferenciais e novidades para conquistar o cliente. Assim, os serviços começaram a desenvolver seus próprios conteúdos exclusivos, como séries e filmes, fato que atingiu também a TV tradicional, forçando-os a se inserir nesse novo modelo de negócio e fruição.

Com o grande número de serviços de streaming e seus conteúdos exclusivos, novamente tornou-se necessário inovar, com isso, um fator de grande importância é o desenvolvimento de sistemas de navegação otimizados e fluídos, fator esse que nos inspirou a este estudo. Utilizamos a avaliação analítica, proposta de [15], a qual indica um conjunto de maneiras econômicas de avaliar interfaces de usuário, que nos permite avaliar as decisões de UX e IHC utilizadas nas plataformas de streaming. Com isto, identificamos, classificamos e contamos problemas de navegação de interface no aplicativo para TV dos serviços de streaming Netflix, Prime Video (Amazon) e Globo Play.

Os testes foram realizados no Laboratório de Interação e Mídia (LIM), na Universidade Federal da Paraíba (UFPB), onde foram entregues aos usuários roteiros com descrição de tarefas, divididos em etapas a serem realizadas com 5 participantes. Dois tipos de roteiros foram sorteados aos participantes: um para filmes e outros para séries. Esses roteiros consistiam numa série de atividades, onde o voluntário realizava tarefas de navegação de interface como: navegar na página principal do sistema; procurar um filme a pedido do mediador da maneira que achasse mais adequada; fazer a mesma procura utilizando-se do mecanismo de busca; alterar legenda antes e durante a fruição; procurar conteúdo extra sobre o que estava sendo exibido O teste foi registrado em vídeo, possibilitando aos pesquisadores o posterior acesso à totalidade de informações proferidas pelos participantes, uma vez que as ações realizadas por eles eram simultaneamente comentadas (think aloud).

O objetivo foi de detectar dificuldades ou erros de usabilidade na interface. Uma dificuldade encontrada pelos participantes, por exemplo, foi a de não poderem alterar

o áudio ou legenda do conteúdo no sistema Prime Video da Amazon durante a fruição, sendo possível apenas a customização de legendas.

Também foram realizados questionários pós-testes, não com o intuito de gerar algum dado social relevante - impossível devido o número de participantes na pesquisa - mas com o objetivo de gerar um complemento e uma melhor interpretação e apoio na análise dos dados obtidos.

Table 1. Síntese dos resultados do estudo

Sistema	Netflix	Prime Video	Globo Play
Fluidez do sistema	Fluido	Refreado	Fluido
Conteúdo extra	Reduzido	Excelente	Reduzido
Ferramentas de busca	Resposta rápida (tempo real); boa redundância na visualização da informação do conteúdo	Resposta lenta (latência); interface confusa	Resposta rápida (tempo real); sem redundância de informações do conteúdo
Navegação de interface	Satisfatória; elementos de interface bem organizados	Confusa; imprevisível; elementos de interface mal organizados.	Boa; elementos de interface bem organizados

A análise dos dados no estudo citado revelou que uma navegação intuitiva e a fluida no sistema são de extrema importância para o usuário, e são os elementos do design de interação que causam o maior impacto em sua experiência. O resultado disso foi a preferência dos usuários pelo sistema Netflix sobre o Prime Video (Amazon). Porém, se fosse apenas isto, os usuários optariam preferencialmente pelo serviço Globo Play ao invés do sistema da Amazon, uma vez que a primeira plataforma apresentou também um design intuitivo e navegação de interface fluida. Não foi o caso. A questão é que o Prime Video, além de ofertar um conteúdo mais universal e de produções próprias, os conteúdos exclusivos anteriormente citados (assim como a Netflix), apresentou um excelente design de conteúdos extras (como o X-ray) e uma melhor descrição do conteúdo oferecido pelo sistema.

Concluímos que tanto a navegação no sistema (navegação nas telas, nas rotas dos níveis de navegação entre elas, o tempo de resposta do sistema e a fluidez) que podemos aferir como elementos da IHC, como a oferta de conteúdos extras, que complementam a experiência do usuário na fruição e podem ser pensadas pela UX, pos-

suem importância complementar para o usuário, que por sua vez afetam no processo de comunicação a que este artigo confere importância.

Dessa forma, é possível inferir que, se o Prime Video corrigir seu problema de navegação, é possível que alcance ou até supere a Netflix em termos de preferência do usuário, aliando uma navegação fluida e de boa redundância a uma oferta de conteúdo extra funcional, ou seja, desenvolvendo um design de interação que faça intersecção entre IHC e UX.

6 Discussão

Produções audiovisuais sempre foram destinadas às grandes mídias como cinema e televisão, mas com o surgimento das plataformas de serviços streaming (on demand), esse direcionamento de produção vem mudando, tanto em seu conteúdo quanto nas formas de transmissão, recepção, interação e visualização pelos usuários/telespectadores com essas obras. Como por exemplo a Netflix que se utilizou de conceitos de vídeo interativo e criou um episódio de Black Mirror onde o usuário poderia escolher por quais caminhos a narrativa deveria seguir resultando em diferentes finais a depender da escolha do usuário. A escolha acontecia em determinados momentos da cena, com o sistema paralisando o andamento e oferecendo duas opções de escolha em tela para o indivíduo que fazia suas operações através do controle remoto. Embora críticas tenham sido feitas a maneira como o enredo foi projetado, como por exemplo, o fato de existirem escolhas erradas (a ideia das narrativas interativas é a de que o participante veja as consequências de suas escolhas) no estilo quiz, a parte interativa da interface durante a intervenção do participante foi bem desenhada. Esse tipo de interação com interface e conteúdo é uma nova proposta de fruição audiovisual, onde antes os telespectadores eram obrigados a seguir a grade de canais e conteúdos impostos pela TV aberta ou em salas de cinema, agora com as plataformas de streaming essa obrigação se torna uma opção, onde o telespectador é também usuário, podendo controlar toda a fruição.

Em uma pesquisa realizada nos EUA, [16] mostra que o consumo de conteúdo audiovisual oriundo da TV vem diminuindo e indica um crescimento dos serviços on demand. Argumenta ainda que a potencialidade dos serviços de streaming por demanda, que são caracterizados por trazer liberdade e poder de escolha ao telespectador. Fatores como tempo e local não são mais problema como nas mídias tradicionais, agora podemos consumir conteúdos onde e quando quisermos, isso nos traz uma melhor experiência enquanto telespectador onde podemos agora controlar nosso consumo de forma atemporal. Para os fatores enquanto dispositivo, interface e experiência, podemos agora ter um consumo multiplataforma do ponto de vista tanto do dispositivo quando de suas interfaces, que trazem para o nosso cotidiano facilidades de acesso e mobilidade, agora não precisamos de um computador somente para ver filmes e séries, diversos outros dispositivos podem nos suprir essa necessidade como os smartphones e tablets, se tornando um conteúdo onipresente.

As áreas da IHC e UX sempre se preocuparam com a qualidade e eficiência de interfaces e serviços digitais, e para garantir isso foram desenvolvidas diversas

recomendações e heurísticas que auxiliam no seu desenvolvimento, mas quando tratamos de conteúdo em si, essas áreas não nos contemplam com diretrizes de como esse conteúdo pode se integrar e potencializar a interface ou vise versa. Esse tratamento do conteúdo junto com a interface é de extrema importância diante das novas características das plataformas de streaming onde agora o usuário controla sua fruição. Seu conteúdo deve estar diretamente interligado com a interação.

É perceptível que a comunicação, IHC e a UX utilizada na fruição multiplataforma é potencializadora de conteúdo e produtos, mudando a economia de criação do audiovisual, usando tecnologias distribuídas que possam ser mais eficientes e lucrativas sem ter como base a tv e cinema [17]. Um exemplo dessa mudança criativa é o serviço Amazon Prime, que dentro de um grande pacote de conteúdo e serviço, oferece em seu produtos que vão desde o audiovisual até um livro da série que o usuário está acompanhando, tornando-se uma experiência única que uma vez percebida pelo usuário por fatores de empatia, emoção, cultura, prazer, utilidade, eficiência. A experiência do usuário em sistemas sob demanda é mais ampla que o próprio sistema em si, é também parte de um ecossistema de estratégias de marca, marketing, conteúdo, pesquisa com usuários, e-commerce, aplicações e redes sociais [18]. É delimitar estratégias de pontos de contato do usuário com o produto, criar publicidades direcionadas, conteúdos que atraiam a atenção, manter relação com o usuário em redes sociais e também o pós contato onde é a parte emocional da relação com o produto, é onde acontece o compartilhamento, a geração de seguidores e o bom comentário que é resultado da boa experiência.

Considerar a IHC e a UX até mesmo antes da produção de filmes e séries é algo a se pensar, pois é nesse momento que irá se formular toda uma experiência, com o roteiro, produção, montagem, divulgação, interação e visualização. Pensar nesse contexto maior é essencial para obter uma boa experiência junto ao seu público. Nas produções audiovisuais que se utilizam de dispositivos digitais para sua visualização ou manipulação, necessitam de uma projeção da experiência do usuário tanto no seu conteúdo, quanto nas suas interface. Essa modelagem de experiência pode ser percebida em roteiros e publicidades audiovisuais como também em suas interfaces funcionais e com boa fruição.

As áreas da IHC, UX e comunicação podem colaborar para a geração de produções audiovisuais que possam ser melhor adequadas para os serviços de streaming como Netflix, Amazon Prime Video e Globo Play. Com isso identificamos algumas características intrínsecas aos serviços de streaming que podem ser relacionadas a IHC e a UX enquanto interface, sistema e experiência. Fatores como tempo, local, dispositivo, interface e a experiência como um todo, são características diretamente ligadas a esses serviços, diferente dos broadcasting que são presos a grade de canais e programas.

7 Conclusão

Este artigo refletiu sobre como as áreas de UX e Interação Humano Computador são indispensáveis nos processos de fruição do audiovisual voltado para os serviços de

streaming, principalmente com a inserção de sistemas e interfaces como parte da fruição audiovisual. Essa experiência percebida pelo usuário é caracterizada por fatores como empatia, emoção, cultura, prazer, eficiência, entre outras sensações que devem ser trabalhadas para o desenho de uma boa experiência. Em síntese, trata-se de adaptar e melhorar processos comunicacionais e de interação a fim de potencializar uma boa experiência durante a fruição.

Concomitantemente, a IHC traz ferramentas e técnicas de análise dos contextos da interação do indivíduo com sistemas computacionais através de interfaces. A partir dessa análise, que engloba elementos sociais, pessoais e tecnológicos, faz-se um diagnóstico sobre as melhorias que podem ser introduzidas no processo de produção e fruição audiovisual. Considera-se que as interfaces de interação, sejam gráficas, baseadas em outros elementos de software, ou o hardware que suporta o processo, devem ser adequadas a cada contexto de uso e a diferentes perfis de usuários. Dessa forma, há uma busca constante pela adequação dos recursos tecnológicos às demandas dos usuários, que se agrava ainda mais pelo uso em diversos dispositivos e contextos.

Por outro lado, na comunicação predominam ferramentas e técnicas, tais como, pauta, roteiro, criação publicitária, que visam gerar o melhor produto para uma audiência futura. Com as Novas Tecnologias a Informação e Comunicação, o acesso a esses produtos, ou aos conteúdos, é mediado por sistemas computacionais. O uso de interfaces de interação faz parte do processo e recepção da informação. Dessa forma, UX e IHC podem ser recursos importantes para apoiar criações audiovisuais mais adaptáveis e eficientes para esse novo contexto. Um modelo recente que aborda todo o contexto de fruição audiovisual e as interfaces de sistemas, é o Design Audiovisual(DA), que tem como objetivo fornecer uma base para criação e análise de como a fruição se dá a partir do uso de interfaces e a integração com o conteúdo, unindo às áreas de IHC e Estudos de mídias [4]. Como trabalho futuro, usaremos o DA como modelo para pesquisas sobre esse formato sob demanda e como o DA pode melhor apoiar esse recurso midiático.

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Exploring balance between TV and Smartphone to distribute efficiently discount coupons

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Abstract. Commonly users' attention is divided between multiple devices like the consumption of television content and the use of another device, such as smartphones. In this case, users tend to use mobile phones while ads are being advertised. The Smartly project aims to explore the potential of using multiple screens to enhance the TV experience by allowing users to receive on their smartphones promotion coupons related to the television content they watched. Following the development of the backend system and the mobile application, the project advanced for a test phase. During this phase, several data gathering techniques were used, such as questionnaire surveys, interviews, and direct observation of users interacting with the application. The user experience evaluation was based on a Self-Assessment Manikin (SAM) test. This paper focuses on the results taken from twenty-one evaluators, namely the results of the interview and the results of the SAM test. The results showed that, for most of the users, the application is intuitive and easy to use. The system is planned to be used in a real context during a Field Trial allowing to get more tune information about its utility.

Keywords: Interactive Television, Smartphone, Second Screen, Notifications, User Experience, User Interface.

1 Introduction

Currently we are facing an increase in the use of mobile devices while watching television content [1]. The user is exposed to an endless number of stimuli that can lead to an information overload. Thus, to get users' attention it is necessary to offer them services that meet their needs, with personalized experiences. Considering this trend, the Smartly project aims to expand the range of services offered to the consumer, trying to capture their attention through complementarity information between the television and the smartphone. Thus, Smartly aims to fill this gap by encouraging consumers to watch television ads providing them with related promotional coupons. To achieve this, a set of tools capable of triggering notifications, which are associated with the TV content, were developed. When a specific notification appears on the television screen, the user is invited to press the yellow button of the remote triggering an invitation to use a mobile app. Once installed, the mobile application allows users to receive, manage and use promotional coupons related with watched TV adds.

2 Theoretical Context

This paper reports on the Smartly research project that incorporates an ecosystem in which an interactive television (iTV) application and a mobile application are part. Therefore, the concepts of iTV and smartphone are fundamental in the structure and design of the conceptual framework of this work.

iTV combines enriched TV content with the existence of a return channel [2] allowing applications to have interactivity, enhancing their ability to meet user needs. The second-screen concept enriches the TV viewing experience, because users can benefit from mobile applications in parallel with the usage of TV screen [3]. According to a Nielsen's survey [4] about TV viewing and digital device usage, 35% of respondents look up or shop for products and services after they were advertised on TV. Notifications appear as a connection link of this technological ecosystem: iTV and smartphone. They serve as a link [5], allowing users to be warned that they have new information available [6] and can be transmitted in several forms (visual, audio or haptic) [7]. Although notifications are considered beneficial to user, they are also considered a great source of distraction [8]. However, this is not a reason to be

deactivated, users give them great value because without cognitive effort, it is easy to obtain relevant information [9].

According to [10], about 52% of smartphone owners (this number continues to increase) want to be connected to their personal device as well as to television, creating a multi-screen scenario. In that sense, it was necessary to find and describe examples of applications allowing this kind of interactivity, but also applications that notify users in several devices simultaneously.

Following, a set of examples of applications is listed and a brief description and the explanation of main features and functionalities, strengths and weaknesses are presented.

LG webOS TVNotify - The purpose of this application is to enable users to view notifications (for example, from missed calls, messages, emails, or be related to the user's social networks) on television that commonly are only be displayed on smartphones, So, users do not need to always be close to the smartphone. It offers privacy control settings allowing certain personal information not to be transmitted on television and give the user the power to choose which kind of notification he prefers to see. More recently, the application has allowed to be added to a black list from which we do not want to receive notifications on television [11].

Notifications for Fire TV - Like the previously mentioned application, this allows the user to forward notifications received on the mobile phone to the television. Other features have been added like the ability to make phone calls, send images from other applications, take screenshots, and quickly search for other applications and the ability to customize the notification. The great advantage of this application is to allow privacy mode for specific applications [12].

2ndVision - This application automatically syncs a mobile application with the TV content (using audio fingerprint), showing on the tablet complementary content related to what is being shown on the TV (name of the actors, a brand of a car, information on a location seen on the TV show, among others). The user can find all the information previously mentioned in the feed, filter the contents by a certain category (e.g.: location, weather, etc.) and store them for later use. There is an agenda that allows users to specify, according to their preferences, the programs they want to see later. The application allows also to create notifications, letting users to receive content alerts. The user may also classify the additional information through the rating and share it using e-mail or social networks. All extra content is gathered and presented to the user due to audio recognition features, namely audio fingerprint [13].

Sony Notify BRAVIA is an Android application that, like the applications mentioned above, allows users to choose which of their personal applications can forward the alert to the TV set, as well as to change the privacy settings (between basic and advanced). If they are on the same wi-fi network as the television, a pairing between the smartphone and the Sony TV can be done and notifications can be forward from the smartphone to the TV set.

As differentiating factors, this application allows users to view the history of the notifications received by TV and all people on the same Wi-Fi network can connect to it, creating multiple connections [14].

The Smartly Project

The Smartly project is a partnership between Aveiro University and Altice Labs, aiming to create a set of tools capable of promoting television ads consumption, thought the use of mobile devices.

To promote this, it offers a feature that allows the user to receive a notification, while watching TV, to install a mobile application. After installing and signing to the application, whenever a user has the TV tuned on the channel that shows an enriched ad, the notification is displayed and the user will receive a notification on the mobile application with an offer related to the television content (the ad).

To create this ecosystem, it was necessary to develop a network between a set of components, such as: Content Recognition Engine, MEO Infrastructure (MEO is the IPTV service from Altice Labs), Smartly application, Smartly Database and Smartly TV application. These components and their connections are represented through the Smartly system architecture diagram (see Fig. 1).

2.1 General Architecture

The system architecture comprises multiple parts. The “backend” part uses a couple of API’s to allow to manage notifications in the Smartly database and in the Smartly mobile application. This “backend” part is also responsible for checking the necessary requirements for receiving a notification (through Engine Content Recognition and MEO Infrastructure) and to display it in the television (through Smartly TV application).

In the “frontend” part a web interface for the backend management (Smartly Web interface) and a mobile application (Smartly mobile application) where user can see and manage his coupons were developed.

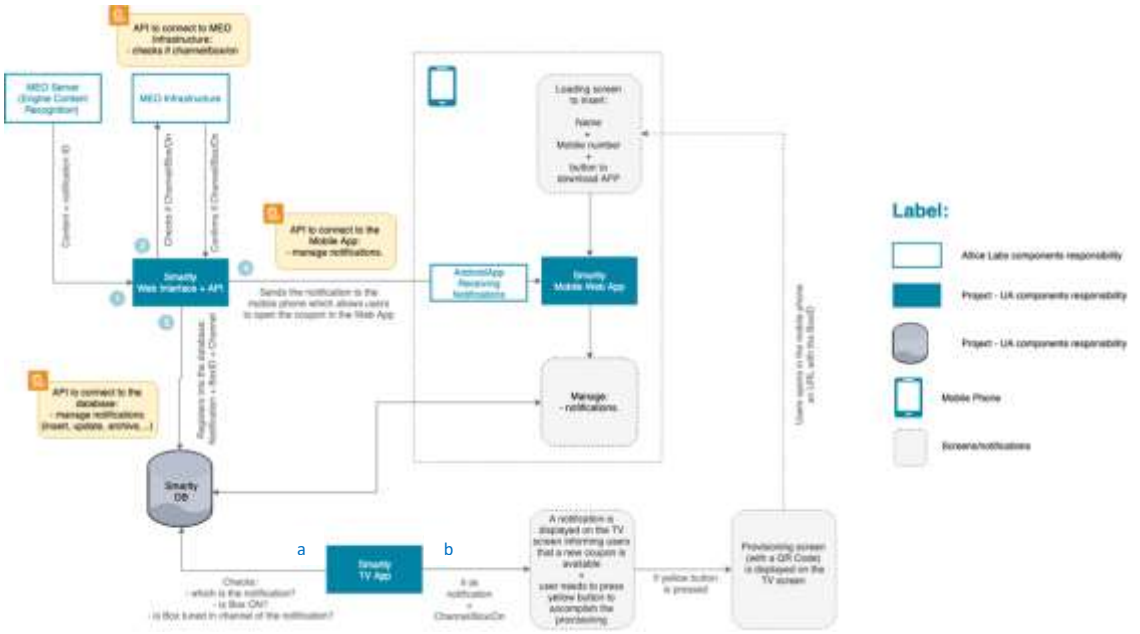

Fig. 1. Smartly System Architecture.

The whole notification process comprises different steps that are shown in Fig. 1 and described here.

1. The Content Recognition Engine constantly analyses if the transmitted content has associated coupons. When the system detects that is being transmitted content, for which there are associated coupons, a notification is sent to the Web interface API, and the next steps are triggered;
2. In the MEO Infrastructure it is checked if the boxes are active and, if so, if they are tuned in the channel where the content is being broadcasted;
3. If the box is active and is tuned to the channel where the content is being broadcasted, this information is communicated back to the API Web Interface that inserts, into the database, information about the notification, the Box ID and the channel;
4. A notification is sent to the smartphone allowing users to open the coupon in Smartly Mobile App;

The Smartly TV App will make regular requests to the database to check if there are new notifications to show (a). After detecting that exists a new notification, a message appears on the television screen indicating the existence of a new offer and informs the user that is necessary to press the yellow button on the remote to perform the provisioning (b). Provisioning is the procedure that associates mobile phones to a specific set-top box (STB). This procedure is only necessary in the first use or when the user wants to associate a smartphone with a STB (it is possible to have one smartphone associated to *n* STB). After completing the provisioning, the coupons will be automatically sent to all of associated smartphones.

If the yellow button is pressed (on the remote of the STB), the provisioning screen appears with a QR Code, which redirects the user (through a URL with the Box ID) to an interface requiring:

1. The name of the user;
2. The mobile number;
3. Download the application.

In the second step, when the user enters his mobile number and clicks "Next", the database is updated, in order to associate the mobile number with the previously registered Box ID. Following the installation, the user is presented with a welcome screen and is required to authorize the necessary permissions for its full operation, namely the access to the mobile number. This permission will register the users to receive notifications, because is necessary to check in the database which Box ID is

associated with that specific mobile device. Smartly Mobile App allows the user to not only view their coupons, but also manage the notifications.

The Web Interface API, the Mobile App and the TV App interact with the Smartly database, either to save user information, boxes and mobile numbers, as well as user management (mobile number, Box ID, notifications, categories, etc.), notifications and relationships between users and notifications. It should be noted that notifications sent to users' smartphones are always made according to their customized preferences.

2.2 The Mobile Application

The Smartly mobile application allows users to manage their coupons and preferences. Fig. 2 depicts an overview of the main screens of the application, where four menu sections are visible: "Home", "Coupons", "Help" and "Definitions".

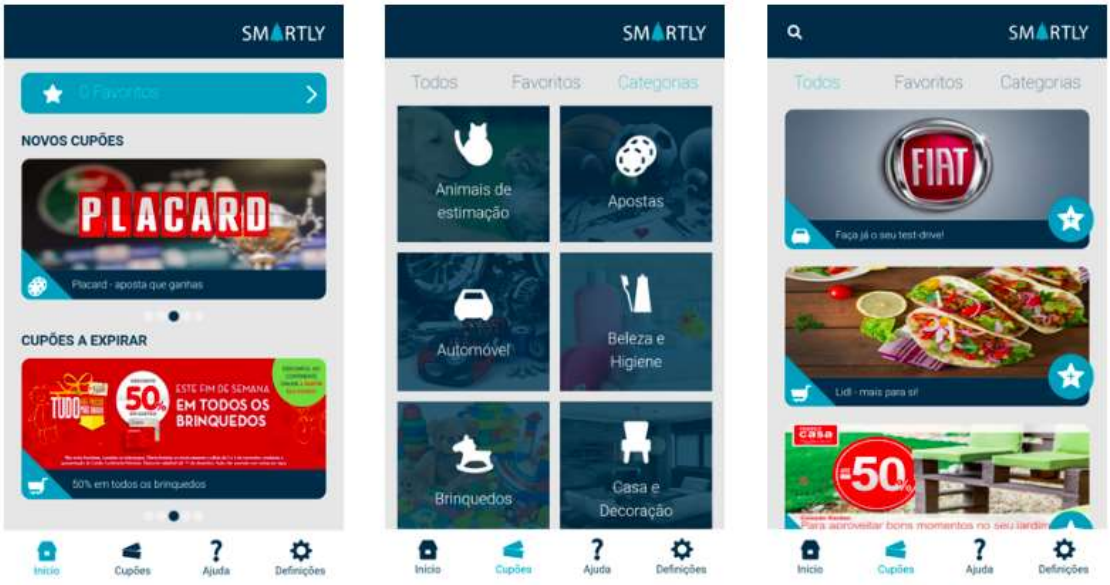

Fig. 2. Smartly Mobile App

The "Home" (Início) screen is the application landing page and shows the new coupons, the expired ones and the number of favorite coupons the user has.

When the user chooses the "Coupons" (Cupões) menu item he has access to the "Categories" (Categorias) page, where the coupons are listed by categories where the user has the possibility to search for a specific coupon using the search box on the top of the screen. He can also add or remove a coupon from the favorites or simply see more details about it.

In the "Help" (Ajuda) menu item the user will find the application tutorial. In the "Definitions" (Definições) menu item the user can choose from which categories he wants to receive notifications, manage the Set-top boxes he is linked to, turn on/off notifications and see the privacy policy.

Fig. 3. Smartly Mobile App

3 Evaluation Methodology

Aiming to provide users a rich experience in this ecosystem, it is mandatory to test solutions with the target audience. This can be achieved through tests that consider user experience (UX) and interface design. Several UX definitions are available but [15] they as being associated with the experience and interactivity between the user and a technological device, in other words, are the perceptions and responses that emerge from the interaction between an individual and a technological device during product, system or service usage. It becomes difficult to define this concept, since there are several perspectives on it. However, this is a consequence of three variables: the user's way of thinking and acting; how the system was developed; and the context in which it was experienced [16]. As for interaction design, according to [17], it covers four main practices: identifying needs and establishing requirements; develop alternative design to meet certain requirements; build interactive versions of the design developed so they can be communicated and benchmarked; and to evaluate what was developed during the process.

The user experience (UX) is still a difficult concept to define because it is associated with diffuse and dynamic concepts: emotional, affective and aesthetic variables. The UX analysis is also very versatile because it can focus on an individual interaction between the user and the application or on multiple interactions of countless users with one or several services [18]. In addition to the definition of UX it is also important to identify the evaluation methods of this concept. [19] emphasizes that if the evaluated product has already been available to users a few months ago allows a better evaluation of the product by them since they have already had the opportunity to try it. On the other hand, when evaluating a prototype, especially on paper, it becomes more difficult to provide the actual context in which the product is inserted to the user. However, sooner UX is evaluated in a product or service, more successful it will be since errors and constraints arising from user feedback can be bypassed in earlier stages, which will be noticeable to users later in use of the product in the daily basis [20].

The methodology used in the Smartly application tests can be divided into four phases (Fig. 4).

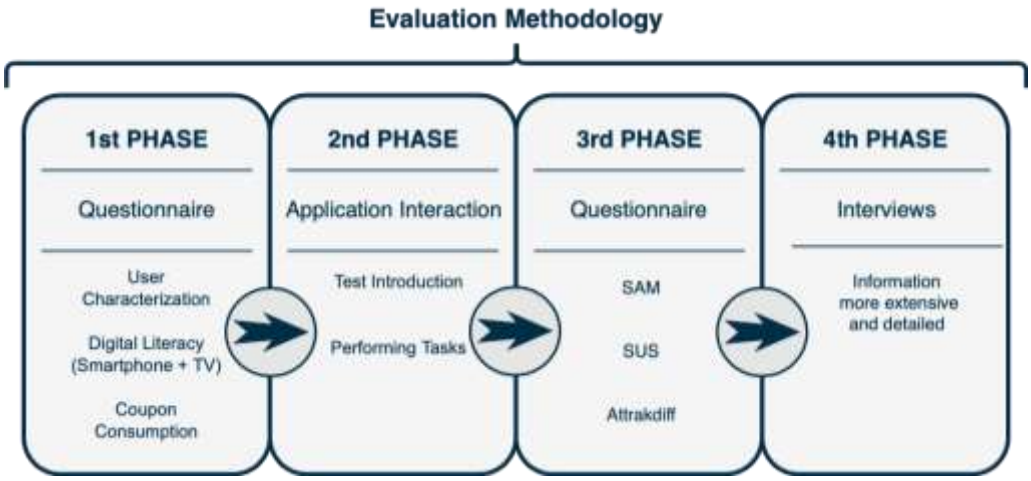

Fig. 4. Evaluation methodology

In the first phase, the participant characterization was made using a questionnaire based survey, allowing researchers to organize and assemble data faster and more rigorously. In this survey, the user was questioned through multiple-choice questions (with single and multiple answers) and open-ended questions about the personal information (gender, age, literacy, etc.), digital literacy as well as television and smartphone usage habits (including the use of digital discount coupons).

The second phase included a short introduction about the Smartly project and then the user is invited to watch TV while interacting with the mobile application. Researchers asked participants to perform thirteen specific tasks in the Smartly mobile application while watching a TV video that simulates the TV broadcast (the video includes news programs and commercial breaks where a notification informing that a new coupon is available appears).

After finishing the interaction, the third phase of the methodology was started, in which the user must fill out a new questionnaire survey to evaluate the UX/UI.

Finally, the fourth phase of this methodology included an interview to obtain information about user overall impressions.

In the case of Smartly, to evaluate the user experience a Self-Assessment Manikin (SAM) scale was used. SAM helps to analyze the user's emotional reactions, such as pleasure, arousal, and dominance over the application [21]. The SAM scale is based in three diagrams in which the first measures the level of satisfaction between happy and sad, the second measures the motivation from excited/enthusiastic to calm/boring, and the third measures submissive to powerful control. The fact that the range of possibilities varies between opposite feelings allows users to state the level of intensity over each emotion as well as to see whether it has been positive, negative or neutral.

In order to put into practice this methodology and the mentioned scales, the tests occurred in a controlled environment – a laboratory. This gives the researchers the opportunity to be with the participants in an isolated and uninterrupted moment, thus controlling the influence of the context. Frequently, in these moments, a direct observation is carried out allowing the researchers to pay attention to the individual's interaction with the system. To achieve this there are several techniques: think aloud, cooperative evaluation, protocol analysis and post-talk walkthroughs [19]. In this case, the analysis protocol is characterized by various forms of recording the users' actions: i) pencil and paper; ii) audio recording to follow the think aloud; iii) video recording to perceive the users' behavior with the application; and iv) recording of data/problems/notes of what is going on throughout the test. Users were asked to comment their experience with the system after the interaction but with the opportunity to resume the use of the application while they were being questioned by the researchers about the application. This method, called Post-talk walkthroughs, is used when the tasks requested by the researchers are demanding and do not allow verbalization at the moment of interaction by the user, like in the case of this work [19]. registration

4 Results Analysis

After completing the tests with the users, data from both questionnaire and interviews was analyzed.

4.1 Interviews

Regarding the interviews and the method of post-talk walkthroughs used, to achieve reliable qualitative data it was essential to have the notes collected by the researchers as well as audio and video recording. Considering that, some of the user's common feedback were related to: i) the interaction with the coupons ("The auto play of the carousels does not allow full control and the transitions are too slow.", "The information on each coupon has too many clickable steps. This becomes annoying and, in addition, the information becomes redundant."); ii) the way coupons search is done ("Why is there only the possibility of searching in the "all" coupons tab? I would like to be able to search in the entire menu for coupons.", "It would make more sense that within each category the coupons were listed as in the "all" coupon tab. It would be more consistent, and it would be easier and quicker to find a specific coupon."); iii) the textual and visual feedback provided by the application ("I think the coupon validation date is missing at the home menu. For me that is an essential piece of information.", "I realized which was the bookmarks button and how to use it, and I was not surprised by the plus or minus symbol, despite being accustomed with the state color differentiation.").

Some of the comments mentioned in the previous paragraph were already expected by the researchers, but others, such as the coupon expiration date always visible in the application were not. Although it can be an obvious aspect, it was not implemented at this early stage by the researchers. The ability to allow the user to choose, in each category, how he wants to view coupons - list or carousel - is important to maintain application consistency and be easier and more practical for users.

As a result of the tests, there are some features or aesthetic problems referred by most of the participants. Concerning the application, it was referred that "It made me a lot of confusion open the coupons menu and the selected tab was not the left one. I think the tab name order should be changed to 'Categories - All - Favorites'". Users' also suggested new features, such as "It should not just be the television to call my attention to the smartphone, but the smartphone could also notify me for TV content which will give me some kind of advantage". It was also referred that "If the system has the possibility to understand which users are using more the application and the coupons, it would be important to be able to categorize the type of customer (beginner, professional, etc.). That would motivate users to increase their application use" and "It would be great if the application could take advantage of geolocation and when I was in a certain place, according to my location, it will suggest me to use some coupon.".

4.2 Questionnaire

The SAM questionnaire allowed to measure the user's emotional responses in the interaction with the application. There were measured three factors with the 5-point rating scale version: satisfaction (1 - low satisfaction, 5 - high satisfaction), arousal (1 - low motivation, 5 - high motivation) and dominance (1 - low control, 5 - high control) [22]. The results in the test were: satisfaction = 4.23; arousal = 3.64; and dominance = 4.63. Considering this, it was noticeable that the feedback and the results of the SAM depicts a general satisfaction of the users, although the motivation could be greater (that's why several extra functionalities were proposed). Regarding control, the obtained value was positive and the users feedback showed that in most features the user felt confident and with control of the action, even though there are some improvements to be made.

5 Conclusions

With the increasing adoption of second-screen devices as complementary applications while users are watching TV, the importance of finding solutions that can balance user attention between two or more screens becomes even more relevant. The Smartly application proposes a distribution scheme of discount coupons that follows this issue. The tests results show that, in overall, the Smartly Mobile application is intuitive and easy to handle. It is also possible to verify that most of the users (considering the sample of our tests) have experience with applications with similar interaction paradigms, making the learning process and perception and the comprehension of each functionality easier.

Some aspects were referred to as less positive by participants, but when asked about suggestions to solve them, they could not tell exactly how to do it.

In short, it is possible to conclude that the work done so far was appreciated by most of the participants in this study, but there are improvements to be made to enhance the potential of the application as well as the effective and efficient complementarity between television and other devices.

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O Uso do Verbete Indivíduo como Alternativa às Limitações do Termo Usuário

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Abstract. The purpose of this article is to discuss the different ways of using the term user and to suggest the replacement by the term individual. The word user is widely used in computing, library science, and communication, meaning a person using a technology, or a digital system. However, this notion of use becomes problematic in the context of media fruition, where the reception of information cannot be characterized as simple use by a user. In technological convergence, which unifies distinct areas such as interaction, production, and reception of content, people's relationship with technologies that mediate fruition becomes more complex than someone using a computer. To achieve the objective of this study, a narrative review was conducted in the scientific literature about the study of the term user and its evolution, uses and suggestions of new entries for the same purpose. The word that best describes a person using digital systems, interactive or otherwise, has been found to be "individual".

Keywords: User, Individual, Computing, Media Fruition, Evolution.

1 Introdução

No campo de estudos da Interação Humano Computador (IHC), considerar "humanos" ao invés do termo genérico "usuário" tem sido uma discussão bastante profícua nos últimos anos [1]. Considera-se que o termo usuário é limitado e não expressa plenamente todos os aspectos inerentes à interação com sistemas digitais. Já nos estudos sobre a mídia, que contempla estudos de audiência e recepção, outros termos, como audiência, telespectador, ouvinte, internauta ou leitor, predominam para definir o receptor da informação. Desconsidera-se, por exemplo, que o "leitor" de um jornal digital o acessa pela internet, representando também o papel de internauta e de usuário. Ao assistir um vídeo inserido no jornal textual, a pessoa assume um papel de "telespectadora".

Em função dessa confusão semântica, há uma tendência na área da Comunicação e Informação para generalizar o termo usuário quando se refere ao uso e à fruição de conteúdos e sistemas digitais. Desconsidera-se, dessa forma, que o público de um

produto midiático é composto por pessoas com repertórios, gostos e necessidades distintos. Isso implica desconsiderar, inclusive, que o comportamento da audiência está condicionado pelos contextos tanto exteriores quanto intrínsecos a cada indivíduo. Por um lado, uma pessoa assistindo a um programa de TV não pode ser considerada usuária; por outro, uma pessoa navegando por uma lista de programas na smart TV para escolher qual programa assistir, não é um simples telespectador.

Essa aparente desassociação de termos se torna ainda mais confusa quando discussões relacionadas ao software e às interfaces de interação passam a fazer parte do universo da Comunicação, servindo de base para a produção, distribuição, acesso e fruição das informações. A mesma relação pode ser aplicada ao campo da IHC, quando esta começa a incluir conceitos relacionados ao conteúdo durante o desenvolvimento do software. Por exemplo, sistemas multimídia são direcionados a pessoas que, possivelmente, vão interagir de diferentes formas, com atribuições de significados variados. Mesmo como usuários do sistema, o percurso entre os diferentes caminhos midiáticos implica uma multiplicidade de usos, o que o termo usuário acaba por planificar.

Este artigo investiga essa lacuna de terminologias, as origens do termo usuários e sua problemática aplicação para explicar a fruição de conteúdos neste ambiente totalmente interdisciplinar, que congrega áreas antes distintas, como IHC e estudos de recepção. Como resultado, sugere a adoção do termo "indivíduo", que, a partir de uma análise sociológica, parece explicar melhor o processo atual da relação entre pessoas, tecnologias e conteúdos.

2 Origens e Evolução do Termo Usuário

Para entender melhor o mecanismo usado na aplicação do termo usuário e suas potencialidades, ou problemas, observamos estudos científicos que mostram as diversas áreas que utilizam dessa palavra e se ela é enquadrada na Comunicação. De acordo com o dicionário do idioma Português Priberam, usuário é toda pessoa que faz uso do computador, de programas, sistemas ou serviços informáticos [2]. Todavia, baseando-se na revisão narrativa da literatura realizada para este artigo, o termo também é bastante usado para definir uma pessoa que utiliza o serviço de uma biblioteca. Dois dos principais materiais encontrados durante a pesquisa focam em estudo desse tipo de usuário [3,8].

Usuário vem do Inglês *user*. Neste idioma e no Português, o verbete tem como um dos primeiros referentes a pessoa que usa um computador. Tanto os sistemas baseados em linha de comando, com início ainda na década de 1960 (Figura 1), quantos os sistemas baseados em interfaces gráficas, como Macintosh (Figura 2) e Windows (Figura 3), na década de 1980, incorporaram o termo para designar diferentes pessoas usando, de modo compartilhado e alternado, o mesmo computador – garantindo, assim, certa individualidade de ordem técnica (cada sessão de usuário carrega o software que lhe é adequado) ou de ordem pessoal (conjunto de configurações estéticas e de usabilidade). Em todos os casos, um login é necessário para identificar a pessoa diante do computador, que se adapta em função do perfil e configuração preexistentes.

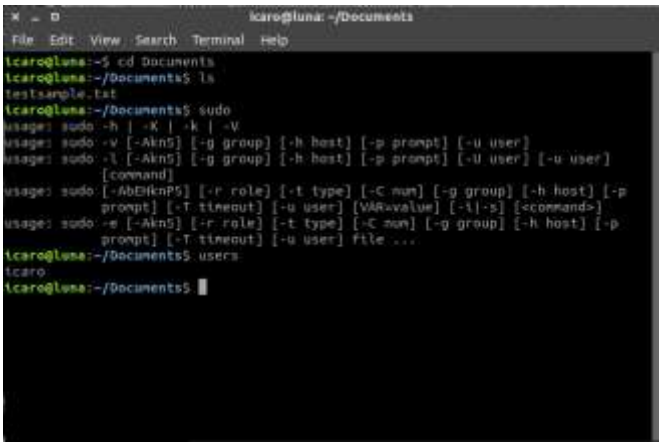

Fig. 1. Terminal Linux que mostra o usuário do computador

Historicamente, o termo usuário foi disseminado ainda na década de 1940. Os primeiros estudos do usuário foram iniciados na Conferência de Informação Científica da Royal Society, em 1948, após a apresentação de trabalhos que instigaram a preocupação com as necessidades do usuário [4].

Fig. 2. Tela de login Mac

Já no campo dos estudos midiáticos, o termo passou a fazer parte da terminologia da área quando estudos relacionados à transição analógico digital ficaram comuns [1]. Com a popularização das aplicações multimídia, carregadas em computadores pessoais com interface gráfica e, posteriormente, pela WWW, a palavra passou a

compor o senso comum da área, se referindo a qualquer pessoa usando um computador ou interagindo em redes digitais, aplicativos ou websites (neste caso, "usuário" passou a ser utilizado como complemento ou sinônimo de internauta). Em 2010 foi publicada a Enciclopédia INTERCOM de Comunicação, que no Primeiro Volume, Dicionário Brasileiro do Conhecimento Comunicacional - Conceitos (termos, expressões e referências indispensáveis ao estudo da área) [5], apresenta 1097 verbetes, produzidos por 499 autores. O termo usuário é mencionado no documento todo 78 vezes, para explicar verbetes como blogosfera, download, jornalismo digital, videogame, entre outros. No entanto, além de não ser definido como verbete do dicionário, nenhuma menção ao termo usuário traz qualquer definição.

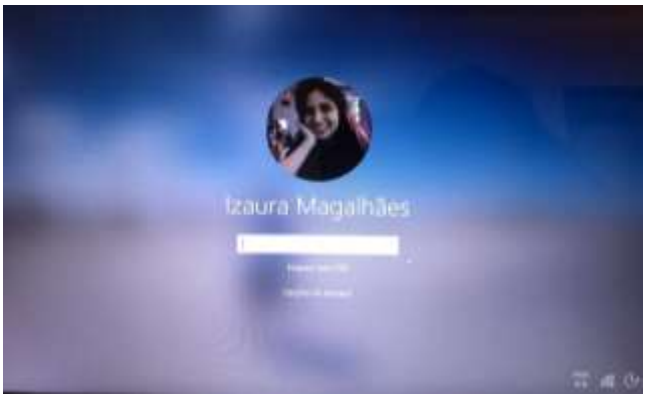

Fig. 3. Tela de login Windows

3 Usos e Críticas

Depois de uma intensa análise dos trabalhos científicos e da literatura correspondente, constatam-se lacunas de informação e de levantamentos acerca do assunto, principalmente quando se trata do uso e significados do termo dentro da computação e da comunicação [1]. No total, foram analisados 11 textos a partir de buscas realizadas a partir das palavras-chave "usuário", "computador", "usuário na computação", "história do usuário" e as respectivas versões em inglês.

Mesmo com a abrangência da pesquisa, um número reduzido de materiais foi encontrado. Todavia, ao expandir a análise para outras áreas, como sistemas de informação, biblioteconomia e indústria farmacêutica, constata-se que é uma área relativamente bem pesquisada. Em sua maior parte, os estudos mais completos sobre o comportamento, a necessidade e o modo de uso dos usuários estão focados na área da biblioteconomia. Ademais, apesar da quantidade de pesquisas atuais, temos o problema de que boa parte dos materiais que abordam de uma forma abrangente e histórica o estudo do usuário são um tanto quanto antigos.

3.1 Críticas ao termo

Na área da comunicação, onde o software passa a fazer parte da experiência da recepção, os estudos sobre a terminologia adotada são limitados. A ideia de uma audiência passiva, comum nas teorias clássicas da comunicação, que recebe as mensagens e reage de forma limitada, mesmo que produzindo e agregando conteúdo, continua predominando nas análises da área. Outros autores têm adotado o termo usuário sem questionar seu alcance e implicações.

"Não é surpresa que trate aqueles que usam a tecnologia apenas como usuários" [6]. Para o autor, o uso desse vocábulo em âmbitos computacionais vem causando uma confusão, dado o fato de que o "usuário" apresentado dessa forma é meramente um consumidor. A introdução da palavra interator, proposta por Janet Murray [7] na década de 1990, vem com o intuito de trazer algo à mais para o papel exercido pela pessoa que experimenta um software, por exemplo, visando que ela não vai necessariamente somente utilizar o que está pronto, podendo também acrescentar, melhorar e empregar novas funções para certos produtos e/ou sistemas [6].

Já [8], partindo de uma visão mais voltada à biblioteconomia, faz um contraponto à utilização do termo usuário, repensando-o em diferentes áreas do conhecimento. Apoiando-se em um pensamento de Alex Primo, citado anteriormente, sugere que o termo usuário conota um alguém sempre à mercê de um ser superior, promovendo assim a apresentação do termo interagente, oriundo da ideia de interação. A autora, então, apresenta uma análise da palavra interação, com o intuito de mostrar o quão empregado já era este vocábulo, expondo que 50% do total de artigos publicados sobre estudo do usuário de 1970 até 2014 possuem a menção do termo interação (Tabela 1).

Table 1. Artigos publicados sobre Estudo de Usuário (BRAPCI). Fonte: [8]

Período	Artigos	Menções 'interação'
1970-1979	04	01
1980-1989	08	03
1990-1999	03	01
2000-2009	37	19
2010-2014	28	15
Total	**80**	**39**

É notório o maior uso da palavra de acordo com o passar dos anos. Isso se deve à maior atenção dada ao assunto, além do surgimento de algumas áreas como, por exemplo, a Interação Humano Computador (IHC), que após a sua disseminação em diversas áreas, promoveu, a partir da década de 1980, um novo olhar para a importância de priorizar a experiência dos usuários, principalmente nos campos da computação e desenvolvimento de software.

4 Limitações com a Interatividade

As discussões referentes à interatividade trouxeram o termo usuário para a Comunicação, especialmente no que tange aos Estudos Midiáticos. Junto com a interatividade, o software também passou a fazer parte das análises, por ser responsável pela interação, tanto em sistemas simplesmente computacionais, quanto na televisão digital ou nos aplicativos móveis [9]. Na área do rádio, os primeiros estudos a mencionar um "ouvinte-usuário" são dos anos 1990, remetendo a usina do som e softwares para computadores baseados em serviços de sites [10]. O conceito trazido pela interatividade propõe uma nova configuração no processo da comunicação, na qual existe uma ação entre duas partes, que irá promover um favorecimento da participação dos interlocutores e a intervenção de todos os envolvidos [8].

A interatividade, portanto, proporciona a possibilidade de troca de informação, por exemplo, entre um software e quem está "do outro lado da tela". As informações são passadas para esse "usuário" por meio de um acréscimo de dados e de uma interação feita entre o humano e o computador. Outro exemplo de interação é um chat de ajuda, existente em diversos sites de compra. Nessa situação, a pessoa não está apesar utilizando um sistema, mas também está gerando dados para receber informações.

Outra análise pode ser feita ao expandirmos o raciocínio para a TV Digital ou sistemas de vídeo sob demanda, onde o "telespectador" usa o controle remoto, ou um teclado, para buscar informações interagindo com um software. A limitação do conceito usuário se torna evidente quando o resultado da interação não é uma ação a ser executada por um software, ou uma resposta esperada por uma pessoa. Caso o resultado da interação seja um produto midiático a ser consumido no próprio sistema, há uma substituição de status da pessoa. Consideremos um cenário: a pessoa chega em casa, liga a TV, abre o aplicativo da Netflix, navega pelas seções, busca por um filme, não o encontra, e decide assistir um episódio de série. Escolhe a série e aperta Assistir. Até aqui o comportamento foi típico da descrição do termo usuário. No entanto, quando o episódio da série começa, a pessoa deixa de "usar" um sistema computacional para simplesmente assistir. Ou seja, ela agora é uma espectadora da obra.

Raciocínio similar pode ser feito sob a ótica dos Estudos de Mídia. A pessoa, ao ligar a TV e assistir um determinado canal, pode ser classificada como telespectadora. No entanto, a partir do momento em que ela abre um Guia Eletrônico de Programação na TV Digital para consultar a sinopse de um filme, e decide abrir o aplicativo da Netflix, instalado na SmarTV, ela passa a usar o sistema computacional, substituindo o ato de assistir a uma determinada obra por outra. Além disso, quando a continuidade da fruição depende da ação dessa pessoa – como no caso do filme da Netflix – ela está constantemente mesclando os dois status. Neste ponto é importante destacar que a escolha da peça a ser assistida, e a disposição para interagir com o sistema em busca de um programa, são alimentadas por processos de identificação: gostos e inclinações pessoais tendem a ser fatores importantes nessa dinâmica, e o termo usuário não contempla nenhum dos dois.

Essas limitações se aplicam também aos termos interator e interagente, que não compreendem a alternância de papéis de quem está recebendo a informação. Ambos os termos tendem a uma tendência de sobrevalorização dos momentos de ação, onde

há interação através de interfaces de hardware e software, em detrimento dos processos que levam à escolha e dos momentos de fruição passiva, sem interação. Independentemente da ótica, se Computação ou Comunicação, o objetivo de assistir a um filme, para manter o exemplo, é a mesma: momentos de relaxamento e entretenimento, elencados pelo viés do gosto. Ou seja, uma experiência agradável. Nenhum dos termos discutidos dá conta de classificar ou explicar essa experiência física, emocional e psicológica. Além disso, se considerarmos sistemas multimídia, tal defasagem do termo se agrava ainda mais, pois as escolhas individuais devem ser compreendidas, também, como instâncias de fortalecimento identitário a partir do consumo cultural.

O avanço dos estudos dos usuários proporciona uma nova perspectiva sobre com quem estamos trabalhando, fazendo com que tenhamos uma interpretação mais clara e ampla de quem são essas pessoas, quais são as suas necessidades e o que lhes agrada. Esse fato deve-se, como já dito anteriormente, à IHC, que vem provando a importância e as vantagens que pensar e se adequar às necessidades do ser humano trazem para um produto e para uma empresa. Propostas, como a do Design Centrado no Humano, expandem a visão de usuário para uma experiência que engloba, além da eficácia e eficiência, a satisfação e a melhora o bem-estar humano, a acessibilidade e a sustentabilidade; e busca neutralizar possíveis efeitos adversos do uso da tecnologia na saúde humana [11].

5 Conceito e aplicação do termo Indivíduo

De um modo geral, diferentes correntes sociológicas valeram-se do termo indivíduo para definir o "homem racional". A expansão dos centros urbanos nos séculos XVIII e XIX, especialmente em virtude da industrialização crescente, trouxe a necessidade de estudos que explicassem os novos formatos sociais que estavam então surgindo. Em muitos desses estudos, como critica Jesus Martin-Barbero, o indivíduo é tratado, então, como parte de uma "massa" indistinta, para a qual os significados culturais são atribuídos e formatados apenas em conjunto [12].

Somente na primeira metade do século XX, especialmente com teorias como a psicanálise e a psicologia, o indivíduo passa a ter renovada importância nas Ciências Sociais. Apesar de a noção de "massa" prevalecer forte no estudo dos meios de comunicação, especialmente sobre o rádio num primeiro momento, e depois sobre a TV, ela se torna insuficiente para compreender as dinâmicas que levam pessoas de territórios e culturas distintos a agirem de forma semelhante. As diferenças inerentes a cada esfera social passam a importar em ramos da Sociologia, e noções como as de agência e negociações [13] se tornam fundamentais para compreender a dinâmica da cultura através da história.

Essa evolução dos estudos acompanha, inclusive, mudanças sociais que foram determinadas pela organização política e econômica do mundo após a segunda grande guerra. Setores marginais da sociedade passam a ganhar relevância, sobretudo econômica e cultural. Exemplos podem ser encontrados especialmente nos anos 1960: movimentos de liberdade sexual, a maior expressividade do feminismo, a intensificação do debate racial, demarcam mudanças em várias partes do globo, e um deslocamento de sentidos promovido em uma suposta pós-modernidade [14,15]. É

possível identificar, inclusive, a emergência de contraculturas, isto é, movimentos que dentro de contextos específicos questionam a mídia hegemônica, ligada ao mercado, e influenciam sobremaneira a vida em sociedade [16]. Não obstante, essas mesmas subculturas são, mais tarde, absorvidas pelo próprio mercado e estendidas como novas formas de consumo [17].

Desse movimento, entretanto, destaca-se a formação de um imaginário em torno da autonomia individual. O sentido de "liberdade" é reconstruído dentro da lógica social, cultural e mercadológica que domina esse momento do desenvolvimento social. Tanto os estudos sociais como as campanhas de marketing passam a elaborar a pessoa como um indivíduo único, coeso [18-20].

Essa noção de individualização é, em parte, resultado da reorganização promovida pela globalização econômica e mundialização cultural. O universal se transforma em um valor da era moderna, em que barreiras não eram bem-vindas – pelo menos, do ponto de vista da circulação monetária, de commodities e de informações [18]. Noções como "aldeia global" se tornam dominantes nos discursos midiáticos. Essa aproximação, entretanto, implicou também a valorização das caraterísticas locais. Enquanto na formação dos centros urbanos, no final do século 19, os Estados-nação forneceram formas simples e coesas de identidade, geridas política e midiaticamente com a chancela dos poderes locais [19], no novo momento, que se intensifica no quarto final do século XX, essa coesão começa a se dissipar em função do fluxo de informação cada vez mais acelerado.

A fragmentação cultural e as possibilidades múltiplas que o indivíduo tem de se construir e se mostrar diante do outro, enfatizadas pelas lógicas econômicas no século 20, se tornam elementos de distinção, seja de posição social, seja de formação cultural [21]. A oferta de produtos – físicos ou simbólicos – se torna tão diversa que a estratégia das pessoas é acentuar sua individuação, por meio da escolha dos produtos que usa, das marcas que ostenta, dos produtos culturais (filmes, músicas, séries de TV, quadrinhos) que consome [22]. Não se trata de uma diferença completa: existe certa padronização dos produtos oferecidos, mas sem chegar a ser uma regra geral que torne tudo exatamente igual. Essas pequenas diferenças permitem que algumas indústrias passem de uma lógica de high volume, isto é, vender muito e constantemente, para uma lógica de high value, em que o custo de produção mais alto, em função da tentativa de criar uma impressão de personalização, é amortizado pelo maior valor do produto; o este, é justificado no lado do consumidor pelos valores simbólicos que acrescenta [23].

O auge da intensificação da busca pela individualidade, podemos afirmar, tem início ainda nos anos 1990. Com a multiplicação das ferramentas de comunicação, a informação também se fragmenta, se atomiza, e se torna mais um componente dentro desse conjunto de pedaços que o sujeito usa para compor sua identidade.

A modernidade tardia passa a ostentar então, como valor, a diversidade dentro de um universalismo, que é global. Segundo Renato Ortiz, esse oxímoro é bastante característico do fenômeno que ocorre atualmente [18]. A ideia de pertencimento a algo maior e complexo não é dada por uma série de símbolos coesos, como aqueles fornecidos pelos nacionalismos da primeira metade do século 20, e sim por uma montagem de fragmentos que é inerente a cada indivíduo. Cabe nesse pacote tanto movimentos nacionalistas, como aqueles da ordem do consumo de produtos físicos e de consumo cultural, que indicam um determinado "estilo de vida". Ocorre, então,

que a "montagem" de uma identidade, com esses fragmentos, deve também corresponder à efemeridade do cotidiano, à transitoriedade que permita ao indivíduo uma sensação de pertencimento a vários grupos sociais ao mesmo tempo, mesmo que por uma curta duração.

Esse, pelo menos, é o imaginário que domina o século 21, e não se trata de elogiá-lo ou criticá-lo. O que pretendemos com esta breve exposição é demarcar que esses são os valores sociais presentes, com os quais o produtor audiovisual deve lidar. O resultado que se apresenta, portanto, é uma infinidade de ligações que as pessoas podem empreender entre elas, e entre elas e o mundo, em busca da composição de uma identidade que é, ao mesmo tempo, única e compartilhada. Ao mesmo tempo, as pessoas precisam lidar com a, cada vez mais presente, sensação de anonimato, uma função da ampliação do contato com uma multidão imediatamente conectada via mídias sociais. É preciso destacar, ainda, que existe uma sensação de autonomia nas escolhas realizadas pelos indivíduos, mesmo que impulsionadas por ferramentas do marketing, e essa sensação é, na maior parte das vezes, muito mais fundamental do que a identidade única e construída a partir de escolhas totalmente livres.

A popularização da web acrescenta ferramentas que acentuam o sentimento – e a necessidade – de fragmentação e de individualização [19, 24]. Dois processos paralelos ocorrem aqui, especialmente em virtude do uso que as pessoas aplicam às ferramentas digitais para o compartilhamento de conteúdo. Em primeiro lugar, o indivíduo idealiza uma identidade com a qual trabalha em rede, que pode ser mais ou menos fiel ao que realmente ela é em outras esferas [24]. É, contudo, a busca e a expressão de um self relativamente coerente. É a construção de uma narrativa pessoal em rede que tem como objeto uma representação diante do outro que está ao mesmo tempo próximo e distante, e cujo objetivo é comunicar, por meio de ações, algo sobre si mesmo. O segundo processo é o modo como o software interpreta o conjunto de dados disponibilizados pelo indivíduo ao utilizar as ferramentas digitais. Há um conjunto de relações que podem ser trabalhadas e, para fidelizar essa pessoa como utilizadora de um determinado sistema, as respostas devem também ser mais ou menos coerentes com o perfil que o sujeito projeta de si mesmo. Mais ou menos, porque esses processos tecnológicos também representam os interesses da firma que está usando os dados coletados.

Três pontos devem ser destacados, à guisa de conclusão prévia. Primeiro, o zeitgeist contemporâneo implica a sensação de autonomia, liberdade e individuação, refletidos na escolha dos produtos e comportamentos que o indivíduo toma para si, mesmo que estes sempre se realizem dentro de padrões. Segundo, a facilidade de circulação de informação, fruto da instituição da mídia como estrutura social e cultural contemporânea, oferece ao indivíduo uma miríade de possibilidades que ele utiliza para construir um perfil e uma narrativa suas na rede social. Terceiro, ele espera em resposta que os mecanismos tecnológicos que utilizam seus dados lhe devolva processos que valorizem a experiência, abrindo assim um novo campo da economia.

6 Considerações Finais

Este artigo discutiu o uso e a aplicação do termo usuário e sugere a sua substituição pelo termo Indivíduo. A palavra usuário é amplamente usada em computação, biblioteconomia e comunicação, significando uma pessoa que usa uma tecnologia ou um sistema digital. No entanto, essa noção de uso se torna problemática no contexto da fruição midiática, onde a recepção de informações não pode ser caracterizada pela relação simplista de uso por um usuário. Na convergência tecnológica, que unifica áreas distintas como interação, produção e recepção de conteúdo, o relacionamento das pessoas com tecnologias que mediam a fruição torna-se mais complexo do que essa relação de uso. A partir de uma revisão narrativa na literatura científica, percebeu-se que as críticas ao termo são variadas e consistentes.

Dessa forma, o presente artigo sugere que palavra indivíduo descreve de forma mais adequada uma pessoa que usa sistemas digitais, midiáticos ou não. O termo indivíduo se apresenta como uma solução viável para compreendermos o papel que cada pessoa assume no consumo audiovisual desenhado dentro da lógica da interatividade. Entre os pontos que colaboram para tanto, encontramos o vasto referencial dos Estudos Culturais em discutir os processos de identidade. A identificação que as pessoas processam em contato com os produtos consumíveis - sejam eles físicos ou não - são parte de um processo de individualização do consumo. No caso do rádio e da televisão, por exemplo, Raymond Williams já identificava, nos anos 1970, o aprofundamento de uma "privatização móvel" dada pelos contextos de fruição dessas produções [17].

Mesmo que seja importante discutir como o processo de individualização de consumo impacta a organização social e sua mobilização, é relevante o papel que as apropriações culturais de bens, dadas de modo relativamente independente e individual, têm na construção do self. Corresponder a produção audiovisual a anseios de uma pessoa, que quer se apropriar daquele elemento na construção de um "estilo de vida", significa dar elementos tanto para a construção de uma imagem individual, como de pertencimento a um grupo maior. É, no limite, a correspondência a um valor moderno importante: a individualidade composta de uma presença eclética. Sua exploração abre campos para, inclusive, discutir-se a renovação da importância sociocultural de um produto (pensamos desde logo na telenovela e seriados, historicamente campo de debates de temas cotidianos)

Ao levar em conta que sua audiência é múltipla, composta por uma diversidade muito grande de indivíduos com características próprias, o produtor audiovisual também passa a acessar um conjunto muito amplo de valores possíveis a seu produto. A sobreposição de usos possíveis e semelhantes, nesse sentido, se torna parte do planejamento da obra, sua estrutura, capaz de corresponder a necessidades que vão mais além da fruição imediata e descomprometida.

De um ponto de vista mais técnico, as relações culturais com a tecnologia – ou, mais precisamente, com as interfaces - também podem se traduzir em respostas mais adequadas à personalização. O que se busca, portanto, é um processo elástico o suficiente para englobar adequadamente níveis diferentes de competências dos indivíduos, longe da padronização que o usuário pressupõe. Pode-se criar, talvez, relações mais duradouras com as interfaces, que se configuram em nova camada de significados inseridos na mensagem.

Por fim, o termo "indivíduo" expõe as contradições que podem existir entre a expectativa do produtor (una e direcionada) e as múltiplas expectativas dos indivíduos, tão variadas quanto cada personalidade. As manifestações dessas contradições podem, na organização do sistema, ganhar espaço para serem evidentes e, transformadas em dados, orientar mais facilmente a organização das ações sem a fixidez de uma regra única - isto é: o reconhecimento da multiplicidade, aliada à já mencionada personalização, pode orientar a criação de um sistema adaptável de consumo audiovisual, individual e baseado na carga da experiência cultural humana.

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Analysis of data service information of digital terrestrial television in Cuba *

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Resumen The data service is one of the values added to digital television. At present, this service is presented to the Cuban viewer in a different way depending on the receiver that has installed. On the other hand, the specification that defines said service does not present the necessary flexibility to improve its functionalities and visuality. In addition, the structure and content that is transmitted presents little use for the population. In the present work the detected problems are analyzed and changes in the specification are proposed to solve said problem. The analysis carried out and the new proposed contents are based on the results of surveys applied to a sample of the population of Havana whose design and analysis is presented in this paper. The proposed changes will allow an adequate quality verification process for present and future digital television receivers in Cuba.

Keywords: analysis of data · digital television · value-added services.

1. Introducción

La televisión digital terrestre (TDT) presenta un conjunto de ventajas respecto a la analógica: mejor aprovechamiento del espectro radioeléctrico, mejor calidad de audio y vídeo, mayor oferta de programas televisivos, la posibilidad de servicios interactivos y de contenido adicional o complementario de lo que se transmite, entre otras [4], [7], [5]. Aquellas funcionalidades que se adicionan a las existentes de la televisión analógica son llamados servicios de valor agregado [2]. En este trabajo abordaremos el servicio de datos (SDD) que es uno de los valores agregados a la televisión digital. Este servicio se presenta al televidente al presionar la tecla DATOS (o SERV. según el modelo del decodificador) que se encuentra en el mando a distancia [3].

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En la actualidad el SDD se presenta al televidente de manera diferente según el receptor que tenga instalado. Por otro lado, la especificación que define dicho servicio no presenta la flexibilidad necesaria para mejorar sus funcionalidades y visualidad. Adems, la estructura y el contenido que se transmite presenta poca utilidad para la población.

En el presente trabajo se analizan los problemas detectados y se proponen algunos cambios a la especificación china que se utiliza en Cuba [1] para corregir dicha problemtica. El análisis realizado y los nuevos contenidos propuestos se basan en resultados de encuestas aplicadas a una muestra de la población de La Habana cuyo diseño y análisis se presenta en este trabajo. Los cambios propuestos permitirán un adecuado proceso de verificación de calidad de los presentes y futuros receptores de televisión digital en Cuba.

2. Metodología

En [8] los autores proponen el desarrollo de un conjunto de nuevas funcionalidades que permiten mejorar la actualización y calidad del contenido que transmite por el canal actual de datos. Esta nueva plataforma tecnológica la denominaron TVC+. En la Figura 2 se muestra como TVC+ obtiene la información desde fuentes primarias de contenido mediante los estándares de RSS y servicios Web. Este contenido es empaquetado en los ficheros que son transmitidos para que sean visualizados por los receptores de TDT siguiendo la especificación existente [1].

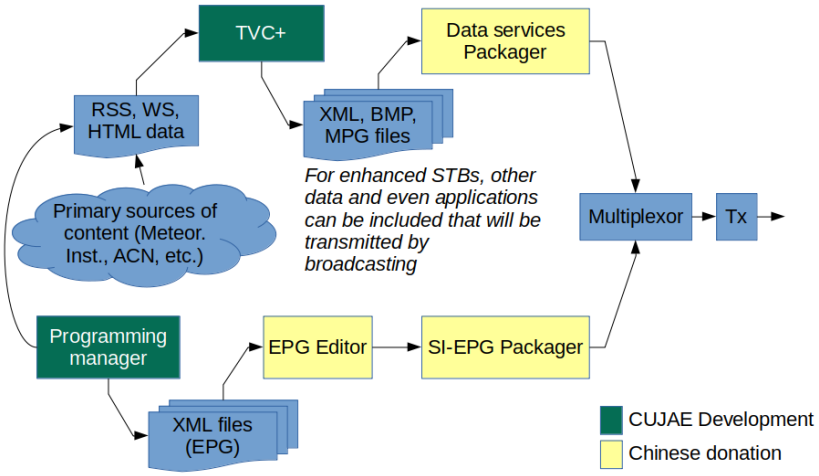

Figura 1. Esquema general de la solución propuesta en su despliegue inicial.

En el presente trabajo se abordan los problemas de visualización del sistema desplegado. Para ello, en LACETEL se realizó una grabación de unos 5 minutos

de la señal transmitida a mediados de enero 2019. Luego se procedió a verificar la misma señal en los diferentes decodificadores que han sido comprobados en otros momentos en LACETEL.

Por otro lado, para conocer la opinión de la población sobre el SDD en cuanto a su estructura y contenido, se diseño una encuesta que fue aplicada a todos los municipios de la capital durante el mes de mayo de 2018. El diseño de la encuesta se presenta en la 2. En el diseño se tuvieron en cuenta los antecedentes de la bibliografía consultada [6], [9].

Municipio: _____ Edad: ___ Escolaridad: _____ Ud. recibe la señal digital en su hogar? Sí __ No __
En caso afirmativo, conoce Ud. el servicio de datos (donde aparecen 4 botones)? Sí __ , No __
En caso afirmativo, responda el grado en aprecia su: Actualidad __ , Dinámica __ , Utilidad __ (0 al 3)
En cualquier caso: Indique su preferencia sobre el contenido informativo que le interesa que aparezca? (1 al 9)
Alertas __, Avisos __, Cuba __, Mundo __, Deporte __, Cultura __, Ciencia __, Curiosidades __, Efemérides __
Medicinas naturales __, Primeros auxilios __, Estado del tiempo __, Pronóstico del tiempo __, Jardinería __
Recetas de cocina __, y cocteles __, Consejos __, Tasas de cambio __, Pago jubilados __, Ofertas ETECSA __
Clasificados __, Trámites __, Horario transporte __, Inform. complementaria de la TV __, Cartelera cult. y dep. __
Estadísticas actuales del béisbol __, Ranking musical __, Concursos __, Otro _____

Figura 2. Diseño de la encuesta aplicada a los municipios de La Habana.

El SDD aporta información añadida que estará sujeta a las necesidades y políticas de cada televisora y de las demandas de sus televidentes. Sin embargo, su la gestión que realiza el ICRT presenta varias deficiencias, entre las que se encuentran:

- El vínculo entre los departamentos involucrados resulta deficiente y por tanto el flujo de información no se mueve correctamente.
- Existe poco control sobre la calidad en la conformación y prestación de estos servicios.
- Los trabajadores involucrados son en su mayoría egresados de carreras completamente ajenas a la televisión. Además, no poseen el entrenamiento suficiente para llevar a cabo sus funciones.
- Los Manuales de Procedimientos de los canales no muestran procesos asociados a la conformación de estos servicios.
- El Servicio de Difusión de Datos aún no se encuentra en total explotación debido a problemas técnicos y de usabilidad.

Para su diagnóstico, se trazaron una serie de pasos metodológicos que guiaron la investigación, en la cual se incluyó entrevistas a los principales encargados de su confección. Además, se tomó muestra del comportamiento del SDD en el período que duró la investigación. El procesamiento y análisis de los resultados se presentan en la siguiente sección.

3. Resultados y discusión

En la Figura 3 se resumen el resultado de las pruebas realizadas en el Instituto de Investigación y Desarrollo de Telecomunicaciones (LACETEL) el 23 de enero de 2019. Los decodificadores son los que han sido evaluados en algún momento antes de su comercialización y se agruparon en 7 cajas decodificadoras de definición estándar (SD), 11 de alta definición (HD) y 15 televisores híbridos (iDTV). Los errores se muestran en cada columna para cada decodificador. El significado de cada columna es el siguiente:

Equipos	Imágenes	Fondo	Título	Texto	Tablas
STB SD					
KONKA KSDT863-M	x	x	x	x	x
SOYEA SDP160	x	x	x	x	x
MiCO DT46-N03	x	x	x	x	x
MiCO DT25-2080	No se cuenta con ningún ejemplar que funcione				
GELECT SD-HL215	No se visualiza el servicio				
RUNCH DTT1513	No se visualiza el servicio				
HAIER HDMB-2000T/M	No se cuenta con ningún ejemplar que funcione				
STB HD					
KONKA KHDT875-A		x	x	x	x
Real TV HMA1	x	x	x	x	x
RUNCH DTT1900	x	x	x	x	x
RUNCH DTT1900 V1.2	x	x	x	x	x
SOYEA HDP160	x	x	x	x	x
KONKA KHDT875-CE	x	x	x	x	x
GELECT HD-AA1604	No se visualiza el servicio				
GELECT HD-HL1209	No se visualiza el servicio				
KONKA KHDT885-BD	Carga hasta el segundo nivel y luego se bloquea				
KONKA KHDT885-BH	No se cuenta con ningún ejemplar que funcione				
SOYEA HDP110D	x	x	x	x	x
iDTV					
ATEC 32L14D	x	x	x	x	x
KONKA KDL32KT627	No se cuenta con ningún ejemplar que funcione				
SOYEA LKK32CMB	x	x	x	x	x
DAYTRON DT32DUHB	No se cuenta con ningún ejemplar que funcione				
PHILCO TPH32HCU	x	x	x	x	x
SKYWORTH 32W2800	x	x	x	x	x
KONKA KDG32MB542C	x	x	x	x	x
HH 32DHI1	No se cuenta con ningún ejemplar que funcione				
LG 32LH510B-BC	x	x	x	x	x
TCL 32D2900	x	x	x	x	x
PANDA TPH32PLD	x	x	x	x	x
KONKA KDG32MB662CW	No se cuenta con ningún ejemplar que funcione				
KONKA KDG32MB662C	x	x	x	x	x
KONKA KDG40MB303C	No se cuenta con ningún ejemplar que funcione				
SAMSUNG UN32M4500AJXC	No se cuenta con ningún ejemplar que funcione				

Figura 3. Resultado que muestra los errores detectados en los diferentes decodificadores presentes en LACETEL el 23 de enero de 2019.

Los problemas con las imágenes y las tablas se deben a que los decodificadores interpretan incorrectamente la información transmitida.

En la actualidad este servicio se presenta al televidente cubano de manera diferente según el receptor que tenga instalado.

Las imágenes están conformadas como está especificado en [1], o sea, con formato BMP 256 colores con la paleta de MS Windows. Para demostrar este problema se abrieron las imágenes originales y las utilizadas en TVC+ en un editor de imágenes (en este caso el *gimp 2.8*, ver Figura 3). En esta verificación se comprobaron que los formatos de codificación, los tamaños y las paletas de colores son idénticos en ambos casos.

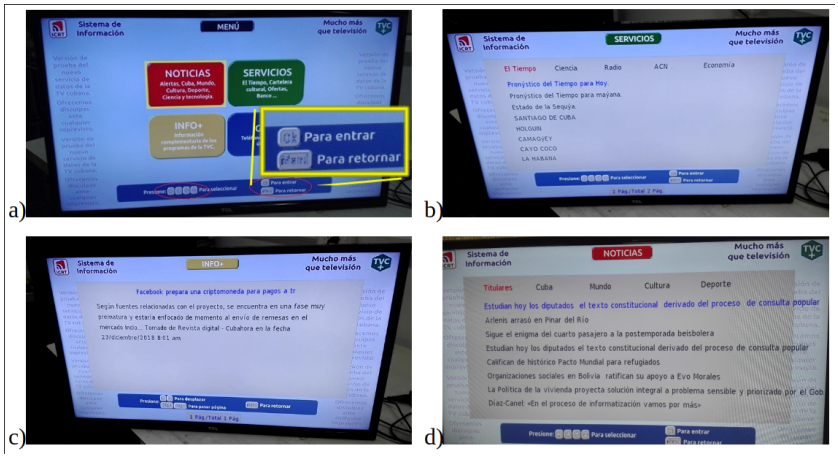

Figura 4. Fotografías que muestran los principales problemas detectados: (a) colores diferentes a los transmitidos, (b) caracteres extraños en los títulos y textos, (c) títulos recortados y (d) títulos de noticia fuera del área de dibujo.

Para el problema de codificación se abrió en un editor de texto (en este caso el *gedit 3.8.1* de *GNOME*) el fichero RSS que genera la fuente del Instituto de Meteorología (Ver Figura 3). Se pudo comprobar que la codificación del XML era incorrecta pues indicaba en el encabezado que era UTF-8 cuando en realidad era ISO-8859-1 (ver Figura 5(a)). Por otro lado, no se especificaba la fecha y hora de la publicación y esto provocaba que la noticia no se refrescara de manera automática pues el título siempre es el mismo. Al corregir ambos errores (ver Figura 5(b)) se comenzaron a mostrar de manera correcta los caracteres y se refrescaba la noticia cada día.

```
1<?xml version="1.0" encoding="UTF-8"?>
2<?xml-stylesheet href="../estilos/rss-style1.css" type="text/css"?>
3<rss version="2.0">
4
5 <channel>
6    <title>Instituto de Meteorología de la República de Cuba</title>
7    <link>http://www.insmet.cu/</link>
8...
9<item>
10         <title>Pronóstico del Tiempo para el resto del día de Hoy.</title>
11         <description><![CDATA[Fecha: 25 de enero de 2019. Hora: 3:00
  a.m.<br><br>
12                                                  <p align='justify'><font
  color='#003d6c'><i>▯ calor y algunas lluvias en la tarde▯</i></
  font><br>Amanecerá parcialmente nublado en Pinar del Río y la Isla de la
  Juventud, con poca nubosidad en el resto del archipiélago. Desde el final de la
```

(a) RSS original donde se observa la codificación errónea en la línea 1, la ausencia de fecha de publicación entre las líneas 10-11 y los caracteres extraños en la línea 12.

```
1<?xml version="1.0" encoding="ISO-8859-1"?>
2<?xml-stylesheet href="../estilos/rss-style1.css" type="text/css"?>
3<rss version="2.0">
4
5 <channel>
6    <title>Instituto de Meteorología de la República de Cuba</title>
7    <link>http://www.insmet.cu/</link>
8...
9<item>
10         <title>Pronóstico del Tiempo para el resto del día de Hoy.</title>
11     <pubDate>10/3/2019
12            5:56:41 </pubDate>
13         <description><![CDATA[Fecha: 10 de marzo de 2019. Hora: 3:00
  a.m.<br><br>
14                                                   <p align='justify'><font
  color='#003d6c'><i>... calor y algunas lluvias en la tarde ...</i></
  font><br>Amanecerá parcialmente nublado en Pinar del Río y la Isla de la
  Juventud, con poca nubosidad en el resto del archipiélago. Desde el final de la
```

(b) RSS donde se corrige la codificación en la línea 1 e incluyendo la fecha de publicación en las líneas 11-12.

Figura 5. Demostración del error en la fuente RSS original del Instituto de Meteorología.

En cuanto a los errores referidos a los títulos, se comprobó que algunos decodificadores no tenían en cuenta lo especificado en [1] que fija en 100 la longitud máxima de caracteres del título. Se procedió a fijar en 30 la máxima cantidad de caracteres y se agregaron tres puntos suspensivos al final para que indicara que había más información. Para no perder el título completo, se decidió agregarlo al inicio del texto de la noticia en mayúsculas sostenidas. Con estos ajustes se verificó que ya se corrigió el problema (ver Figura 3).

El problema con las tablas es similar al de las imágenes pues el formato que se utiliza es el mismo que el original, además, la información es la misma que transmite a todos los decodificadores, por lo que no es posible que en algunos se vea correcto y en otros no. Ambos problemas tienen que ser aclarados con los fabricantes de los decodificadores para que respeten lo descrito en la especificación.

Se realizaron un total de 611 encuestas distribuidas por los diferentes municipios de La Habana. De los encuestados, 466 eran usuarios de la televisión digital

terrestre (TDT). En la Figura 3 se observa la distribución de las encuestas según el municipio y si es usuario de la TDT.

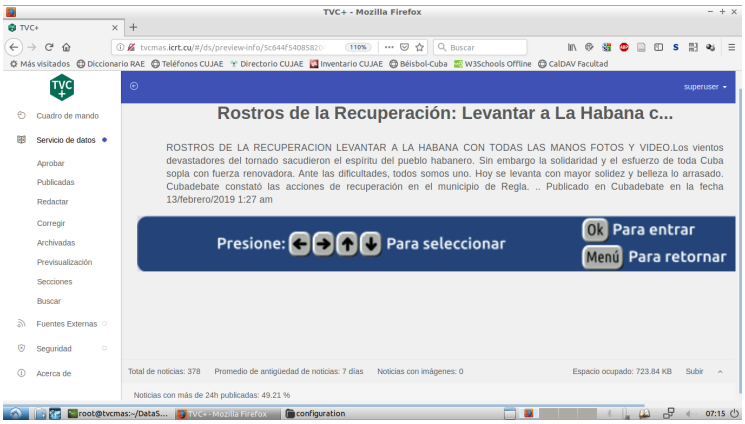

Figura 6. Interfaz de TVC+ que muestra la corrección del problema de los títulos de las noticias.

Municipio	TDT		Total
	No	Sí	
Arroyo Naranjo	6	14	20
Boyeros	9	30	39
Centro Habana	2	3	5
Cerro	11	20	31
Cotorro	2	20	22
Diez de Octubre	35	46	81
Guanabacoa	4	14	18
Habana del Este	7	112	119

Municipio	TDT		Total
	No	Sí	
Habana Vieja	5	3	8
La Lisa	12	60	72
Marianao	24	32	56
Playa	17	58	75
Plaza	9	27	36
Regla	2	3	5
San Miguel	0	24	24
Total	**145**	**466**	**611**

Figura 7. Interfaz de TVC+ que muestra la corrección del problema de los títulos de las noticias.

Del total de encuestados solo el 54,2 % conoce la existencia del servicio de datos, y de los 466 usuarios de la TDT apenas el 67,2 % conoce este servicio. Teniendo en cuenta esta situación los encuestadores explicaron y ejemplificaron en que consistía dicho servicio. La valoración recibida por parte de los usuarios en cuanto actualidad, utilidad y dinamismo del servicio de datos que se ofrecía fue negativa en todos los casos, solo alrededor de un 20 % de los encuestados evaluaron dicha propuesta con criterios positivos en estos aspectos.

A continuación los encuestadores procedieron a aplicar el resto de las preguntas de la encuesta. Estas preguntas están encaminadas a conocer cuáles son las temáticas de mayor interés de la población que pueden ser incluidas en el nuevo servicio de datos para ser consultadas por la población. La evaluación de cada temática se hizo en una escala del 1 al 9. En la Figura 3 se muestran las temáticas que alcanzaron más del 50 % de evaluaciones entre 5-9. En este caso resalta la temática del pronóstico del tiempo como la de mayor interés de la población, siendo también de interés las noticias relacionadas con el acontecer mundial y las ofertas de ETECSA.

Temáticas	% de criterios positivos (5-9)
Pronóstico del tiempo	69,9
Mundo	60,1
Ofertas ETECSA	59,7
Clasificados	53,2
Alertas	51,1
Avisos	50,1

Figura 8. Muestra de la población de La Habana distribuida por municipios. Incluye el total de encuestados y si reciben o han visto la TDT.

Teniendo en cuenta estos resultados descritos, se realizó una investigación para analizar las principales causas existentes en el proveedor de contenidos. Como resultados encontrados está el hecho de que en proveedor de servicios de TV (ICRT), no existe una cultura organizacional adecuada que asegure el buen funcionamiento de los servicios de valor agregado.

Además, de las entrevistas se pudo constatar que el personal a cargo no posee las competencias necesarias para poder llevar a cabo el trabajo de confección de estos servicios de forma adecuada. No se tienen identificadas las insatisfacciones de los televidentes con respecto a estos servicios, ni tampoco se ha realizado un estudio para saber cuáles son sus demandas de información.

4. Conclusiones y trabajos futuros

Se identifican los problemas detectados y se proponen cambios en la especificación para resolver dicha problemática. Los cambios propuestos permitirán un adecuado proceso de verificación de calidad de los presentes y futuros receptores de televisión digital en Cuba. Algunas de estas funcionalidades pueden incluirse en TVC+ que en la actualidad está desplegado en el ICRT. Esta solución permite la soberanía tecnológica de nuestro país en esta importante área del conocimiento con posibilidades futuras reales de intercambio con otros países de la región. Para la corrección de las deficiencias se realizaron un conjunto de propuestas dirigidas a mejorar los procesos asociados a la Gestión de Información de estos

servicios. En la actualidad no se puede considerar una utilidad acertada de los servicios de valor agregado en tanto no se aseguren los procesos que contribuyan a una mejor gestión de la información que contienen. Su valor agregado estará dado en la medida de que el televidente pueda nutrirse de una información que en términos de análisis de contenidos satisfaga mejor sus necesidades. Como trabajos futuros analizar las propuestas integralmente, continuar con el ajuste para probar las funcionalidades en varios STB y culminar la implementación de las funcionalidades en TVC+.

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