TECHNOLOGICAL CONVERGENCE IN AUDIOVISUAL TECHNOLOGIES

Cédric Courtois, Evelien D'heer, and Dimitri Schuurman

IBBT-MICT-Ghent University

ABSTRACT

This paper presents the results of a large-scale survey on viewing practices. Data from over 10,000 cases are used to explore the adoption-use diffusion gap and the correlation structures in the frequencies of the use of multiple channels (e.g. linear television, download, Vod) on multiple devices. The results show that although a lot of devices capable of audiovisual playback are adopted, few (only computers) of them are used to consume television content. Furthermore, in terms of viewing frequencies, the data suggest spill over effects of using multiple devices, rather than a displacement. Finally, it shows there is a stable tendency to use multiple delivery channels within devices, rather than forming a pattern between devices. That is, channels usage frequencies are correlated within devices, rather than scattered among devices.

Keywords: Technological convergence, audiovisual media consumption, delivery channels, affordances, adoption/use diffusion

INTRODUCTION

As audiovisual industries have shifted towards digital production and their delivery channels are increasingly converging, consumers are confronted with a potential ubiquity of audiovisual materials in their daily lives. Television broadcasters are extending their offerings beyond the linear channel by repurposing their content online, offering live streams and video-on-demand (VoD) solutions (Doyle, 2010). Likewise, interactive digital television offers many possibilities in recording, retrieving and thus selecting favored content. Whereas television was the absolute ruler for decades, nowadays many other devices are capable of doing practically the same. Still, there is not that much research on how this potential wealth of choice is appropriated in our everyday audiovisual consumption routines (Tsekleves et al., 2009). A first, crucial question this paper addresses is whether the possibilities of these affording devices are actually embraced. In this respect we will focus on the division between adoption diffusion on the one hand, and use diffusion on the other. The former refers to the adoption rates of technologies themselves, whereas the latter regards the actual use of their functions. In other words, our first concern is what devices are actually incorporated in people's technological repertoires and whether these technologies are actually employed to serve the function of television content consumption.

Furthermore, we dig deeper into how these different devices serve this function and how they are actually used in terms of delivery channels. More specifically, drawing upon niche theory, we assume that different devices are fit into audiovisual technology repertoires because they are able to serve specific goals in terms of channel selection. For instance, television has always been used to consume in a linear fashion, whereas computers connected to the Internet have an almost inherent selective, on-demand character. Hence, we put forward a second research question that addresses the issue of channel use: do we diversify in devices because each device allows an easy access to specific channels, or are channels equally used within the same devices?

Finally, we aim to contextualize these findings by generating a deeper understanding of the results concerning this device-channel use. Therefore, we draw upon theory concerning the construction of technologies and the concept of perceived affordances in particular. As such, insight is gained in how technologies are intertwined and incorporated within peoples' lives, which are increasingly packed with media consumption.

The adoption diffusion - use diffusion chasm

Perhaps the most influential perspective of technology adoption is classically found in Rogers' (2003) work on the diffusion of innovations. This theoretical model plots consumers on a bell curve depending on the timeframe in which they decide to adopt a technology, ranging from 'forerunning' innovators to 'leaping-behind' laggards. Nonetheless, no attention is devoted to what happens after a technology is adopted and how this evolves. As technologies are becoming increasingly multidimensional in the actions they afford, even during their lifecycles, adoption itself covers only a small part of the broader picture. For instance, one might buy a computer, yet only using some basic functions such as a word processor, an e-mail client and a web browser. Still, later on, many other functions could be explored and incorporated in the daily use of the device.

This is where the concept of use diffusion comes into play. Loosely based on the notion of social shaping of technologies (Lievrouw, 2006), it bears the acknowledgement of consumers themselves defining how to employ technologies in their day-to-day lives (Schuurman et al., 2011). This might even be at a great distance of what their producers have intended: it may be much more diverse, thinking out of box, while it might as well be very limited. This can be linked to Norman's (2002) concept of perceived affordances, concerning the extent to which functions of (technological) artifacts are identified within a context of physical, semantic, logical and cultural, hence social constraints. In fact, many devices such

as computers and mobile phones were devised before, but not originally intended to furnish audiovisual consumption.

Still, simply not 'seeing' a use is one possible explanation, while on the other hand, certain functions could be perceived as redundant because other devices already fulfill them. This is especially relevant in the field of audiovisual consumption, given the recent increase of affording devices. As such, it is especially relevant to first get a grasp on what technologies (including peripherals such as VCR and DVD-players) are adopted and how they are combined in what we consider technological repertoires. Secondly, we need to know what technologies are actually used to consume audiovisual television content. Hence, the following two-fold research question is proposed?

RQ1a: What technologies are adopted and fit into a broader technological repertoire?

RQ1b: What technologies are actually used for audiovisual content consumption?

The notion of media niches

Today, multiple technologies are in competition to deliver television content through similar channels. Perhaps a helpful perspective on this kind of situation is the theory of the niche and media spending (Dimmick et al., 2000). It posits that media are all competing for consumers' limited resources (e.g. time, effort, money). As such, consumers need to perform the exercise of assessing what medium allows the highest degree of gratification. As such, new possibilities might push older ones aside in case of a substantial overlap (substitution/displacement). Otherwise, if older media serve gratifications that are difficult to replace, they might persevere and firmly occupy a so-called 'niche'. In sum, the basic idea is that opportunities are judged upon the unique degree to which they are satisfying prior needs.

One of the possibilities why people could detach from the walled garden environment of their television is because for instance the Internet, readily accessible on a computer, has a lot of easily accessible, free (illegal) content to offer (e.g. through news sites, on platforms such as YouTube). As such, a television could be used for linear broadcasts, while a laptop could serve for on-demand streaming and perhaps a desktop with DVD or Blu-Ray unit to play back a disc. On the other hand, if all channels would be used on a single device that is thought of as an equivalent to others, then would there be some kind of displacement taking place? For instance, if a laptop is used to access multiple channels, is there still a need for a television screen? Therefore, we propose an additional research question:

RQ2: How are different channels used on different devices, and why?

METHODOLOGY

Data for this research were gathered within a larger project in collaboration with a Belgian telecommunication provider. A panel of 46,000 people was invited to fill out an online questionnaire. After a post hoc correction for age, gender and geographical location, a number of 13,312 valid cases were retained. This led to an operational sample of 49% males and 51% females, characterized by the following age distribution: 20-29y (16%), 30-39y (17%), 40-49y (20%), 50-59 (17%), 60-65 (7%) and 65y+ (23%). A considerable general penetration of audiovisual playback devices was found within the sample: 99% has a television, 61% owns a desktop, 54% has a laptop and 24% owns a mobile phone capable of playing video.

The survey contained a battery of items inquiring the frequency of which television, laptop and desktop are used to play back content obtained through a variety of channels: linear, carrier (e.g. DVD, Blu-Ray), download/own recording and VoD. The response categories were (a) never, (b) less than once per month, (c) once a month, (d) once a week and (e) daily. Moreover, respondents were asked to indicate what audiovisual technologies and peripherals (e.g. VCR, DVD player) they have and what audiovisual technologies they actually use.

Finally, next to the survey, a number of ten follow-up interviews were performed (Age 20-57, 5M, 5F), inquiring the affordances of audiovisual media technologies. The purpose of these interviews was to gather a better understanding of the main, quantitatively derived results by offering possible, everyday life explanations for what we found earlier on.

RESULTS

Audiovisual technology adoption diffusion

To answer the first research question (Q1a), a latent cluster analysis (Vermunt and Magidson, 2006) was performed on the fourteen dichotomous variables indicating technology adoption. The smallest, yet significantly fitting model, consists of two classes ($L^2(13279) = 7293.01$, $p = 1.00$). A closer look at the results reveals that the first class, from now on referred to as *'traditionalists'*, unveils a rather conservative stance towards audiovisual technologies. This class, representing 68% of the sample, has an absolute probability of owning a television set and demonstrates high chances of having a VCR and DVD player. Moreover, in the majority of cases, they own a laptop and/or desktop computer. The second class, referred to as *'technological omnivores'* has higher probabilities of owning all kinds of mobile devices, such as portable gaming consoles, portable DVD players, and mobiles phones and media players with video capabilities. Moreover, they share higher chances of owning

computers. In terms of socio-demographics, the traditionalists tend to consist of more females (55%), whereas the technological omnivores are more likely to be male (57%). Furthermore, the traditionalists are situated in substantially older age categories (Z = -46.26, p < .001).

< Insert Figure 1 >

Audiovisual technology use diffusion

In the previous section, we analyzed the patterns of technology ownership. Still, many of these devices serve multiple purposes apart from audiovisual playback. Therefore, in line of the second part of the first research question (Q1b), we analyzed what devices are actually used by the members of the two previously discovered classes to consume television content. We calculated ϕ-coefficients to determine the association between two binary variables: cluster membership on the one hand and using a device for audiovisual consumption on the other hand (Table 1). The values should be interpreted as standard correlations, with values ranging from -1 (strong negative association) to 1 (strong positive association). Due to the magnitude of the sample, all associations yield significance. Yet, when we look at the coefficients' magnitudes, they are generally very low and hence insubstantial (Table 1). In fact, only laptops and desktop computers tend to reflect a modest association with the technological omnivores. This means that technological omnivores are substantially more prone to use these devices to consume television content that the others. All other devices are rarely used. That is if they are used at all. In general, we are able to state that although there is a considerable rate of adoption, the specific diffusion of use is quite scarce.

< Table 1 >

Audiovisual technologies and channel use

Secondly, we want to determine whether devices are used in a specific manner in terms of channel connectivity, or if they all serve a similar purpose. To determine this, we performed a thorough analysis of the correlation structure of frequency measures of using a specific type of channel (download/recorded, linear broadcast, VoD and carriers like DVD and Blu-Ray) on a specific type of device (television set, laptop and desktop; mobile phone is excluded due to the low use diffusion). To determine whether the frequencies of channel usage are scattered among devices or whether they a neatly grouped per device, a principal component analysis is performed. This technique allows identifying components of strongly correlated variables, whereas the correlation between these components is minimized. However first, due to the large sample size, three random subsamples were drawn amounting to approximately 33% of the original sample ($N \approx 4700$). The analysis reveals three components, jointly explaining 66% of the variance in the original item pool. Table 2

summarizes the component loadings, eigenvalues, variance explained and internal consistency of the component items. Three components are identified, clearly showing how the frequencies of channel usage are grouped within devices, rather than scattered among devices. This means that within devices, multiple channels are used with devices with a substantial similar frequency.

< Table 2 >

Yet, this is a preliminary analysis. Before we can conclusively state that channels are stably grouped within rather than between devices, we need to confirm these findings and check whether the found component structure also holds up for the other subsamples. Therefore, we engage in a confirmatory factor analysis, which is used to determine whether a proposed (theoretical) model fits with the empirical reality. In this case, we want to investigate if the derived component structure retains its stability for the other two subsamples. Using multi-group structural equation modeling with Asymptotically Distribution-Free estimation for large non-normally distributed measures (ADF; Blunch, 2008), it shows that the model in general fits all three samples ($\chi^2(180) = 1094.87$, $p < .001$, TLI = .96, CFI = .97, RMSEA = .02). Moreover, additional analyses point out that the measurement weights (representing the relation between a component/factor and its measurement items) are invariant over samples ($\Delta\chi^2(9) = 12.61$, $p = .18$). The same is true for the structural covariances (representing the relation between components/factors) ($\Delta\chi^2(6) = 6.33$, $p = .39$). Hence, the results found in the first subsample are to be generalized to the other subsamples as well (Figure 2).

< Figure 2 >

In a second phase, we inquire if there is a difference for the previous finding with regard to the type of technological repertoires. We have found that the technological omnivores have more diverse patterns of technologies at their disposal. Still, both classes have nearly absolute chances of owning a television set and demonstrate fairly high probabilities of owning a computer. Still, subsequent analysis pointed out that in comparison with the traditionalists, the omnivores are more inclined to use their computers to consume television content. Hence, it is not that likely that the model will render the same result for both identified classes. This presumption is confirmed through supplementary analyses. Although the model still fits well ($\chi^2(102) = 985.08$, $p < .001$, TLI = .96, CFI = .97, RMSEA = .03), we find differential measurement weights ($\Delta\chi^2(9) = 3579.70$ $p < .001$) and structural covariances ($\Delta\chi^2(6) = 768.97$, $p < .001$). A closer look shows that the differences in the

measurement model are mostly due to lower correlations between frequencies of using different channels on computers for the traditionalists. Furthermore, the correlations between the components (Table 3) inform that the use of a television is somewhat stronger associated to consumption on a laptop and a desktop. More substantial however is the stronger correlation between desktop and laptop usage frequencies for the omnivores. This means that the usage of different types of computers is more strongly associated.

< Table 3 >

Understanding quantitative patterns

First we recapitulate on the major findings of the quantitative study. They clearly show the prolonged reign of television, accompanied with various peripherals such as DVD and Blu-Ray players. The reasons mentioned in the interviews are quite straightforward, ranging from the tremendous ease of use, the best viewing experience in terms of quality and the ability to engage in comfortable social viewing. Nonetheless, in the group technological omnivores (and in a lesser extent for the traditionalists), several technologies are present as well. Still, a look on the actual use diffusion in terms of consuming television content is rather sobering. We found only small contingencies between technology repertoires and the use of specific devices to view television content. As such, we cannot but conclude that the adoption-use diffusion gap is tremendous in this respect. Only computers render somewhat substantial contingencies. One of the questions we addressed in the follow-up interviews is why these devices are used for audiovisual consumption. The answers showed consistency, regardless of the type of technology profile. It appears that audiovisual consumption has become commonplace during surfing sessions and takes up a substantial amount of browsing time. Also, audiovisual content is ubiquitous during web surfing: links on social network sites, video clips at news sites, sports recaps, etc. either on demand or through live streams. Also, the Internet is often used to search and (illegally) download films and series because they are free of cost and/or hard to find in shops or on VoD platforms. The participants in the follow-up study even claimed that they stick to their laptop (or desktop) computers because it is too much of a bother to transmit content to the television, while they are sufficiently satisfied with screen size and image quality. The younger participants, most of them students, even claimed that a laptop to some extent serves as a 'surrogate' for television, albeit not completely replacing it. Still, this tendency should be understood by their limited means and motivation to acquire their own sets and their apparent mobility from place to place. In general, in the quantitative analysis, we found that there is a modest spill over effect. That is, people watching television more frequently also use their computers more often for a similar

purpose. Still, a general tendency in the quantitative findings is the absence of a substantial use of mobile devices. As little as two participants claimed to have ever used a mobile media player or phone for audiovisual content. Both agree that even for them it is a marginal form of consumption, which is limited to waiting time and commuting. The others could not even think of an appropriate purpose. A general tendency however is that even though the devices are available, they are considered unsuitable due to their size, quality, energy consumption, slow Internet connections and the difficulties of loading audiovisual content onto them.

CONCLUSION

In conclusion, this research has shown that although we own various devices that enable audiovisual consumption, only computers seem to gain field in actually being used. Even so, this is not displacing, yet extending more traditional audiovisual consumption. As such, this should encourage audiovisual media professionals to further engage in repurposing content through online media. Remarkably, channel choice seems to be situated within devices, rather than between devices. This means that there are no cross-patterns, indicating that devices do not really occupy channel niches. Finally, mobile video does not seem to be attaining more than a few enthusiasts, due to a number of technical but also social constraints.

REFERENCES

BLUNCH, N. 2008. *Introduction to Structural Equation Modelling,* London, Sage.

DIMMICK, J., KLINE, S. & STAFFORD, L. 2000. 'The gratification niches of personal e-mail and the telephone: Competition, displacement, and complementarity'. *Communication Research,* 27**,** 227-248.

DOYLE, G. 2010. 'From Television to Multi-Platform : Less from More or More for Less?' *Convergence,* 16**,** 431-449.

LIEVROUW, L. 2006. 'New Media Design and Development: Diffusion of Innovations vs. Social Shaping of Technology'. *In:* LIEVROUW, L. & LIVINGSTONE, S. (eds.) *Handbook of New Media.* London: Sage.

NORMAN, D. A. 2002. *The design of everyday things,* New York, Basic Books.

ROGERS, E. 2003. *Diffusion of innovations,* New York, The Free Press.

SCHUURMAN, D., DE MAREZ, L. & BERTE, K. 2011. 'The chasm between having and using - Adoption versus use diffusion of iDTV in Flanders'. *International Journal of Digital Television,* 2**,** 223-235.

TSEKLEVES, E., COSMAS, J., AGGOUN, A. & LOO, J. 2009. 'Converged Digital TV Services: The Role of Middleware and Future Directions of Interactive Television'. *International Journal of Digital Multimedia Broadcasting*.

VERMUNT, J. K. & MAGIDSON, J. 2006. *Latent Class Analysis* [Online]. Available: http://www.statisticalinnovations.com/articles/Latclass.pdf [Accessed January 30th 2012].

Author bio: All three authors work as researchers at the IBBT (Interdisciplinary Institute for Broadband Technology; www.ibbt.be) research group for Media and ICT at Ghent University's department of Communication Studies (www.mict.be).

Table 1: Figures on use diffusion

	Traditionalists	**Omnivores**	**ϕ**
Television	98	97	.03
Mobile phone	0	3	.10
Portable game console	0	1	.08
MP3 with video	0	2	.10
Other mobile device with video	0	1	.06
Projector/beamer	0	1	.06
Desktop	9	20	.16
Laptop	12	26	.17

Table 2: Principal component analysis results (*Subsample N* = 4719)

	TV component	**Laptop component**	**Desktop component**
TV - Download/Recorded	.91		
TV - Linear	.89		
TV - VoD	.84		
TV - Carrier	.83		
Laptop - Download/Recorded		.84	
Laptop - Linear		.78	
Laptop - Carrier		.77	
Laptop - VoD		.66	
Desktop - Download/Recorded			.81
Desktop - Linear			.78
Desktop - Carrier			.77
Desktop - VoD			.65
Eigenvalue	3.08	2.43	2.39
R^2	.26	.20	.20
Cronbach's α	.90	.78	.77

Table 3: Component correlations per technology repertoire

	Traditionalists	Omnivores
r Television-Laptop	.16[a]	.21[a]
r Laptop-Desktop	.06[b]	.17[a]
r Television-Desktop	.17[a]	.20[a]

Figure 1: Technology repertoires
(included as attachment)

Figure 2: Confirmatory factor analysis (standardized estimates of subsample)
(included as attachment)