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CLOUD COMPUTING AND (NEW) MOBILE STORYTELLING IN THE INTERNET OF THINGS

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ABSTRACT

The increasing weight of user-chooser participation in Cloud Computing and the Internet of Things (IoT) urges the making of conventions, terminologies and ontologies that may frame their usage in particular in what concerns tagging the objects of IoT. This labelling will be – is already – surpassing its mere cataloguing mission, being used to convey whatever narratives the operator may want to associate them with. New tools give way to novel artistic practices, and a new aesthetics seems to be in the making. The trend towards Mixed Media demands a transdisciplinary dialogue between its performers and Digital Humanities' practitioners. This paper intends to summarize some of the issues arising from the deficiency of conventions, and proposes – to be theoretically explored in future work – the hypotheses of including these novel storytelling practices into the field of Design Fiction.

INTRODUCTION

Artists, scientists and engineers are presently living the same «Desktop Revolution» that affects all fields of knowledge, a Kuhnian epistemological paradigm change already echoing in every human area. The Internet evolution allowed the development of Digital Humanities, embracing the new set of tools available, the new relationships between producers and users, interactivity and networking. The users' number crescendo allows an anticipation of the need for clearer definitions of the utensils that are being used, and the possibilities they offer.

This paper intends to be a speculation over the main issues raised by the lack of clear terminology and ontologies, natural of a period when new expressions, artistic and scientific, are in the making. Giving some practical examples of projects to illustrate some of the issues, it will propose – as a hypothesis to be developed in future work – that these new storytelling strategies do not fit within the existing literary conventions and categories, not even the ones developed by interactive fiction models, demanding to be included into the equally novel idea of Design Fiction.

NEW PRACTICES FOR A NEW PARADIGM

The model of the artist-engineer embodied by Leonardo da Vinci is not confined to the Renaissance. All artists, at all times, used their ingenuity as engineers, exploring the various scientific fields that might interest them to help themselves to the latest discoveries, findings, the most recent advances (even proposing some hypotheses) in the very physical and scientific area of materials, and media used to manufacture their works (Barbas, 2011). In that same way engineers and scientists in their practices are not devoid of aesthetical judgement (MacAllister, 1998). Presently, neurological studies of the human brain activity, through fMRI imaging experiments used to evaluate reactions to beautiful objects (paintings, musical excerpts) are starting to prove that the location of the brain's aesthetical functions and reactions are identical in the human subjects tested (Ishizu 2011).

Artists, scientists and engineers are presently living the same «Desktop Revolution» (Johnson, 1977) that affects all fields of knowledge. This is an epistemological upheaval, attesting the formation of a new scientific paradigm (Kuhn, 1979), which is already echoing in human production, whatever the arena. Nowadays, no one can imagine working without a computer.

However, the tasks and usages are naturally different: «The humanistic turn of mind provides the historical perspective, interpretative skill, critical analysis, and narrative form required to articulate the significance of the scientific discoveries of an era, show how they change our sense of what it means to be human, and demarcate their continuity with or difference from existing ideologies» (Davidson 2008).

In the new Digital Humanities Era, Internet evolution has been carefully followed, and mainstream computer timelines and terminology duly adapted. Tim O'Reilly's distinctions (O'Reilly 2005) between Web 1.0 (around 1991-2000) and Web 2.0 (from 2001 onwards) gave way to Humanities 2.0 as a practice embracing the new set of tools available, the new relationships between producers and users, interactivity and networking. All this echoing also in the artistic expression.

One of the first experiences in Portugal is «Alletsator XPTO – Kosmos.2001» (<http://po-ex.net/alletsator>) by Pedro Barbosa and Luis Carlos Petry, an opera libretto on electronic text synthesized in computer: «For actors, musicians and other animals».



Figure 1: Alletsator XPTO – Kosmos.2001, P. Barbosa, L. C. Petry, opera libretto - text synthesized in computer

A more recent example - theme of a poster presented at ACM WomEncourage 2014, and embodying a mixed media exhibition in Lisbon City Hall - is the series «Cloud Portraits of 22 Portuguese poets» by Alexandra Antunes-Couts (<http://www.alexandraantunes.com/2012/11/herberto-helders-typographic-portrait.html>), giving continuity to her MA poetry projects: «Máquina de Emaranhar paisagens» (<https://sites.google.com/site/maquinadeemaranharpaisagens>) and «Divertimento com Sinais Ortográficos» (<https://sites.google.com/site/funnypunctuationmarks/home>). The author uses specific software for word frequency which combined, generates word clouds from each poet lexicon, titles and texts, graphically executed with inDesign:

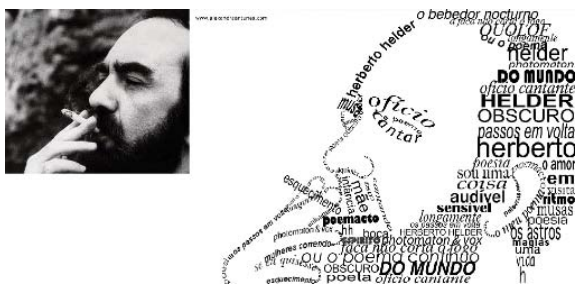


Figure 2: Herberto Helder (2012) A. Antunes
Typographic cloud portrait 297×210 mm. Portugal

Consequently, the gradual democratization of access to data combined with a change in the approach from top down to bottom up, was detected. Humanistic users also inherited system administration tasks that «forced them to develop their own IT skills and sensitivities» (Yanosky 2008). This need to learn new tasks, paired with the liberty to choose software and platforms (and to adopt the ones sanctioning a steep learning curve), challenges the idea that users do not know what they want. With the increase of new user-chooser centred participation it has become harder for big IT departments and corporations to control what to offer and to whom. This issue is growing along with the anticipated

number of global users:

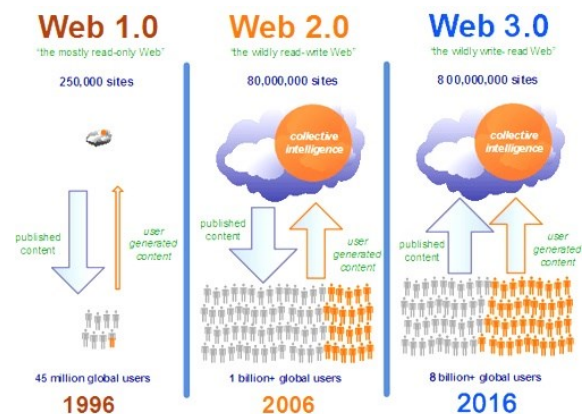


Figure 3: 2016 Expectations for web development

Within these changes and due to their novelty, other questions arise concerning terminology and ontologies - namely the expressions used in the title: Cloud Computing, mobile storytelling, and Internet of Things - for which there are several definitions available, and not everyone agreeing with them.

CLOUD COMPUTING

Cloud Computing is a scientific metaphor for the Internet and a standardized cloud-like graphic shape used to denote a network with the implication that the specifics of how its end points are connected is not relevant for the purposes of understanding the diagram.

For Humanists it immediately recalls the comedy by Aristophanes - where he ridicules the great Greek philosophers. The Clouds (*Nephelai*) were also the nymphs bearing water to the heavens in cloudy pitchers, and nourishing the earth and rivers with their rains. So, only good things can be expected from the present internet-public-clouds with its elasticity of, allegedly, free resources.

Recently, and in accordance with NIST regulations (<http://www.nist.gov/itl/cloud/index.cfm>), it is generally considered a rich itinerant computing technology that leverages unified flexible assets of wide-ranging Clouds and network structures toward limitless functioning Clouds, storage, and mobility. It will serve: «a multitude of mobile devices anywhere, anytime through the channel of Ethernet or Internet regardless of heterogeneous environments and platforms based on the pay-as-you-use principle» (Sanaei 2014).

These enthusiastic definitions are balanced by counter-proposals such as the one presented by the design research IIC - Inhabiting and Interfacing the Clouds (<http://www.iiclouds.org>), that object to the current expression of Cloud Computing and big proprietary solutions - Cisco, Dropbox, Google Drive, Amazon S3 or CE2 - particularly in forms intended for private individuals and end users. ICC considers that these implementations have chiefly followed the logic of technical development, corporate

interests, and are paradoxically envisioned as a purely functional, centralized setup. They (Keller 2015; Nova 2014) defend the concept of Personal Cloud or OpenCloud. Their alternative model implies a «cross-disciplinary approach that links interaction design, the architectural and territorial dimensions as well as ethnographic studies». This matter is still under discussion.

Open, Closed or Hybrid, Cloud allows user access through networked client devices and mobile collaboration via wireless, cellular, broadband technologies, sanctioning working and collaborating independently of space and time.

Users-choosers access Cloud computing via desktop computers, laptops, tablets and mainly smartphones. The latter, as Cloud clients, rely on Cloud computing for a great majority of their applications, becoming essentially useless without them.

MOBILE EMPOWERMENT

The advances in Cloud, wireless and mobile computing, together with the abilities of mobile devices, reached a point where compute-intensive applications can now run on mobile devices with limited computational capabilities. This is attained by using the communication power of mobile devices to establish high-speed connections to vast computational resources located in the Cloud.

This access and potential has originated a boom in the development and creation of Applications (Apps) for handheld devices, which are pre-installed, or delivered via web by request, to perform all imaginable tasks.

As an example, there are two Apps developed by CADA (<http://www.cadal.net>) a Lisbon-based art group that makes mobile software to explore «the interrelationship between the variable character of human beings and the spatial-temporal dimensions they create and negotiate in everyday life». These Apps are for ambient and personal data visualization.

«Today» (2007) - (<http://www.cadal.net/works/today-visualize-your-calls-version-2-for-android/>) - converts the amount and type of daily phone calls made and received by the user into a readable graphic. Each call or message generates a specific symbol which appears chronologically in real time. The result is an ever-changing, evolving image.

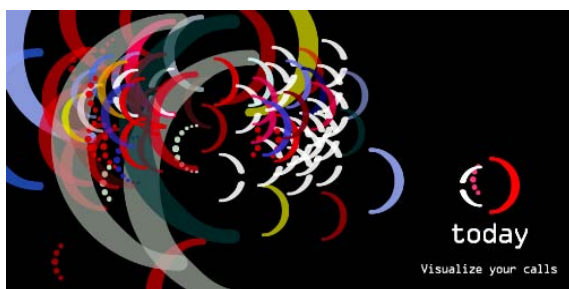


Figure 4: Today – self-tracking data visualisation App (2007)
S. Oliveira, J. Hawkey, S. Prudêncio,
CADA, Lisbon, Portugal

The second example - «Time Machine» (2007-2009) (<http://www.cadal.net/works/timemachine/>) - is the outcome of a project developed with Academia participation – CADA and CITI-FCT New University of Lisbon. It converts personal emotional and temporal patterns into a visual form, exploring colour. The output is a data visualization interface displayed on the phone, designed to produce a highly personal topology of time usage.

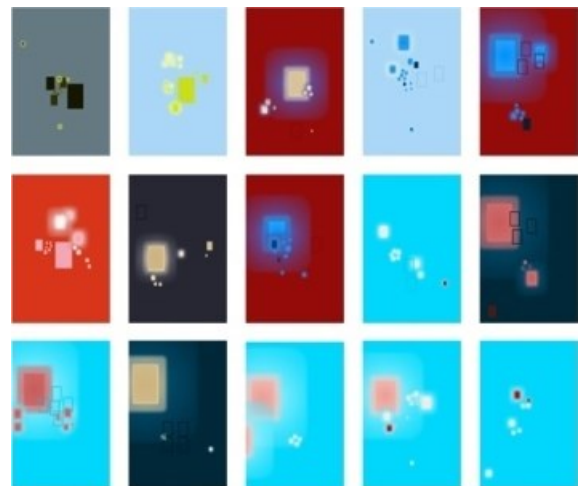


Figure 5: Time Machine – self-tracking data visualisation App (2007-2009) J. Hawkey, S. Oliveira, CADA, Lisbon, N. Correia CITI-FCT UNL, Caparica, Portugal

Apps developers, mainly recruited among the «geeky» users, have to consider the amount and variety of platforms and operating systems available, and are contending in a fierce market. For consumers, competition assures that the most requested mobile phone Apps keep being low-priced or free.

The most novel experiences include crowdsourcing to help people with disabilities. Just launched, Be My EYES (<http://www.bemyeyes.org>) is an open source non-profit App that aims to help the visually impaired in everyday situations. The user sends a message to the contact. The latter receives a notification. They connect via live video and the volunteer can help by answering the questions asked.

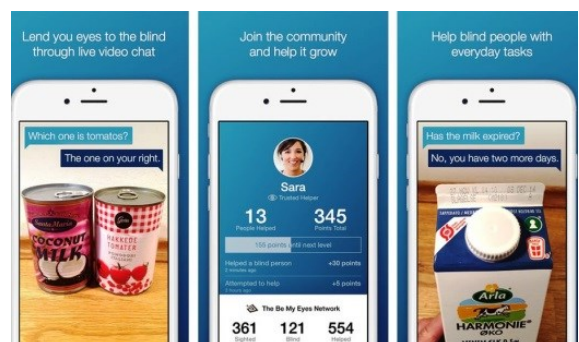


Figure 6 : Be My EYES - video data visualization App for crowdsourcing aid (2012-2015), H. J. Wiberg, Aarhus, Denmark

The outcome is a true empowerment of human users, and all the activities they will want to perform with their mobiles – namely new forms of storytelling in the Internet of Things.

OBJECTS TELLING STORIES BEFORE THE INTERNET OF THINGS

Relying on RFID (Radio Frequency Identification) sensors and a tablet, «Noon - A Secret Told by Objects» (2007) (<http://cargocollective.com/tiagomartins/Noon-A-Secret-Told-by-Objects>) by Christina Heidecker from Linz, Austria and Tiago Martins from Caparica, Portugal, is a mobile storytelling project, an interactive installation using real objects to convey a narrative, which resorts to a bracer, a wearable interface for ubiquitous gaming based on gesture-driven and tangible interaction.

Embedded with motion, direction, pressure and RFID, this bracer can be connected with mobile devices and allows for freed gaming using real objects. The player has to unveil the origins of the tragic fire that claimed the lives of the Novak family accessing the memories embedded in the remaining objects.



Figure 7 : Noon - A Secret Told by Objects (2007)
Interactive installation, Ch. Heidecker Linz, Austria
and T. Martins, Caparica, Portugal

In 2013, Tiago Martins, with Vesela Mihaylova and the musician Claudio Pina developed another mobile storytelling project: «Tripo» (<http://cargocollective.com/tiagomartins/Tripo>).

Three interconnected short stories are delivered through an imaginary device inspired by the tin can radio. Technically, they resort to electronic modules, RFID tags. Participants are led on the exploration of an indoor space, to find hotspots where the device can be used. At each of the hotspots participants may use the object to listen to fragments of stories which evolve and intersect throughout the location, as if they were memories of the space itself.



Figure 8: Tripo – Interactive installation (2013) – V. Mihaylova, Linz, Austria, C. Pina, T. Martins, Portugal

The hypotheses of objects talking to each other transferring data between themselves and over a network operating in real time became possible due to the convergence of wireless technologies, micro-electric mechanical systems and the Internet.

INTERNET OF THINGS (IoT)

In general the term refers to a global system of exclusively detectable interconnected objects that can effortlessly interoperate using communication protocols like RFID, Bluetooth, NFC (Near Field Communication), barcodes, embedded sensors and actuator nodes.

The goal of IoT is: «that all daily life objects equipped with unique identifiers (having specific identities and virtual behaviours) can be linked to the Internet and therefore can be managed as well as connect, communicate and interoperate with each other» (Khosrow-Pour 2015). The concept was initially applied in RFID-tags to mark the Electronic Product Code (Auto-IDLab) (Chen 2012).

Alternative definitions are being suggested: IoIT – Internet of Intelligent Things, as it deals with intelligent devices with adequate computing capacities (Chen 2012); Internet of Smart Things (O'Reilly 2005) as distributed intelligence is a part of it; Internet of Stuff (Bell 2015) due to the possible variety of things to be connected; or The Internet of You (Mims 2013) aiming to include a more affectionate relationship with the user. «The Internet of Things extends the Cloud Computing concept beyond computing and communication to include everything, particularly, the physical devices, Internet of intelligent things and robot as a service» (Khosrow-Pour 2015).

The point is that traditional boundaries between hardware and software are falling, and this disruption, this new software-enhanced, networked physical world needs a name. Internet of Things seems as good as any other.

THE THINGS – ENCHANTED OBJECTS

The Things of this IoT seem to be everything, in due course, and the (un)imaginable amount of objects and data are demanding organization, ontologies.

Efforts are being made concerning Machine to Machine (M2M) international standardization, and the three main groups involved are The Industrial Internet Consortium (<http://www.iiconsortium.org>), The Open Interconnect Consortium (<http://openinterconnect.org>) and the AllSeen Alliance community (<https://allseenalliance.org>), the latter offering the AllJoyn software, publicizing itself as: «the first truly collaborative, open ecosystem for interoperable products and services that will communicate engage and delight users in new, exciting and useful ways.» However, akin to what happens with Cloud Computing and Big Data issues, huge proprietary strategies are at stake: «German firms were trying to strike a balance between forming an international software standard for IoT while simultaneously representing German interests» (Geiger 2014).

As to the Things per se, some call them «enchanted objects» (Rose 2015) endowing them with magical qualities; others envision the objects subjectivity and humanization: «These Things have been called “enchanted objects” due to their capacity to contain their own stories, data-enabled to be actuated, connected, and “talk to other objects”» (Lloyd 2013). And these Things, endowed by humans with sensors and communication protocols, are invading everything. And the users, whenever they see it fit, cannot resist the temptation and will resort to anything to tell a story.

Smart-code

The above referred Auto-ID Labs (<http://autoidlabs.org/>) initial and primary research area was establishing standards for global commerce such as introducing barcodes to the retail industry. These were replaced by Quick Response (QR) codes, whose four information modes, fast readability and greater storage capacity, led them to be artistically used. There are two examples from 2012.



Figure 9: Chicago project - A Poem From Us (2012)
QR code – poetry-tags in objects (barcode)

Felix Jung's The «Chicago project - A Poem From Us» (<http://avoision.com/portfolio/a-poem-from-us>) encouraged visitors to record themselves reading a favourite poem, and to share their videos and thoughts via the project website. It gave free stickers with customized QR code that would display a random poem.

The first enhanced reality QR code made from Portuguese cobblestone and embedded in the ground was created by BeQRious. It welcomes the user and takes her to a site that offers data about Lisbon's Chiado and nearby places, including touristic and shopping information, local culture, commerce and cuisine.



Figure 10: Rua Garrett's QR code (2012)
Urban information Lisbon, Portugal

Smart-homes

The utopian ideal of a smart-home is on the go, and listed in Forbes (Woolf 2014). Home-kit companies are already duelling for a huge future market. A smart-home kit accepts the connection of hundreds of objects among themselves, from the coffee-maker to door security locks.

The main issue is the connection system itself – either the recourse to http via wireless, or the creation of a hub-universal-translator capable of deciphering the multiple protocols and process it all in the Cloud. In all cases the user access is done via smartphone, and the multiple efforts to standardize how multiple connected objects talk to one another is under way.

Smart-wearables

The whole idea of wearable technology - objects that can be used by humans - being smartwatches, smart bracelets, smart glasses or hearing aid devices, is for people to be hands-free, online all the time, with seamless and portable access to the needed data when desired.

Concerning wearables - synonymous with M2M things - some industries, namely e-textiles, are still waiting for truly flexible-circuit boards, strong enough to withstand the demands of clothing and supple enough to contort with skin.

Bendable electronics will allow for a new range of applications, many of which are impossible to achieve using conventional methods.

While waiting for these advances, the hypotheses of some future new referents for «Pillow Talk» have been explored in two 2010 projects.

In the first one by Johanna Montgomery, Scotland, U.K. (<http://www.joannamontgomery.com/Pillow-Talk>) subject of a CNN news-story among other cases (<http://youtu.be/PHrWi7rgxaY>), each user wears a ring, and a small speaker is placed inside the pillow case. The ring picks up real-time heartbeat and transmits it via smartphone App to the other pillow. The purpose is to hear the other's heart-beat. The result aims to be an intimate interaction between two lovers, regardless of the distance between them.



Figure 11: Pillow Talk - smart objects (2010)
J. Montgomery, Scotland, U.K.

The second «Pillow-talk» (<http://obm.media.mit.edu>) comes from M.I.T. and is a project developed by Edwina Portocarrero and David Cranor. It is composed of a seamless voice-recording device embedded in a pillow, intending to capture dreams and that which we normally forget. After the dream is recorded into the pillow, the audio file is transmitted wirelessly to a jar containing shimmering LEDs to display the arrival of a new memory. Electronics in the jar can play back the recordings through a small speaker under its lid when it is opened.



Figure 12: Pillow-talk – smart-objects (2010)
Edwina Portocarrero, David Cranor, MIT, USA

Smart-bodies

Body area networks (BANs) are emergent as enabling technology for many human-centred application domains such as health-care, sport, ergonomics, emergency, security and single assisted living. They consist of wireless wearable sensor nodes coordinated by a static or mobile. The data generated can be processed in real-time by the coordinator, transmitted to a server for processing and storing.

Due to the advance of flexible ultrathin electronics, BANs are being printed directly on the skin and can be worn for an extended period of time, while performing normal daily activities. Bio-stamps, or stick-on electronic Tattoos (<http://rogers.matse.illinois.edu/index.php>) cling to the skin like a temporary tattoo and can measure electrical activity from the body, allowing medical diagnoses and monitoring health conditions noninvasively.



Figure 13: Biostamps - stick-on electronic Tattoos (2011)
smart-objects, epidermal electronics, J. A. Rogers

More intrusive is the aesthetical experience of Tiago Mesquita «The Heart of Living» (<http://theheartofliving.pt>) winner of the Portuguese Young Artists Award (Jovens Criadores) 2014. Tiago implanted a chip on his chest, close to the heart, with a NFC (Near Field Communication) that only requires a smartphone to access the public website where he is recording his memories - images, videos and music at any time. Only he can delete or insert new content.



Figure 14: The Heart of Living – smart-body experience,
chip implant (2014) T. Mesquita, Portugal – Winner of the
Portuguese Award Young Artists (Jovens Criadores) 2014

INTERNET OF THINGS AWARDS

Started in 2011, the IoT Awards (<http://postscapes.com/internet-of-things-award/2014/index>) is aiming to honour the year's best project, companies, and ideas helping to create the Internet of Things in several areas (including the above referred) - connected: Body, City, DIY, Home, Industry & Environment, Open Source, and Technical. These could be considered the main arrays of public and corporate interests.

This year's 4th. edition reached 22 categories. Design Fiction type was accepted from the first moment: «The results may only be props or prototypes — but the best ones, as recognized by the Design Fiction award, end up helping us navigate our near futures and the stories they contain» receiving storytelling devices. The 2011 third runner up was a «Storytelling and Poetry Reciting Chair» (<http://www.mia-kos.com/storytellingchair.html>) by Mia Kos, Zagreb/Barcelona. A chair with sensors became enabled to tell stories and recite poetry when pressure was applied to the sitting part. Technically, was used a small system based on simple electronics and Arduino. The aim was to develop the concept of objects with alerted or enhanced behaviours.



Figure 15: – Storytelling and Poetry Reciting Chair (2011)
Mia Kos, Zagreb/Barcelona - IoT Award 2011-2012

IoT AND STORYTELLING

All of the above mentioned projects and examples imply or refer a narrative and/or some kind of storytelling, but none can fit in the normal categories of fiction, even the latest modes of interactive fiction. The idea of things telling stories is not new, and the objects' information content still requires human input and interaction, but new technologies used for storytelling have reached new heights and complexity, invoking the McLuhan equation «medium is the message» (McLuhan 1964).

The Internet of Things will have to shelter «a narrative architecture with the conventions and tools that will allow people to consume and create stories. Like any new media channel, those conventions might borrow from what came before (just like TV borrowed from live theatre) but we'll

soon discover the unique affordances of the technology and start to create something entirely new» (Thompson 2013).

If a Thing has the capacity to register information, it will surely be – as it has been – used to tell a story. And Things, even in non-artistic fields, have aesthetical aspirations. The struggle comes from existing conventions, short to embrace this kind of mixed Media. IoT fictions are non-linear, a-chronological and a-synchronous narratives, and could be incorporated in the concept of Design Fiction.

The concept of Design Fiction, itself in the making, also implies several and conflicting interpretations (Blecker 2009; Sterling 2009; Tanenbaum 2012), but they seem open enough to come to include and embed the aesthetic requirements of this new kind of literary practice.

This hypothesis can be substantiated by two things: the fact that Design Fiction admits «narrative elements» having the concept of '*diegesis*' at its heart, or: «Design Fictions are events enabling the coupling of things and words» (Hales 2013). One of the globally accepted models-examples of a Design Fiction object is the Newspad from «2001: A Space Odyssey» (1968) – the novel-film signed by Arthur C. Clark and Stanley Kubrik.

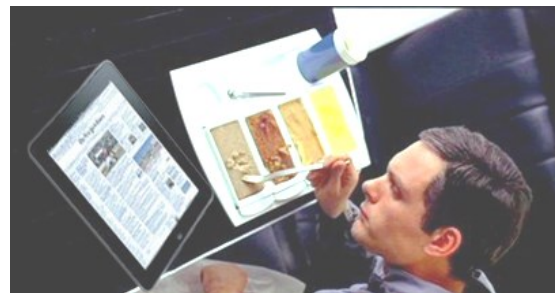


Figure 16: 2001: A Space Odyssey NewsPad (1968)
A. C. Clark, Stanley Kubrik

The main issue would be to unfetter the concept from the field of Science-Fiction allowing it to include/enlarge itself to comprehend all other kinds of fiction, from novels to IoT narratives.

CONCLUSION

The theories and practical examples itemized above allow a glimpse of the speed at which things are changing in the new fields of science invading everyday life.

The increasing weight of user-chooser participation in Cloud Computing and the Internet of Things urges the making of conventions, terminologies and ontologies that may frame their handling in particular in what concerns tagging the objects of IoT – already addressed by some Consortiums and crowdsourcing projects.

As for artistic practices, a new aesthetics seems to be in the making, and the trend towards Mixed Media would require a wider dialogue between its practitioners and Digital

Humanities, Literature (and its branch Science-Fiction) Interactive Fiction and Cyber arts.

In itself, the concept of Design Fiction also implies several contradictory interpretations but they are open and new enough to come to include and embed the aesthetic requirements of this new kind of storytelling practice.

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BIOGRAPHY

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She was a member of the InStory team (2005-2007) – best Portuguese web mobile project 2006. She prepared a project on serious games, PlatoMundi, aiming to introduce e-learning and ethical issues in game playing; she is developing a new project – Numina – that proposes to digitize and study the poetic and dramatic literary estate of José Leite de Vasconcelos (1858-1941), a physician, philologist, ethnologist who founded the Portuguese National Archaeological Museum.

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