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Abstract

New media have made available a wide range of platforms and content choices. However, audiences cope with abundant choices by using more narrowly defined repertoires. Unfortunately, we know little of how users create repertoires across media platforms. This study uses factor analysis to identify user-defined repertoires from data obtained by following 495 users throughout an entire day. Results indicate the presence of four repertoires that are powerfully tied to the rhythms of people's daily lives. These were in turn explained by a combination of factors such as audience availability and individual demographics.

Keywords

agency, audience behavior, audience research, cross-platform consumption, media repertoires, mobile, new media use, online media, structuration, television

The current media environment offers users an overwhelming number of choices. The typical household receives well over 100 TV channels, not to mention the options available 'on-demand.' Internet users can access content at home, work and,

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increasingly, on the go. Media consumption seems to have become an anywhere, any-time proposition. Yet, no one person uses all these media. Instead, people cope with the abundance of choice by relying upon relatively small subsets, or 'repertoires' of their preferred media. Unfortunately, we know very little about the kinds of repertoires that users create in rich media environments. This study analyzes media consumption across platforms with an eye toward identifying repertoires defined by user behaviors. In doing so, we integrate the role of social practices and individual traits in explaining patterns of use in the age of new media, filling an important gap in research on cross-platform audience behavior.

We begin by outlining a broad theoretical framework for understanding media repertoires. This highlights the role of structural factors and habits in shaping user behaviors. We then review the literature on channel and media repertoires, leading to our research questions and hypotheses. We test these propositions with a factor analysis of data that were collected by following 495 people throughout an entire day, recording all forms of media use at 10-second intervals. Of these 495 subjects, 476 were observed again after six months. Four factors emerged, suggesting that, even in the new media world, media repertoires are powerfully tied to the day-to-day rhythms of people's lives.

Theoretical perspectives on media use

The literature on media use offers two rather different theoretical perspectives. The first focuses on how structures, such as program schedules, shape media consumption. The second highlights the importance of psychological factors, like needs and preferences, in determining media choice.

The 'structural' perspective emphasizes the importance of factors such as audience availability and access to media technologies in shaping audience behavior. This approach has been used to study the influence of program-scheduling characteristics on television audience duplication, including channel loyalty and repeat viewing (Cooper, 1996; Goodhardt et al., 1987; McDowell and Sutherland, 2000; Webster, 2006). Research of this sort often uses aggregate measures of media consumption, for example ratings data. In these studies, structural factors explain a high percentage of variance in television viewing.

The second approach has been dominant in social psychology and communication. This perspective assumes that people are active agents who make purposeful, rational choices when they consume media. This approach is typified by 'uses and gratifications' research, that sees media consumption as a mechanism to gratify individual needs (Katz et al., 1973; Peck and Malthouse, 2010; Ruggiero, 2000), and other theories that focus on psychological states and predispositions as precursors to media choice (Hartmann, 2009). Economists often take a similar approach. Their models of program choice assume media consumption is shaped by well-informed 'program type' preferences (e.g., Owen and Wildman, 1992).

There have been various attempts to integrate these traditions. Some have focused primarily on explaining television program choice (e.g., Cooper and Tang, 2009; Webster and Phalen, 1997; Webster and Wakshlag, 1983; Yuan and Ksiazek, 2011), others address

all manner of digital media consumption (Webster, 2011; Webster and Ksiazek, 2012). Many of these recent studies have adapted Giddens' (1984) theory of structuration as a way to understand how individuals operate within the media environment. In a nutshell, this work sees agents (media users) drawing on the structural resources of the media to achieve their own ends. These resources include the available technologies, programs and services. As agents use media, they reproduce and alter the structural features of the environment. In this view, agency and structure are mutually constituted, something Giddens called a 'duality' (1984: 25).

How then might these theoretical perspectives inform our thinking about media repertoires? The increasing availability of on-demand media at home, work, and on the go, would seem to mitigate the power of structures such as program schedules and patterns of availability. In a world of anywhere, anytime media, it is tempting to think that individual needs and preferences are all researchers would need to understand how and why people manage their media resources. Yet, Giddens himself offers a note of caution: even though agents are free to do what they want when they want, routines and habits often play an important role in guiding behavior. He notes that a fundamental concept in structuration is 'routinization' (Giddens, 1984: 60). That is, actions often have a recursive or habitual quality that is deeply embedded in the structured routines of everyday life. Media use is well known for its habitual qualities, which are often timed to patterns of work, leisure, and commuting (LaRose, 2010; Rosenstein and Grant, 1997; Webster and Phalen, 1997). It may well be that the structural features of social life still leave their mark on how people organize their use of media into various repertoires. This study investigates how patterns of availability and individual traits influence repertoires of media use.

Repertoires of media use

Technological developments have caused media options to expand rapidly. The advent of cable television made a large number of channels available to an average household. With more channels available to watch, audience attention became more fragmented (Webster, 2005). The growth of the internet, mobile devices, and other nonlinear media (e.g., DVDs, DVRs), has further expanded people's options by making media content available online. This cross-platform availability of content has also given users greater autonomy to structure their consumption patterns by making content available on demand (Napoli, 2011). Yet, the *time* people have for consuming media remains finite. How users cope with an abundance of media supply thus becomes an ever more pressing question.

Studies have consistently found that users do *not* divide their time consuming all available media (e.g., Heeter, 1985). They instead create subsets of all available options and consume content from this smaller set. These subsets are referred to as *repertoires*. Almost all early studies on repertoires were focused on repertoire formation in television viewing. These consistently found that, on an average, viewers watched a fraction of television channels received by their household. Subsequent studies have expanded the concept of repertoires beyond television viewing, to interpret consumption patterns across multiple media. In the following paragraphs we examine this body of literature.

Channel repertoires

The term 'channel repertoire' is defined as 'the set of channels watched regularly by an individual or household' (Heeter, 1985: 133). Heeter et al. (1983) found that while cable households received 34 channels, on average they watched less than 10 channels a week. This subset of channels was, according to Heeter (1985), a mechanism to cope with an increasingly abundant and complex media environment. Other early studies (Ferguson, 1992; Lochte and Warren, 1989) were consistent with what Heeter et al. (1983) found. Even as the number of channels available and cable adoption grew, researchers continued to find that viewers, on average, were watching a fraction of available channels (Ferguson and Melkote, 1997; Neuendorf et al., 2001). In 2008, The Nielsen Company reported that US television viewers only watched about 14% of channels available in an average household (Nielsen, 2009, July 17). Yuan and Webster (2006) found a similar pattern in China, where an average viewer watched only one third of all channels available.

The majority of these studies identified structural factors as the best predictors of channel repertoires. These included access to cable and audience availability. For example, Heeter (1985) found cable subscription to be a significant predictor of channel repertoires. Ferguson (1992), when testing for the impact of remote control devices (RCD), again found cable subscription to be the most significant predictor. When cable subscription was controlled, RCD use was able to explain only an additional 2% of the variance in channel repertoire.

A second structural factor that explained channel repertoires was audience availability, usually operationalized as time spent viewing television. Unfortunately, accurate measures of time spent viewing are difficult to obtain through self-reported surveys. Although most early studies relied on self-report data to measure repertoires, Yuan and Webster (2006), using peoplometer data, found that cable subscription and time spent viewing accounted for 65% of the variance in channel repertoires. The use of peoplometer data enabled them to explain more variance than any prior studies.

Some studies (e.g., Heeter, 1985; Neuendorf et al., 2001) did show that viewers' age and education had a significant impact on self-reported repertoires, but these factors explained relatively little variance. When repertoires were established using passive measures of consumption (e.g., Yuan and Webster, 2006) individual variables were not found significant. This is because, by setting a minimum time spent with a channel as a criterion to qualify a channel as viewed, a researcher is able to distinguish between viewers who just encounter channels during random surfing (and may report as having watched these in surveys) from those who actually watch a particular channel.

User-defined media repertoires

The studies reviewed so far were all, in one way or another, counting the number of television channels watched by households or individual viewers. The first study on media repertoires to include multiple platforms was conducted by Reagan (1996), which concluded that users who are especially interested in a topic access a greater number of sources to obtain information on that topic. Moreover the study found that different combinations of media are used by respondents in constructing an information repertoire for

a given interest area. For instance, the repertoire of sports-related content was explained by a combination of television viewing, and reading newspapers as well as magazines, but the repertoire of national news was explained by only one medium (television). The study emphasizes that research on repertoires should 'move away from the ambiguity caused by labeling people as "television oriented" or "newspaper oriented," and perceive them more as users of cross-channel clusters of information sources' (Reagan, 1996: 118).

The approach taken by Reagan (1996) forces repertoires on audiences by asking them to choose from a preset list of repertoires. An alternative approach is to let repertoires emerge from patterns of use. Van Rees and Van Eijck (2003) employed such a user-defined approach in identifying media repertoires. They analyzed survey data measuring time spent with 19 medium/content types at half-hour intervals. The repertoires that emerged were a combination of medium and content preferences. For instance, local television, regional newspapers and public television constituted a repertoire that was consumed by respondents over 55 years old. Another repertoire, which included opinion magazines and other serious news sources, was explained by education and status. Van Rees and Van Eijck (2003) concluded that 'content and medium type are not independent: serious information is mostly gathered through folio media' (p. 487), while broadcast media played a more important role in offering entertainment. Similar repertoires were revealed in a study of the German market (Hasebrink and Popp, 2006); females used a repertoire termed 'low information,' while males, particularly those who had retired, used 'television and newspapers.' Yuan (2011) also found similar results among Chinese audiences, where the majority accessed news from two or three media and their repertoires were explained by their news agendas.

Research questions and hypothesis

The studies reviewed above suggest that as people have more media options to choose from, they cope with this abundance of supply by creating repertoires of selective media use. The studies on cross-platform repertoires (Hasebrink and Popp, 2006; Van Rees and Van Eijck, 2003) also suggest that repertoire formation is a 'complex interplay between the media and the content' (Hasebrink and Popp, 2006: 383). Since these studies were conducted, the media environment has only become more complex with increased fragmentation and audience autonomy (Napoli, 2011). Further, the existing literature on media repertoires suffers from a number of shortcomings.

First, although audience availability seems to predict channel repertoires, it has always been operationalized by time spent viewing television (excepting Cooper and Tang, 2009). Such a measure does not include the time a user may be available to consume a medium but decides to do other things. For instance, a person who is at home on a certain evening decides to read a book and not watch TV at all. She was 'available,' but decided against 'viewing.' Using 'time spent viewing' as a measure of availability incorrectly counts her as unavailable for that evening.

Second, although digital media platforms, especially those enabling 'anytime, anywhere' access to content, may allow users greater freedom to exercise their preferences, the role of structures in shaping consumption patterns should not be discarded (Cooper

and Tang, 2009; Webster, 2011). Unfortunately, studies on cross-platform media repertoires (Hasebrink and Popp, 2006; Van Rees and Van Eijck, 2003, Yuan, 2011) use only individual demographics or content preferences to explain media repertoires. This is also in sharp contrast to earlier research on television channel repertoires where availability and access were the more significant predictors of repertoire size.

Third, these studies (Hasebrink and Popp, 2006; Van Rees and Van Eijck, 2003; Yuan, 2011) rely on self-reported media consumption. Yuan and Webster (2006) used behavioral data and were able to explain a larger percentage of variance in television repertoires than all other studies that relied on self-reports. This is because self-reports of media use are often inaccurate. As more options become available across multiple platforms to most users, users may find it more difficult to recall their usage. For instance, Prior (2009) found that self-reported news consumption was highly exaggerated (3 times, on average) compared to estimates obtained from peplemeter data. Therefore variables such as time spent viewing are more accurately measured through passive methods.

Fourth, these studies are purely exploratory in nature. They reveal repertoires of cross-platform use, but do not test them on another sample or at another time period on the same sample. This makes it difficult to assess the external validity and reliability of these repertoires to determine whether they would remain consistent in other situations of media use or if they were simply a function of the particular viewing period in which consumption was measured.

The next section summarizes how our study overcomes these limitations. Our first objective is to interpret the patterns of formation of user-defined repertoires in cross-platform media environments. This leads to the following question:

RQ1: What repertoires of media do users create when they are able to consume content across multiple media?

Based on the literature, we further posit that whatever repertoires emerge, they will be determined by both patterns of audience availability and individual traits of consumers. This leads to the following hypothesis:

H1: Both audience availability and individual demographics will each explain user-defined media repertoires.

Method

As already noted, a reliance on self-report data was a limitation of both prior studies that explored cross-platform media repertoires. However, there are no ongoing syndicated research reports that measure consumption by observing the same respondent across different media. The availability of behavioral data on cross-platform media use is therefore a challenge (Taneja and Mamoria, 2012). We obtained such data from a study commissioned by the Council for Research Excellence (henceforth CRE), to understand cross-platform audience behavior. CRE is an independent group of research professionals who are also clients of the Nielsen company (a US company that provides syndicated data on

consumer media use in many countries worldwide). Funded by Nielsen, CRE conducts research to advance industry-wide understanding of audience behavior.

Data collection

The data were collected in 2008 by observing a representative sample of US adults, who were former panelists of the Nielsen TV peplemeter panel. Subjects were recruited through telephone calls based on a list provided by Nielsen. A sample of 495 subjects was observed in spring (Round 1, response rate 13%). Later in fall 476 of the original respondents were observed (Round 2, response rate 12%). The response rates are lower than in most face-to-face surveys due to the high respondent involvement in the research and the long observation period (2 days) (Groves et al., 2009). The observations took place in six geographically dispersed Designated Market Areas (DMAs). The subjects' ages ranged from 18 years to 95 years (mean 46 years, SD 16). The sample had 53% females and 70% were employed full time or part time. Half were at least college graduates and another 45% had graduated from high school. Most respondents (87%) subscribed to cable or satellite television, 85% had home internet access and 70% owned mobile phones.

Each subject was observed twice for a full waking day, first in spring (April and May) and once again in fall (September and October). Throughout the day, at intervals of 10 seconds, the observers recorded the subjects' location, activities being performed and their media consumption. If they used two or more media platforms simultaneously, the observer recorded each platform's usage separately. If media were consumed simultaneously while performing another activity, for instance listening to radio while cooking, the other activity was also noted. The observers also followed subjects to work, friends' houses, stores, etc. The observations were logged on a handheld device the size of a notebook computer. To avoid fatigue, observers worked 8-hour shifts. An entire waking day for most subjects could be observed with two shifts.

Specific vehicles within each medium were not recorded, but distinctions in content types/genres were made. We will henceforth use the term 'media item' to refer to each medium or genre reported separately in the study (consistent with Hasebrink and Popp, 2006; Van Rees and Van Eijck, 2003). Observers recorded use of 59 such media items. These can be broadly classified into print, audio, and video. Within print the four items reported are newspapers, books, magazines, and other print (e.g., direct mailers). Audio items include broadcast radio, satellite radio, car stereos, CD players, and other portable audio devices (mp3 players, iPods, etc.). Since video media items were the largest in number, CRE categorized each of them into one of the four screens (i.e., TV, computer, mobile, and other).

For the television screen, viewership of live and time-shifted TV (viewed through digital video recorders) has been separately noted. Video consumption such as viewing DVDs, playing games using consoles (such as Xbox) and other devices where viewing took place on the television screen are the other items categorized within this screen. Although the television channels watched are not noted, the observers have noted whether the subjects watched news, entertainment, or sports, were randomly surfing channels, or watching commercials.

The subjects' usage of computers is noted in the form of various online and offline activities. Offline activities include working with professional software (such as MS Office), and watching CDs, DVDs or a video stored on the computer's hard drive. Emailing, instant messaging, searching the internet, streaming videos and accessing news and sports websites are some of the online activities reported. Similarly for mobile phones, tasks like talking, text messaging, accessing the internet, viewing videos and listening to audio are reported separately. The 'other' screen refers to media items not categorized under the first three screens such as navigating GPS, viewing TV at a public place, and watching a movie in a theater.

Analysis

Our objective was to explore macro-level repertoire formation and therefore we aggregated the data over an entire day by computing the total time each subject spent on the days he/she was observed at each location, and time devoted to each of the 59 items. These aggregate measures were used in subsequent analyses.

Repertoires form when audiences choose a subset from available media options. However, instead of researchers imposing predefined categories (e.g., Reagan, 1996) it is best to let user-defined repertoires emerge from patterns of use. Factor analysis is an appropriate data reduction technique for this purpose. In this study, we use both exploratory and confirmatory factor analysis. An exploratory analysis using principal component analysis was first conducted on Round 1 data to determine user-defined media repertoires. These repertoires served as the scales for the confirmatory factor analysis on Round 2 data. Once these repertoires were confirmed, we conducted a multiple regression analysis using the repertoires obtained from the factor analysis of Round 2 data as dependent variables. We included both audience availability and individual demographics in these models, operationalized as follows.

Audience availability. Although availability has explained a large amount of variance in studies on channel repertoires, as already noted, time spent with a medium does not fully capture a person's availability to consume a medium. Instead, a better measure is the actual time spent at a location where the person has an opportunity to use a medium. For instance, when a person is at home, he is available to view television and when the person is commuting he is available to use portable devices such as mobile phones. We operationalized audience availability through three measures: time spent at work, time spent at home, and time spent commuting during a day.

Individual demographics. Demographics are known to influence media repertoires as shown by prior studies (see previous section). The five variables we included were age, gender, education, income level, and employment status.

Findings

Many of the 59 media items measured had a large percentage of zeros, indicating that the vast majority of people did not use these items at all. In particular, 7 items had more than

99% zeros and 17 had more than 95% zeros. These are niche media types (e.g. listening to radio on a GPS device) and there was little variation in usage across people. We therefore eliminated them from our factor analysis. All variables, which measure the amount of time with a media item, had right-skewed distributions and we logged them to make their distributions more symmetric and stabilize their variance, since the variance of count and amount variables often increases with their means (Malthouse, 2001).

We ran an exploratory factor analysis on the logged versions of the remaining 42 items (from Round 1 data), and 14 factors had eigenvalues greater than 1. For 10 of the 14 factors alpha was substantially less than 0.6, indicating low reliability. Some had only one or two items loading on them, and many of the factor loadings were small (e.g., < 0.5), indicating that the items had only modest correlations with the factors.

Of these 14 factors, four had values of alpha greater than 0.6. These contained a total of 16 items, and each factor had at least three items. We re-analyzed these 16 items with another factor analysis, and the results were very good. Four eigenvalues were greater than 1 and a scree plot indicated that the four-factor solution was reasonable. Together these four factors explained over 54% of the variance in the 16 items. The loadings (greater than 0.3) are shown (after a varimax rotation) in Table 1. Most of the loadings are greater than 0.7, indicating strong correlations with the respective factors.

We call the first factor the 'computing for work' repertoire. Email has the largest loading on this factor and work-related software (e.g., MS Office) the second largest. Internet use in this repertoire seems to be for information search rather than entertainment, since

Table 1. Principal components, Round 1 ($N = 495$).

Variable	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1 – Computing for Work ($\alpha = 0.79$)				
Email	0.7522			
Web other	0.7486			
Software office/work	0.7312			
Software other	0.6394			
Web search	0.6210			0.3425
Factor 2 – Television Viewing ($\alpha = 0.71$)				
Commercial/Program promotion		0.8486		
Entertainment/Info program		0.8051		
News program		0.6495		
Channel surfing		0.5729		
Factor 3 – Media on Mobile ($\alpha = 0.60$)				
Mobile text/Multimedia messaging			0.7530	
Mobile talk			0.7086	
Mobile other			0.6185	
Mobile web			0.5696	
Factor 4 – Media Online ($\alpha = 0.62$)				
Online video sites				0.7913
Digital video streaming				0.7332
Web news and sports	0.3687			0.5777

we find large loadings for non-video-based internet content such as search engines and other information-based websites (e.g., company websites). A weaker loading of web news and sports suggests that usage of news websites is somewhat unrelated to other items that constitute 'computing for work.' We call the second factor the 'television viewing' repertoire. Entertainment programming and commercial breaks/program promotions have the largest loadings followed by news programs. Another characteristic of TV viewing, random channel surfing, is also captured by this repertoire.

The third factor, which we call the 'media on mobile' repertoire, combines the different uses of mobile phones. Mobile talk and text messaging are platforms with the highest loadings on this factor followed by internet access on mobile phones. Another item with a strong loading is 'mobile other,' which captures the use of a mobile phone as a camera, camcorder, and voice recorder.

The fourth factor is what we call 'media online,' since it combines different media sources available on the internet. Users of this repertoire access the internet for news and sports, stream videos and visit websites of media companies. Interestingly, web search has a relatively weak loading on this repertoire, reflecting the differences in web use for information search versus entertainment. It is also interesting to note that although both 'computing for work' and 'media online' are repertoires created around a common medium, the computer screen, the types of content accessed are remarkably different.

All repertoires had reasonable reliability as indicated by the alpha values reported in Table 1. If the media repertoires identified above are consistent, these scales should replicate when tested with another instance of similar data. We tested this with a confirmatory factor analysis on data obtained from observations made in the fall (Round 2). The standardized loadings are shown in Table 2 and the model fits acceptably well with a GFI = 0.94, CFI = 0.92, NNFI = 0.90 and RMSEA = 0.054 (Hatcher, 1994). Convergent validity can be evaluated by examining the *t*-statistics of the factor loadings, which range from 6.6 to 19.1. Thus, all *t*-statistics are much greater than 1.96, supporting convergent validity. We also evaluated discriminant validity by re-estimating the confirmatory factor analysis model six times, each time fixing one of the six covariances between the factors to 1 (note that there are $4 \text{ choose } 2 = 6$ possible covariances). The minimum chi-square statistic increase across the six models was 32, which is highly significant indicating that the full model with all six covariances is better than the reduced models. This supports discriminant validity (see Hatcher, 1994 for detailed explanations of confirmatory factor analysis). The consistency of these patterns observed in the two rounds suggests that the repertoires obtained in Round 1 were not a manifestation of consumption on a particular day but have some underlying theoretical basis.

Table 3 shows the correlations between these factors, which were estimated from the confirmatory factor model. As one would expect, 'computing for work' is negatively correlated with 'television viewing', but has a strong positive correlation with the 'media online' and 'media on mobile' repertoires. A plausible explanation could be that those who work tend to use computers and mobile phones more, because of their jobs and commutes, while those who do not work stay more at home and consume more traditional media.

Table 4 describes the amount of time spent with each repertoire. We first added the total time with all of the activities that load on each of the four factors. For example, the total time (hours) with the 'computing for work' repertoire for each

Table 2. Confirmatory factor analysis standardized loadings, Round 2 (N = 476).

Factor 1 – Computing for Work	
Email	0.7996
Web other	0.7334
Software office/work	0.6389
Software other	0.3926
Web search	0.5591
Factor 2 – Television Viewing	
Commercial/Program promotion	0.9562
Entertainment/Info program	0.7027
News program	0.4825
Channel surfing	0.3118
Factor 3 – Media on Mobile	
Mobile other	0.4111
Mobile talk	0.6013
Mobile text/Multimedia messaging	0.6034
Mobile web	0.3820
Factor 4 – Media Online	
Online video sites	0.4537
Web news and sports	0.6793
Digital video streaming	0.4704

respondent is the sum of the time spent with ‘email,’ ‘web other,’ ‘software office/work,’ ‘software other,’ and ‘web search.’ The minimum amount of time across the 476 respondents for each of the four repertoires was 0. The quartiles, 95th percentile and maximum value of time spent in hours during a single day are shown in columns 2–6 of Table 4. ‘Television viewing’ is the most common repertoire, followed by ‘computing for work,’ ‘media on mobile,’ and ‘media online.’ These measures could double or even triple count media consumption, since people could be, for example, online, talking on their mobile phone, and watching television simultaneously. All four distributions are clearly right skewed, which is common with amount and count variables.

To address the right-skewness problem, the logs of the time spent with the individual activities were factor analyzed, and the resulting factor scores are weighted averages of

Table 3. Correlation between factors estimated from confirmatory factor model (N = 476).

Factors	1	2	3	4
1. Computing for work	–	–0.31**	0.45**	0.72**
2. Television viewing		–	–0.18**	–0.12
3. Media on mobile			–	0.25**
4. Media online				–

** $p < 0.01$.

Table 4. Descriptive statistics of repertoires, Round 2 (N = 476).

Repertoire	Total hours					Mean (logged items)	
	Q1	Median	Q3	P95	Max	Mean	SD
Computing for work	0	0.68	2.73	8.01	19.44	2.10	1.64
Television viewing	1.32	3.13	6.36	12.38	17.23	3.79	1.61
Media on mobile	0	0.15	0.54	1.66	6.83	1.19	1.02
Media online	0	0	0.13	1.55	7.80	0.81	1.17

the log activities. We formed a simple estimate of the factor scores by averaging of the logged variables loading on each factor, which we used in the subsequent regression analyses. The last two columns of Table 4 give the mean and standard deviation of the factor scores. The conclusions are similar to those from the total time spent, showing that 'media at home' is the most common repertoire.

The analysis presented in the preceding paragraphs sufficiently answers RQ1. We find that in an environment marked by an abundant content supply across a large variety of media, users create well-defined patterns of media use.

We estimated four regression models to examine which variables predict each of these repertoires. In each model, the dependent variable was repertoire use as measured by the factor scores described above. Independent variables included audience availability and individual demographics. As explained earlier, audience availability was measured using three variables: time spent at work, time spent at home and time spent commuting. (We logged them because their distributions were right skewed with outliers, and logging them symmetrized their distributions and reduced the influence of outliers). We found, as expected, that time spent at home and work had a strong negative correlation. Consequently, these two variables were never included in the same model. Therefore, in predicting the 'television viewing' repertoire 'time spent at home' was used as a measure of audience availability. Conversely 'time spent at work' was used in predicting the 'computing for work' repertoire. Similarly in predicting 'media on mobile' and 'media online' we used 'time spent at work' instead of 'time spent at home' as these two repertoires had positive correlations with 'media at work' (Table 3). The Variance Inflation Factor (VIF) for all other predictors in each model was below 1.5 indicating little or no multicollinearity. Time spent commuting was included in all four models. Age, income, gender, education (measured as completed school years), and employment status (employed or unemployed) were the individual characteristics used. We used these regression models to test hypothesis 1.

In each of these models we find that both individual traits and availability significantly predict user-defined repertoires, which supports the hypothesis. A look at Table 5 indicates that audience availability is a crucial determinant in explaining media repertoires. At least one of the three measures we used for audience availability is a significant predictor of repertoires in all four models. Thus, 'time spent at work' and 'time spent at home' are highly significant predictors of 'computing for work' and 'television viewing', respectively. Additionally, 'time spent at work' explains 'media on mobile' and has a weak positive relation with 'media online.' This suggests that users talk on their mobile phones in

Table 5. Regression models to predict repertoires ($N = 476$).

Predictors	Computing for work		Television viewing		Media on mobile		Media online	
	B	t	β	t	β	t	β	t
Structural								
Time at work (Log)	.471***	7.912			.104**	2.594	.116*	2.328
Time at home (Log)	–	–	1.570***	6.670	–	–	–	–
Time in commute (Log)	–.124	–.1503	–.025	–.268	.115**	2.078	–.197**	2.832
Individual								
Age	.014**	–3.414	.021***	4.422	.026***	–9.045	–.007*	2.102
Gender (male)	–.017*	–2.469	.015*	2.021	–.001	–.124	–.010	1.761
Employed full time	.344*	2.182	–.093	–.557	.190	1.789	.289*	2.182
Education	.290***	9.666	–.121***	–3.735	.020	.985	.140***	5.533
Income level	.005	1.030	.008	1.640	–.003	–1.032	.002	.527
<i>R-squared</i>	.375		.231		.263		.141	

* $p < 0.05$, ** $p < 0.01$ *** $p < 0.001$.

offices. They might also sparingly access the internet for leisure from their workplace. Time spent commuting is positively related to ‘media on mobile’ and negatively related to ‘media online.’ This finding suggests that users who spend a lot of time commuting are heavier users of their mobile phones as they are the only available media during this time.

Two individual characteristics, age and education levels, play significant roles in predicting user-defined repertoires. Education has a positive association with the ‘computing for work’ and ‘media online’ repertoires, but a negative association with the ‘television viewing’ repertoire. These findings suggest that highly educated users and those who use computers at work tend to access more ‘media online.’ This seems natural as most office computers are connected to the internet. Age significantly predicts three of the four repertoires. We find that older people are more likely to watch television, less likely to use ‘computing for work’ and even less likely to use mobile devices. Gender and employment status emerge as either very weak or insignificant predictors of user-defined repertoires. Income does not have a significant relationship with any of the repertoires. We examined for the presence of interactions between age and employment, as well as education and employment, but they were not significant.

Discussion

Our study identified four distinct repertoires that Americans use to manage a growing supply of media content and services. The results offer a parsimonious illustration of cross-platform media use in an increasingly abundant and complex environment. As both academics and practitioners are just beginning to make sense of how individuals consume media in this dynamic digital age, our study lays the groundwork for this emerging body of research. At first glimpse, the repertoires appear to reflect simple affinities for specific media that are available to users at given locations. A closer examination

suggests that the composition of these repertoires is guided by the social context within which the medium is used.

The patterns of availability and use, we observed, are deeply embedded in the rhythms of day-to-day life such as work, leisure, commute, and sleep. The repertoires created by our respondents are essentially structures that are recursively activated within their daily social practices. Users thus rely on habit and iteration in creating their media repertoires, reflecting the agentic dimension of routinized action (Giddens, 1984). However, apart from this 'iterative' aspect, human agency also has a 'practical-evaluative' dimension, which reflects the 'unproblematic patterns of action by means of which we orient our efforts in the greater part of our daily lives' (Emirbayer and Mische, 1998: 975). The user-defined repertoires evidenced by our subjects reflect both these dimensions of agency as we note in a closer examination of each repertoire that follows.

The largest repertoire in terms of time spent is 'media at home' that weds a place-based medium (television) to its predominant uses. Although, as expected, this repertoire is more common among older viewers and those with lower education (compared to 'media at work' and 'media online'), the large mean suggests that television, on average, remains the most-viewed video platform, with viewer availability at home its most salient explanation. Further, negative correlations of 'media at home' with 'media at work' and 'media on mobile' also illustrate that usage of repertoires is driven by availability. Finally, the usage of 'media at home' is uncorrelated with 'media online' suggesting that access to on-demand media (85% had home internet), does not displace linear television viewing. In sum, we can conclude that linear television remains a predominant visual media source, illustrating the importance of routines in determining media use in the digital age.

Likewise, two distinct repertoires – 'media at work' and 'media online' – are both constructed by platforms accessed through the computer screen. These are evidenced by similar users (better educated people) and have a high correlation. Yet the platforms that make up these repertoires are distinct (see Tables 1 and 2). Time spent at work could strongly predict the former but not the latter. In other words, people were predominantly using computers for office productivity during work hours, occasionally accessing news and sports websites. This result illustrates the 'practical evaluative' dimension of agency, where users exercise their choices in ways that create repertoires, acting within structural constraints. Similarly we find that the 'media on mobile' repertoire is evidenced during one's commute, when other media are unavailable, even though mobiles are available at all other times.

The fact that repertoires are tied to specific media offers an important insight into media use in a digital age. Theorists might well have expected user-defined repertoires to be more closely wedded to content genres than medium types. For instance, we could have evidenced a 'news' repertoire that combined internet and television news (e.g., Dutta-Bergman, 2004; Yuan, 2011). Likewise repertoires could have emerged based on 'sport' and 'entertainment.' Similarly platforms like email, instant messaging and mobile text messaging could have constituted an 'interpersonal communication' repertoire. Indeed, prior studies on cross platform repertoires (Hasebrink and Popp, 2006; Reagan, 1996; Van Rees and Van Eijck, 2003) have revealed such findings. Our results, therefore, are novel and a significant point of departure. This we would attribute to both theoretical and methodological differences from earlier studies.

First, prior studies did not consider the role of availability in explaining media repertoires. This, in our opinion, was a major theoretical drawback since availability has historically explained much variance in different aspects of television viewing. Second, earlier work relied on self-reports, a method prone to inaccuracies (Prior, 2009) and one that probably overemphasizes the role of preferences in media choice.

Of course, no method is perfect. Certainly in our data, having someone watch respondents use media throughout the day may have led subjects to limit their consumption to socially desirable content choices. However, two factors mitigate these concerns. First, our study is limited to platform and genre use (CRE did not measure consumption of individual channels, programs, and websites). Second, our respondents are former Nielsen panelists, who may have been better acclimated to their roles as research subjects.

According to a recent review on online news consumption (Mitchelstein and Boczkowski, 2010) existing approaches in scholarship on online media use 'have generated valuable knowledge, but have also exhibited ... important limitations: the assumption of a division between print, broadcast, and online media; the notion that the analysis should treat media features and social practices separately' (Mitchelstein and Boczkowski, 2010: 1093). In this study, the use of cross-platform data enabled us to take an analytic approach that avoided a 'division' between traditional and new media. Further, by measuring subjects' locations and activities in addition to media use, we were able to integrate 'social practices' with media consumption.

In sum, this research makes both theoretical and methodological contributions to the study of media repertoires. To our knowledge, this is the first research to use a combination of individual demographics and patterns of availability to explain user-defined cross-platform media repertoires. We find that audience availability, which has been a powerful determinant of linear TV viewing, continues to shape repertoires. This suggests that despite the increased prevalence of anytime, anywhere digital platforms, daily routines and the media structures that support them still play an important role in shaping patterns of media use. At the same time, individual characteristics, such as age and education, also contribute to this more nuanced explanation of audience behavior.

In a world where users move in rapid succession from one media platform to another, studies relying on simple self-reports of media use will be increasingly problematic. We were fortunate to have access to cross-platform behavioral data, providing us with highly accurate measures of audience availability. Prior studies measured availability as time spent viewing, overstating its importance. We overcame that limitation by accounting for times users were available but did not consume a medium. Our models therefore avoided an overemphasis on either structural or individual determinants to predict media repertoires. Moreover, we were able to replicate our initial analysis with a second round of data.

Newer media technologies are proliferating at a fast pace. Many platforms that we included, such as online video and mobile internet, have become more common since our data were collected. Other platforms that we had to exclude due to low consumption levels, such as TV viewing through DVRs or online social networking, have grown in penetration. Consequently, future studies would do well to incorporate an even wider variety of platforms. Perhaps the use of larger sample sizes and the inclusion of more discrete media resources will reveal more granular and fully elaborated repertoires.

However, our findings strongly suggest that these will reflect not only individual needs and preferences, but also how users commandeer the available media resources to manage the routines of day-to-day life.

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