From 'Gads' to 'Apps':

the key challenges of post-web internet era

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Abstract

This paper aims to discuss the main changes that device's applications have faced along the past decades in order to show how internet connection has deeply influenced the way people communicate and interact with this media. From the Internet of Things (IoT) perspective, the Hannibal serie and its second screen app case is briefly presented for supporting the key challenges of this post-web internet era: (1) protection of sensitive and private user data in a ubiquitous environment, (2) interoperability, (3) communication and (4) proper language.

Keywords: applications; internet of things; post-web internet era; second screen.

Resumo

Este artigo tem como objetivo discutir as principais mudanças que aplicações para dispositivos têm enfrentado ao longo das últimas décadas, de forma a mostrar como a conexão de internet tem influenciado profundamente na forma que os indivíduos se comunicam e interagem com estas mídias. A partir da perspectiva da Internet das Coisas (IoT), o caso da aplicação de segunda tela da série Hannibal será brevemente apresentado de forma a ilustrar os desafios-chaves desta era de internet pós-web: (1) proteção de dados sensíveis e privados dos usuários em ambientes ubíquos, (2) interoperabilidade, (3) comunicação e (4) linguagem adequada.

Palavras-Chave: aplicações; internet das coisas; era da internet pós-web; segunda tela.

1 Introduction

It is not a new idea that human being has its evolution related to abilities to build new and more advanced tools for enhancing experience in daily activities. In prehistory age, this capability had made them distinguish animals. But it was in the industrial age that this skill started to blast off. This episode was so remarkable to the society that became a recurring theme in the literature, arts and later in others art expressions that were made possible through the advance of technologies and languages, such as film and television.

From this point of view, in 1839, the writer Edgar Allan Poe had already described a man with mechanical prostheses in his book "The man that was used up". The reference of objects assuming part of bodies' functions continued a hundred year later, with the science fiction movies from fifties, sixties and seventies also exploring this kind of script with plenty of success. In "The Six Million Dollar Man", an American TV serie from seventies, the captain Steve Austin had his arms, legs and eyes substituted by bionic implants in an experimental surgery. With this "upgrade", he became an unusual man with an impressive body resistance. In the eighties, an animation television serie known as Inspector Gadget can be considered as another good example. Its main character, Inspector Gadget, was a clumsy cyborg detective with several instruments and tools coupled in his human body. With them, he was able to solve mysteries that were used to appear during his missions.

These periodic characters' profile can be a good representation of the society living a dramatic shift in its relation with devices in the end of the last century: electronic devices' industry was starting to open the way for a convergent, mobile and miniaturized consumption market based on the main man growing daily need: communicate with each others remotely. And more than that: promote interactive tools as close as possible to human bodies so they would feel like belonging to the body itself, as an extension of it.

However, if the emergence and popularization of internet connection in the

nineties had fully improved this human experience with innovative tools and devices, it is possible to assume that a new boundary is approaching with post-web internet era and the next generation of information, network and communication technologies: the Internet of Things (IoT). The future vision of IoT is still confusing regarding its definitions, content and differences from other similar concepts. However, IoT attracts great attention as brings promoting opportunities and challenges for economic and social values. In the same sense, changes in the domestication process in home of television, telephone, mobiles, games systems and computers had lead individuals to explore the use of these media in a more pervasive and combined way – exposing a practice of reception and adoption still not clear for industry market.

In this paper, the glance will be taken to the effort of clarifying what is considered here the presumable key challenges of this post-web internet era: (1) protection of sensitive and private user data in a ubiquitous environment, (2) interoperability and communication and (3) proper language. These challenges will be presented taking back the evolution of device's applications from heavy and clumsy hardware gadgets to their most last prominent technologic stage, the second screen (SS) aplications, thus structuring the idea of gad-to-app metaphor. In this paper, the "second screen" expression will be used as it has been propagated by industry and broadcasting market – an innovation of interactive technology submited to a main screen, the television[1]. This is due to the Hannibal serie and its SS app case, which is to be briefly presented as an illustration of a technology immerged in the IoT context and influenced by the domestication process.

2 The 'gad-to-app' metaphor and the objects of desire

Interactive applications are wrongly seen as recent innovations arising from the advance of Internet and web. They are part of a historical shift on how individuals interact, feel, attribute value/functions and use interactive tools. In order to situate the interactive applications in a more proper position in history and their currently role in society, the gad-to-app metaphor is here proposed. Although observing the evolution of applications from a narrow perspective, this metaphor can be a good representation of the shifts faced in human and machine relations.

The first electronic gadgets could be described as a symbol on how individuals position themselves in front of a capitalist society. They could be used as an instrument

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1 Nonetheless, the term "multiple screens" seems to fit much better in an environment where convergence and horizontal relationship are stronger than any rigid and hierarchical relationship between interaction devices, as the expression "second screen" might be supposed to infer.

of power, as also could be a representation of one's belonging to certain society class. This had an important impact on the role of these technologies in defining a social status, making them a recognizable and authentic object of desire. It makes sense when a look back is taken to the pagers and huge-heavy cell phones that businessmen used to proudly hold up in eighties and nineties. In that period, the electronic gadgets could be described as a small tool, hardware or machine with a not-so-good graphical user interface (GUI) having a singular and particular function. The idea of gadgets as object of desire found a wider and growing market to be explored in game systems' area. "Tamagotchis" and "game boys" can be considered the two leading most desired gadgets by kids and teenagers from nineties.

Later, the personal computer (PC) desktop interface gained a significant graphical development congregating loads of tools. The picture of "Inspector Gadget" was so replaced by the modern man of the new century, now able to unite his alarm clock, beeps, chat and games tools in a single screen: the Widgets. The term is formed by the agglutination of the words "windows" and "gadget", meaning "the gadgets for PC screens". Widgets were very popular in computer screens for a couple of years, as tools in "software version" that congregated a number of various gadgets with specific functions in a unique place.

The popularization of internet connection in the beginning of Two Thousands Years and its fast evolution in quality has introduced a number of innovations that foster even more the relation between man and the machine. If in its first years the web was just for accessing data and later sharing multimedia contents, nowadays the age of IoT has taken from PC desktops the main internet access point and has transferred it to mobile and smart devices, enhancing the SS experience. It started with smartphones and smart TVs, but Internet is rapidly reaching refrigerators, tables, mirrors and many in and out house objects. The objects of desire are not anymore a specific electronic machine – but all of them, with Internet embedded.

The applications assumed an important role as a bridge between the physical world and the virtual world, as the human interface for accessing, controlling and sharing interactive experiences. As interactive tools fully explored through internet-connected objects and mobile devices, thousands of 'apps' are currently available through on-line marketplaces to be downloaded or uploaded. Although they cover many entertainments, learning and working human needs, there is still a long way to be explored, as the IoT era is just in its early years.

Thus, the idea of object the desire is still valuable for the recent device's applications, though its association to a social status have faced a big shift since the

first gadgets. Even in countries in development, smart devices capable to embed applications of several operational systems (OS) are getting even cheaper and accessible for working and lower class people. They are not object of desire because represent how much one's can pay for a technology; they evidence what kind of skills one's is able to express, share and expose in a world where the Internet has provided the possibility of broadcasting yourself. Applications are now moving forward to the next generation of networks, where individuals and objects can interact with each others through a wireless non-contact technology which enables a more pervasive, immersive and interactive experience: the IoT.

3 IoT and its convergence perspective

Although the IoT is still not clear and full of different concepts, the first mention of this expression is market-driven. The idea of IoT appeared in 1999, when Kevin Ashton used it in a presentation at the Procter & Gamble company: "Adding radio-frequency identification and other sensors to everyday objects will create an Internet of Things, and lay the foundations of a new age of machine perception" (ASHTON, 2009). In that period, the radio-frequency identification (known by the acronym RFID) was growing in innovation and use.

The RFID allows electromagnetic fields to transfer data through wireless non-contact objects, by automatically identifying and tracking attached tags in these objects. It has a wide range of use in different industries and areas of application, from health to security, fashion to electronic devices, and so on. The origin of IoT's term is linked to the evolution of RFID, but it does not mean the next-generation RFID only, since it encompasses various others technological solutions nowadays. Sensor networks, actuators, TCP/IP, mobile technologies, software enable to identify objects and collect, store, process and transfer information not only in physical environments but also between the physical and virtual worlds.

From the concept of "ubiquitous network society", the International Telecommunication Union (ITU) has been seem the key role of widespread mobile devices in this "in 'always on' communications, in which new technologies like RFID and smart computing promise a world of networked and interconnected devices that provide relevant content and information whatever the location of the user" (ITU, 2005). Mihovska (2010) attempted for others expressions that may be used similarly with IoT concepts. The researcher recalls the term "ambient intelligence", firstly used by IST Advisory Group (ISTAG) from Community Research and Development Information

Service from European Comission (CORDIS); it describes a similar vision of IoT where "people will be surrounded by intelligent and intuitive interfaces embedded in everyday objects around us".

In a preliminary analysis, IoT seems to be a customizable bridge between the physical world and cyber world by ubiquitous sensing, connection and content with definite social attributes: "a dynamic global network infrastructure with self-configuring capabilities based on standard and interoperable communication protocol" (NING, 2013). Since internet revolution, IoT can be considered as a natural evolution of networks and the next generation of internet convergence. Although linked to the idea of internet, the IoT environment do not necessarily requires objects with Internet addresses. As a framework that overcomes the web-base address, it focuses more on extending the internet to real-world objects that can communicate with their "homepage" and will have a digital presence in the virtual world. The IoT' things are recognizable, readable, localizable, addressable and controllable via the Internet.

3.1 Human factors and emerging trends

Traditionally seem from the technological perspective, IoT has strong social and economic impacts though. Those impacts are strictly related to the future scenario of infrastructure and integration of information processing, computer science, social sciences and communication technologies, where smart infrastructures are assuming the leading role in managing daily activities for working, entertainment and learning. The dissemination of smart devices, such as connected TVs, smartphones and tablets, is a good example of how content production is being challenged to reinvent new formats of delivering contents to those multiple platforms. The audience-users are even more digital natives, requesting more practical, immersive and interactive contents, with dynamic and flexible service composition, based in pervasive, embedded and cloud systems.

Mihovska (2010) presented a representative picture based on two spheres of relation in general IoT environment. The first one is Thing-to-Person sphere: "a number of technologies and applications wherein people interact with things and vice versa including remote access to objects by humans and objects that continuously report their status". The second one is the Thing-to-Thing sphere: "technologies and applications wherein everyday objects and infrastructure interact with no human originator, recipient and intermediary. Objects can monitor other objects, take corrective actions, and notify humans".

Figure 1 – Second Screen environment (Angeluci, 2013)
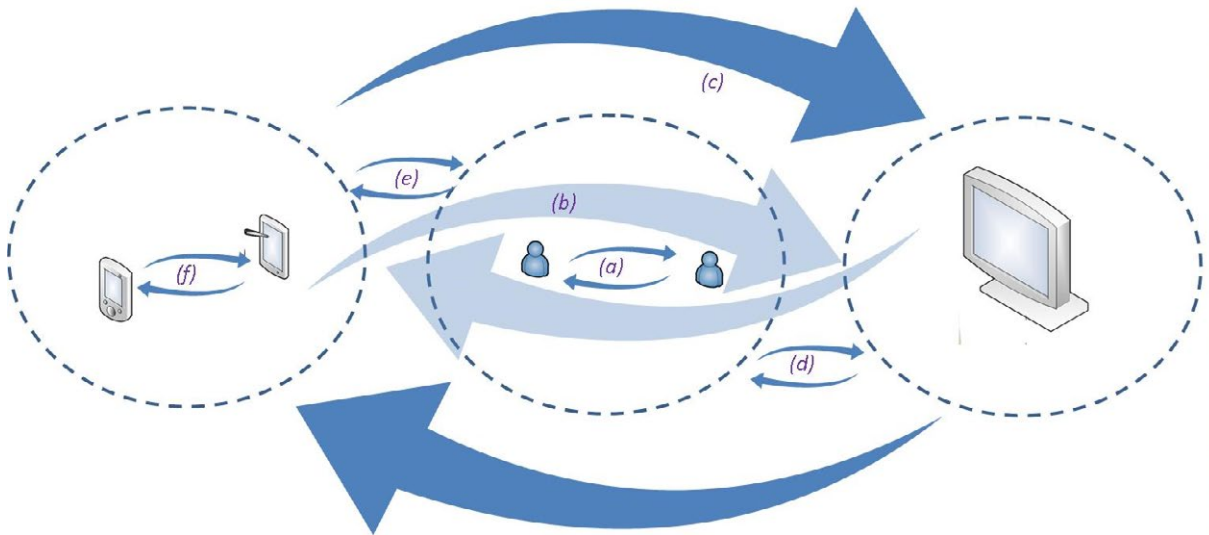
This paradigm of "Person" and "Thing" and its cross-relations has also occurred in literature with some similar approach but from different background areas. When Angeluci (2013) describes a second screen environment from a Human-Computer Interaction (HCI) point of view (Figure 1), a complex scenario considering users and devices are considered in different contexts of relationships. Previously, Scolari (2004) analysis the relation between user and objects by the idea of four specific contemporary interface metaphors: instrumental, conversational, superficial and spatial.

From these perspectives, three different contexts can be considered as potential IoT's area of operation: (1) things-on-the move, (2) ubiquitous intelligent devices and (3) ambient and assisted living. The first aspect – things-on-the move – is related to the use of IoT in contexts of retail or logistics of goods, such as pharmaceutical or food ones. The "ubiquitous intelligent devices" is more linked to the thing-to-thing sphere and consider an environment where any objects can virtually exchange information and run behaviors according to a predetermined set of actions. The last one – which is more related to the focus of this paper – describes a scenario of collaborative operation of functions embedded in many objects of the living spaces. As an example of this topic, the possibility of electronic media devices synchronize and exchange contents and information, both locally and remotely – as can be seem in Google Chromecast2 or others second screens application for TV series.

New capabilities have been created by IoT recently. Handheld devices, such as smartphones and tablet have widely expanded their functions as they can be used for

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2 Google Chromecast follows the "drag-and-drop" perspective when allows users to plug its modem "into any HDTV, connect it to WiFi, then send videos and more from a smartphone, tablet or laptop to a TV with the press of a button". With the device, Netflix, Youtube, Hulu and others several OS applications can be run into a larger TV screen.

tagging of objects, for controlling equipments, commodizations of sensors and networks for surveillance, environment monitoring and consumer surveys, and also for locating things and reporting their location to owners. Some of these emerging trends are due to new user requirements and perception of new functions that these devices can assume in daily life when embedded with such kind of IoT systems. Trying to summarize these trends, Table 1 shows a number of aspects that can be related to the expansion of IoT technologies and perception of innovative application from users.

Table 1 – IoT's emerging trends

Emerging trends	User requirements
Minituarization	Portability
Innovative design	Use cases
Integration with evolving Internet	Stay connected "anytime, anywhere"
Adaptivity and interactivity	Capturing various data with mobile device
Transparency	User-friendliness
Heterogeneity	Mobility and connectivity
Pervasiveness	User interactivity with the environment

4 THE CASE OF HANNIBAL SERIE SECOND SCREEN APP

Backing to the point where this paper has been through – the gad-to-app metaphor as a synthesis of shifting transformations by, through and beyond the Internet connection toward IoT era – it is worthy pointing out that some emerging trends in digital content production are being perceived in the last recent years. Driven both by IoT scenario and changes between generations in education, cultural capital and media use, the screen's convergence has become an evident mark. If domestic technologies had already a defined role in people's access and use of information in past decades, it seems to be clear that the "domestication" process (LIVINGSTONE, 1992) is leading users to use media technologies to locate themselves in the world, in even more complex conditions of mixed and combined use of multiple screens in home. Although government policies or industry could have an important influence on these technology's uses, Silverstone and Haddon (1996, p. 60) highlight the role and power of individuals' choice:

> domestication is fundamentally a conservative process, as consumers look to incorporate new technologies into the patterns of their everyday life in such way as to maintain both the structure of their lives and their control of that structure.

Thus, full availability and robustness of a technology, government or industry's incentive do not guarantee the reception and use of media technologies in home environment. Individuals must to identify the function and relevance of these new devices in their daily's life improvement; otherwise the innovation will not be incorporated[3].

A proper example of this ongoing process is the second screen app phenomenon. It started with the use of social media in different internet-connected devices by commenting broadcast TV content. Recently, new synchronization technologies have allowed sharing and participating with content both in TV and mobile devices in a combined way, with a relatively success and positive audience impact and engagement. Whether using timeline (ANGELUCI, 2013) or audio fingerprint synchronization (DUONG et al, 2012) techniques, these interactive trends are expected to be more expanded through the motivation of industry and broadcast market in creating a business model for it.

The idea of transmedia as a concept widely explored by several authors in communication studies, such as Jenkins (2006), become more well-located in context and time when considering its contemporaneity with IoT framework. Transmedia strategies seemed to be a response to the ubiquity and pervasiveness of post-web internet era, a proper "escape route" for worn and obsolete audiovisual production formats and structures. Taking advantages of innovative use of combined media, also new business models would emerge as an outcome of these new content scripts.

The "Hannibal Second Screen App"[4] follows these trends. It is presented as an experience that serves up a whole new way to watch the TV content using two screens in a single enhanced experience, taking advantage of transmedia strategies. Figure 2 shows the official Hannibal SS web site with further information about the app, which is based in four specific features:

(a) "Sync": based in the audio fingerprint synchronization technique, the user is able to open the Hannibal application in his own mobile device, click "sync" while watching the TV serie and go deeper into the story, with episode specific facts, production notes and trivia while watching the TV content.

(b) "Get social": the user is also allowed to join a live conversation with others Hannibal fans using social media such as Facebook or Twitter. The production

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3 This thought can help to better understand the still slow penetration of interactive applications from open-to-air digital television (ISDB-Tb middleware applications) in Brazil, although can not be listed as the only one factor. Some other factor were considered in Angeluci (2011).

4 Hannibal is an American thriller television serie premiered on NBC in 2013. Critical reviews for Hannibal have been generally positive, and the serie has been seen as a good example of a classy horror that succeeds due to the good alternation of suspense and surprises, well-constructed short and long-term mysteries, and an appropriately action mood.

offers trivial, photos and excerpts in the sync stream.

(c) "Case explorer": The application offers a deeper experience with the audiovisual narrative. It conducts the audience into a closer look at the crime scenes and criminals, also tracking details uncovered across multiple episodes, connecting the dots.

(d) "Character tracker": this feature helps the audience to see how the characters connect and watch as relationships unfold from week to week. Some exclusive photos from each episode are put to be available.

Figure 2 – Hannibal' second screen web site
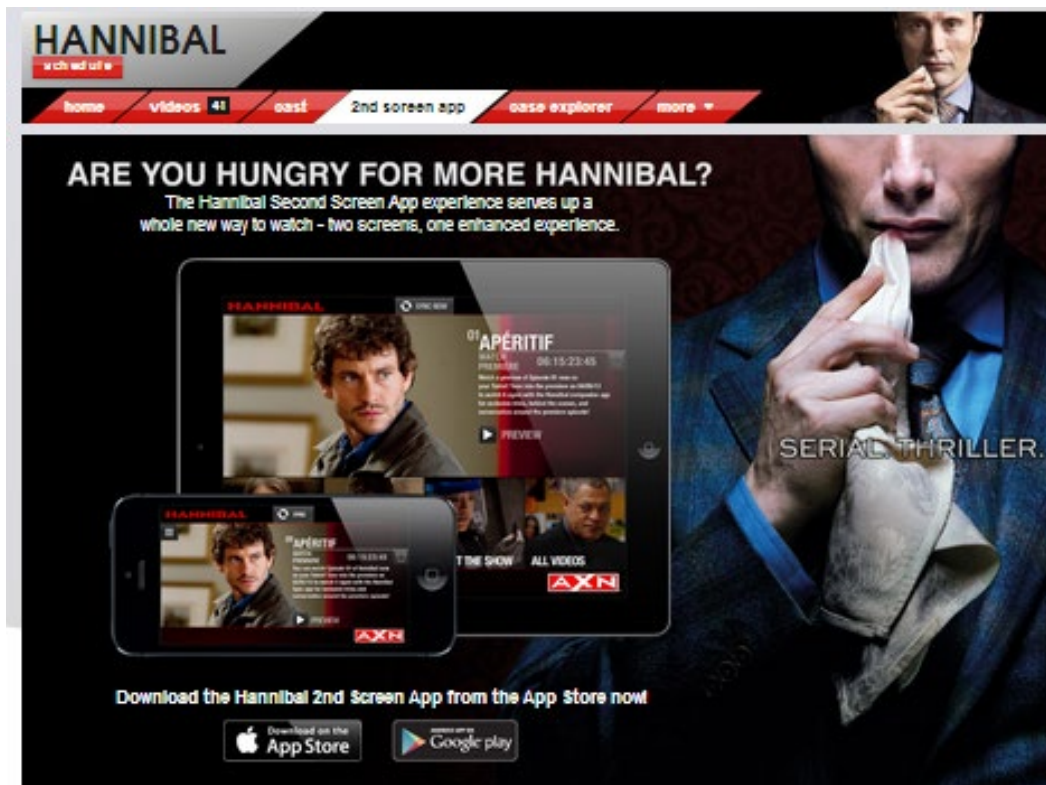
The application was put available for free for the majority of OS. The Hannibal project was the first one to bring to Brazil a SS app related to a television serie. Taking advantage of internet-connected devices and the transmedia storytelling perspective, the horror serie is an example on how users can benefit from IoT development and enhance their experience with their electronic devices in an expressive domestication process.

5 The three key challenges

The experience with Hannibal SS app seems to be a promising trial on how the audiovisual production field can invest on innovation in the IoT age. Although

is a good example, that is an experience still restricted to a small number of people – usually those ones with the proper devices and internet connection quality enough for a full engaged experience.

As the three main key challenges that IoT era might face in the next years in terms of interactive applications, and considering all the topics discussed in the previous lines, it would be considered those ones listed in the Table 2.

Table 2 – The IoT's three key challenges

Key Challenges	Description
Protection of sensitive and private user data in a ubiquitous environment	- standardization of evolving new mechanisms; - study and specifications for exchange and interpret information;
Interoperability and Communication	- use of more comprehensive systems covering regional standards, the legacy and establishing global protocols; - new business models to avoid the practice of consolidation of niche markets for specific devices and content developers;
Proper languages	- form more multidisciplinary professionals; - create innovative scripts for multiplatform contents exploring transmedia perspective in some cases.

This discussion would go further if we consider others aspects. There is a need to enhance service relevance to user's needs to minimize digital pollution for the network and the consumers, contributing to a more "green" Internet at the service level via quality rather than quantity. It would be also relevant to develop service persistence to optimize a user's service experience by adaptation to the varying availability of networking resources and offline service continuation; enabling services to build upon objects, allowing objects to become available, searchable, accessible and usable online for service creation; and also provide comprehensive and support of privacy and trust, allowing proper user perception thereof to explore full potential of online services.

6 Final Remarks

Interactive applications are now moving toward a dynamic global network infrastructure with self configuring capabilities based on standard and interoperable

communication protocols, where physical and virtual "things" have identities, attributes and intelligent interface, seamlessly integrated into the information network. The IoT era has indeed begun and its potential benefits for the economy and society are real, but still unclear. There are numbers of issues still uncovered by the dynamically changing environments, such as security, privacy, interoperability, communication and languages process. As a recent innovation, IoT is likely to drive further to a profitable market growth and meet the needs of stakeholders.

However, the gad-to-app metaphor has led to an important reflection on how the applications development has great influence from user's feelings and perceptions about technology. The domestication concept helped to consolidate this idea when emphasize the individuals' power in integrating technologies to life. This shows how human factors must to be even more considered when discussing about the post-web internet era and the relevance of specific applications: beyond all technology-driven discussions, there is a very important role of human's feelings affecting on what will be an enjoyable and interesting content to be consumed, not mattering the technical innovation.

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