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Caj Södergård



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A word from the Guest Editor

Caj Södergård

VTT - Technical Research Centre of Finland, Espoo

E-mail: Caj.Sodergard@vtt.fi

Content technologies provide tools for processing content to be delivered via any media to the target audience. These tools are applied in numerous ways in media production. Research into content technologies is very active and opens new possibilities to improve production efficiency as well as to enhance the user experience and thereby the business value of media products and services.

This thematic issue focuses on several applications of content technologies. All papers address the user, and the ability to objectively measure and predict the responses various content causes in users is a much needed tool for the media professional. An emerging application proposed in this issue helps journalists find interesting topics for articles from the excessive information available on the internet. Another class of applications dealt with here is recommending content to the users. Relevant recommendations motivate the user to visit and spend time on a web service. Recommenders are therefore important in designing attractive - and monetizable - digital services. As a consequence, this technology is found in many services recommending media items such as music, books, television programmes and news articles. The papers on recommenders in this issue cover the three main methods in the field - content-based, knowledge-based and collaborative - and they bring new perspectives to all three. One such novel perspective which has been evaluated in user studies is that of a portable personal profile.

Most of the included papers are outcomes of the Finnish *Next Media* research program (www.nextmedia.fi) of Digile Oy. Next Media has run from 2010 through 2013 with the participation of 57 companies and eight research organisations. The volume of the program has been substantial; annually around 80 person years with half of the work done by companies and half by research partners. The program has three foci: e-reading, personal media day, and hyperlocal. The papers in this issue represent only a small part of the results of Next Media. As an example, during 2012 the program produced 101 reports, most of which are available on the web.

Even if this thematic issue is centred on work done within the Finnish Next Media program, content technologies are of course studied in many other places around the world. The paper by NTNU in Norway presented here is just one example. Computer and information technology departments at universities and research institutes often pursue content related topics ranging from multimedia "big data" analysis to multimodal user interfaces and user experience. In the upcoming EU Horizon 2020 program, "Content technologies and information management" is a major topic covering eight challenges. This will keep the theme for this thematic issue in the forefront of European research during the years to come.

Caj Södergård, guest editor of this issue of JMTR, holds a doctoral degree in Information Technologies from the Helsinki University of Technology. After some years in industry, he has held positions at VTT as researcher, senior researcher, team manager and technology manager. His work has resulted in several patents and products used in the media field. Currently Caj Södergård is Permanent Research Professor in Digital Media Technologies at VTT.

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Media experience as a predictor of future news reading

Simo Järvelä¹, J. Matias Kivikangas¹, Timo Saari³, Niklas Ravaja^{1,2}

¹ Department of Information and Service Economy
School of Business, Aalto University
P.O. Box 21210, FIN-00076 Aalto, Finland

E-mails: simo.jarvela2@aalto.fi
matias.kivikangas@aalto.fi
niklas.ravaja@aalto.fi
timo.s.saari@tut.fi

² Department of Social Research and
Helsinki Institute for Information Technology
University of Helsinki, Finland

³ Department of Pervasive Computing
Tampere University of Technology, Finland

Abstract

The newspaper medium is forced to evolve in the digital age. In order to transfer the core media experience of newspaper reading to new digital formats, its very nature must be examined. In an experiment with 24 readers of a digital newspaper, responses to seven different news sections (people, city, culture, opinion, business, foreign, sports) were measured with psychophysiological methods and self-reports and the differences in responses to them were examined. These data were then compared to actual reading behavior during a six week follow-up period to investigate how immediate media experience predicts future news reading. It was found that the news sections were differentiated by self-reported emotional responses and other message ratings (e.g., relevance to the self, interestingness, reliability), but not by physiological responses. In addition, both self-reports and physiological responses (facial electromyography and heart rate) predicted news reading during the follow-up period, but the strength or direction of the association varied by news section. Different kinds of emotions predict future reading for different news sections, suggesting that people expect differential emotional experiences from different sections.

Keywords: newspaper, readership, media experience, psychophysiology

1. Introduction

Newspaper is a classic media format currently under transformation into new digital formats. The question arises whether the core media experience is altered in this transformation and, if so, how. The term media experience refers to the equivalent of user experience but in the context of media consumption (Hassenzahl, 2008; Kallenbach, 2009; Beauregard and Corriveau, 2007). The newspaper reading experience is a multifaceted construct (Calder and Malthouse, 2004) and emotions are a central element in it, as they are in any media experience (Ravaja, 2004; Helle, Ravaja and Heikkilä, 2011). We set out to study the relatively little researched connection between the media experience and further news reading behavior. Other aspects of newspaper readership have been studied; such as what consumer demographics read which news sections (e.g., Bearden, Teel and Durand, 1978; Burgoon and Burgoon, 1980) and how the content characteristics in news predict newspaper readership (e.g., McCombs, 1987). In more recent years, online news services and their readership have

been studied in order to understand the transition to digital media and the changes in readership that follow. For example, a study in 2004 compared the reading of different sections of two large circulation newspapers' paper versions to that of their online versions (d'Haenens, Jankowski and Heuvelman, 2004) and found differences in reading times both between the two papers and also between the various sections. They also found that previous interest predicted reading time of foreign news and business news in both paper and online versions. In the case of online news, several factors are related to the convenience of the medium which may drive adoption. In a study on news adoption to seek for information on public affairs, it was found that many readers turned to internet news sources instead of traditional media. Online news readers are also likely to pursue their own interests in seeking and selecting news instead of following the cues of news editors and producers (Tewksbury, 2003). Among the different reasons for adopting online news are ease and convenience, avai-

lability when you want it, timeliness and immediacy, and speed of news access (Conway, 2001). Salwen (2005) concluded that reasons for using online news include being able to get news at any time, being able to directly go to news of interest, easiness and quickness of keeping up with news, convenience, exposure to interesting news stories while doing something else, being able to get different viewpoints, finding unusual news stories online, and being able to get more news than from conventional sources. A recent extensive study by Nguyen (2010) found that factors reflecting how people integrate online news into their everyday life also explain the success of online news: no cost, multitasking, more news choices, in-depth and background information, 24/7 updates, customization, ability to discuss news with peers, and the existence of different viewpoints. Based on this research, it is evident that online news adoption is driven by factors that are related to many of the properties of the internet as a medium and the capacity of this medium to be adopted and domesticated into personalized uses of news as users see best, fitting it into their everyday life. While digitalization of news services has changed news reading, e.g., by adding related features - and it is vital to understand their effects - at the core of reading is still the media experience while consuming the news content itself.

While some studies regarding news section consumption in either print or online media (e.g., d'Haenens et al., 2004) exist, and news reading and emotional reactions to individual news pieces have been studied before (e.g., Ravaja, et al. 2006), the connection of immediate media experience of news sections - the emotions felt during news reading - and its connection to further news reading is a less studied topic. Most research methods used provide insight into immediate emotions after the news was read. However, the emotions felt during the reading experience itself and those reported immediately afterwards are not necessarily the same (Ravaja, 2004). Many primitive emotional reactions are not conscious but, for example, self-reporting measures are limited to reactions that are subject to various response biases (Paulhus and Reid, 1991; Robinson and Clore, 2002). Psychophysiological methods (Cacioppo, Tassinari and Berntson, 2000) offer a way to assess these emotional reactions with a high temporal resolution by mea-

suring signals obtained by electrocardiography (ECG) or facial electromyography (fEMG). One of the main advantages of this method is its ability to quantitatively measure physiological responses continuously without interrupting the media experience. In the context of news reading, the method allows objective assessment of emotional components such as arousal and valence (Ravaja, 2004; Larsen and Diener, 1992; Lang, 1995) during the actual news reading. Recent studies have shown that psychophysiological measurements in the laboratory can predict subsequent consumer behavior. In a study by Poels et al. (2012), it was found that the measurable reactions predict, in a straightforward manner, what games are played by the subject during the follow-up period and for how long. Kivikangas et al. (2013) obtained similar results, also showing how psychophysiological methods can be utilized in predicting future behavior; however, they claim that which specific signals have predictive power in each case is highly context dependent.

In the current experiment, we set out to explore whether the media experience of various news sections in a newspaper - such as Sports, Business or Culture - differ from each other and if these reactions predict what news the subjects will read in the weeks following the experiment. Utilizing psychophysiological methods and an array of self-report measures, we tried to obtain data concerning various aspects of the news media experience and examine how news reading consumption habits are connected to immediate reactions during news reading. Whether a participant's own stated preferences (background questionnaires and self-reports after the stimulus) or the actual emotional reactions during news reading (psychophysiological recordings) are more accurate in predicting their consumer behavior was also under scrutiny. In times when newspaper media are going through immense changes and digital formats and delivery channels are challenging the more traditional paper formats, the industry is trying to find ways to convert the traditional layout and product design principles into the digital world. It is of vital importance for the industry to acquire precise knowledge of how their products are experienced by consumers and how that affects their long term readership. With more advanced understanding, the new digital formats can be designed to enhance the core media experience.

2. Methods

2.1 Participants

The participants in our experiment were 30 adults aged between 19 and 51 ($M=30.4$, $SD=8.3$) who are regular readers of the Helsingin Sanomat (HS) Digilehti (the digital edition of the largest newspaper in Finland, used in the experiment). Due to technical difficulties, 24 participants (10 female, 14 male) were ultimately analyzed.

2.2 Procedure

The participants filled out a background questionnaire and signed a consent form when arriving at the laboratory. After the attachment of electrodes, the HS Digilehti iPad app was shortly introduced to the participants, after which an eight minute baseline was recorded. The participants were instructed to read either an in-

teresting or non-interesting piece of news from a specific news section of HS Digilehti on the iPad according to on-screen instructions. The participants chose which individual article to read based on a quick glance of the headlines and selected either something that seemed interesting or non-interesting depending on the instructions. Both interesting and non-interesting pieces were chosen to ensure a broader experience for each section. Seven news sections in total were included in the study: Foreign, City, People, Opinion, Culture, Sports, and Business. Separately for each section, the participants were instructed to twice read an *a priori* interesting news story and twice an *a priori* non-interesting news story, resulting in four different pieces of news being read from each section, giving 28 news stories in total. The participants always read the current day's paper so the news were different for all participants as only one experiment per day was conducted - thus cancelling out the effects of content on the results. After reading each news article, the participants filled out self-reports. The instructions were presented and self-reports were obtained using Presentation on a PC. The laboratory experiment was followed by a six-week period during which the participants continued their normal news reading behavior. Sanoma News (the publisher of the newspaper) provided the participants' full usage data from that period.

The participants were instructed to read the newspaper as they normally would during the follow-up period to avoid any bias. The physiological signals measured were facial electromyography (fEMG), electrodermal activity (EDA), electrocardiography (ECG), electro-encephalography (EEG), and eye-movements. In the current paper we will only discuss the results of self-reports, fEMG, and ECG as some technical difficulties occurred while recording EDA. EEG and eye-tracking data have not yet been analyzed. The physiological signals were recorded using a BrainVision recorder and the eye-movements using SMI eye-tracking glasses. The self-reports included reports on arousal, valence, and dominance using Self-Assessment Manikins (SAMs; Lang, 1980) and an evaluation of the relevance, objectivity, interestingness, reading thoroughness, and reliability of the news.

2.3 Data collection and pre-processing

Facial electromyography (fEMG) activity was monitored at three muscle sites, *zygomaticus major* (ZM), *corrugator supercilii* (CS) and *orbicularis oculi* (OO), as suggested by Fridlund and Cacioppo (1986). Electrocardiograms (ECG) were measured using the modified lead III electrode placement, and the R-peaks were detected to provide heart rate. For fEMG, the low cut-off filter was 30 Hz, and the high cut-off filter 430 Hz.

The analysis of the raw data was performed using the BrainVision Analyzer v. 2.0.1. The data were filtered using a 50 Hz Notch filter to remove the electric hum.

For each reading session, fEMG and ECG data were averaged over the whole reading time. The pre-stimulus baseline was a 3 s period when the participants read instructions before reading each news article. The fEMG signal was rectified and 50 Hz high cut-off filtered.

2.4 Variables

In the end, we had three groups of predictor variables. The physiological variables were the three fEMG activity indices and the heart rate. For self-reported emotion we used Valence, Arousal, and Dominance SAM scales (Lang, 1980). In addition, we used five single-item questions to measure the more subjective assessments of the media experience: we asked how relevant and interesting the news piece was to the participant (Relevance and Interestingness), how thoroughly they read the news piece (Thoroughness), and how reliable and objective they thought the news piece was (Reliability and Objectivity).

To account for the variation of interestingness between the most and the least interesting news stories within a section, we used the *a priori* interest variable (whether the participants chose the news piece as an interesting or non-interesting piece).

As a predicted variable, we used the sum of seconds during which the participants read an article from the particular section during their six-week follow-up period. The number of seconds was derived from the newspaper's customer data following the participants' registered accounts, with articles open less than three seconds being excluded (as they were probably just indications of the reader browsing the newspaper and skipping the article). We also extracted the individual times an article was read from the particular section, but the results were so similar to those based on the usage seconds that we subsequently report mostly only the results using the time as the predicted variable.

2.5 Data analysis

Mean values of the physiological signals during each of the reading periods were calculated for each participant. A mean of EMG from three preceding seconds (relative to a news article) was also calculated as a baseline to check for carryover effects. Facial EMG data and the usage variables were transformed using natural logarithms to normalize their distributions.

The data were analyzed using the Linear Mixed Models (LMM) procedure with restricted maximum likelihood estimation in SPSS 21. The news item identifier was specified as the repeated variable, with participant as the subject variable. Two different sets of analyses were conducted, one with the predictor variables as predicted to see how sections differ from each other in regard to the predictors, and one with predictors predicting the usage.

Section differences (in the variables subsequently used to predict usage) were analyzed using an LMM with fixed effects specified for the section, instruction (*a priori* interestingness), interaction of section and instruction, and the 3s local baseline physiological value, and with the predictor as the dependent variable. A random intercept effect with the participant as the subject was

included to account for individual differences. Usage predictions were analyzed using an LMM with fixed effects specified for the section, instruction, predictor variable, interactions of section and predictor and of instruction and predictor, and the 3s local baseline physiological value, where applicable. The same random intercept was included also here.

3. Results

3.1 Differences between sections

Descriptives for usage are shown in Table 1. It is notable that the differences in reading times between sections were substantial. When comparing different sections, the physiological signals fEMG and heart rate (HR)

did not differentiate the sections in any way (see Table 2), regardless of whether the news were pre-selected as interesting or non-interesting (*a priori* interest). However, significant differences between sections was found in the majority of the self-reports. They can be most readily detected in Figures 1 and 2.

Table 1: Descriptives of actual reading times (in seconds) during the six-week follow-up, by section

Section	Min	Max	Mean	SD
Overall	0	28 501	1 937.96	3 890.25
People	0	2 587	469.00	662.33
City	0	14 929	3 318.73	4 276.73
Culture	0	5 938	1 324.18	1 580.66
Opinion	0	13 999	1 775.91	3 696.31
Business	0	16 040	2 300.50	4 179.91
Foreign	60	18 506	2 388.05	3 897.63
Sports	0	28 501	1 989.36	5 879.52

Note: SD = Standard deviation

For SAM Valence, news sections were roughly divided into two. People, City, and Culture sections were reported as more positive, while especially the Business section was reported as less positive (the pairwise difference between the smallest value of the former group, Culture, and Business was 0.59, $p = .008$). While the Foreign, Opinion, and Sports sections were also reported as less positive, the differences were smaller (pairwise dif-

ferences of 0.44, 0.32, and 0.22, $ps = .049, .154, \text{ and } .339$, respectively). For SAM Arousal, the only significant difference was that the Sports section was reported as less arousing than other sections (pairwise difference to the closest section, Business, was .583, $p = .004$). As can be seen from Figure 1, all reports for valence and arousal were very close to 5, the mid-point of the 9-point scale used, indicating that the participants re-

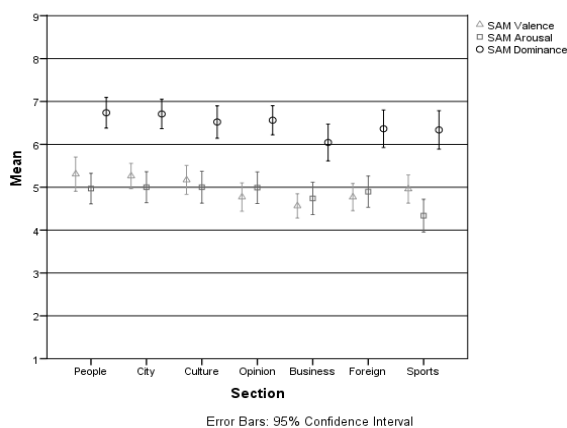


Figure 1: Section differences in self-reported valence, arousal, and dominance

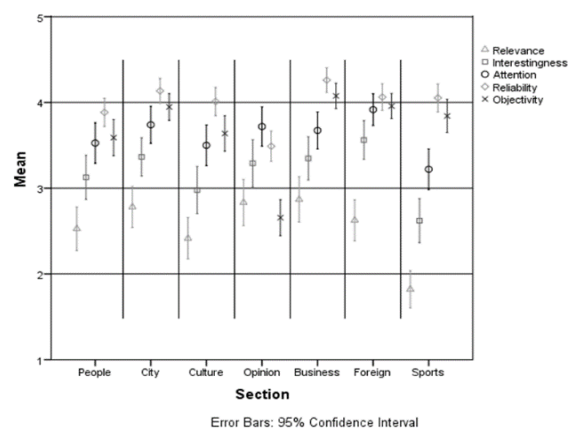


Figure 2: Section differences in Relevance, Interestingness, Thoroughness, Reliability, and Objectivity

Table 2: Overall presence of differences between sections, accounting for whether the particular news article was chosen as interesting or not during the experiment

	Section	<i>A priori</i> interest	Section \times <i>a priori</i> interest
Zygomatic EMG	0.685	1.976	0.473
Corrugator EMG	1.075	1.171	0.509
Orbicularis EMG	0.852	0.183	1.263
Heart rate	0.536	0.471	1.532
SAM Valence	4.192***	110.052***	3.084**
SAM Arousal	3.884***	136.605***	1.026
SAM Dominance	4.792***	17.191***	1.780
Relevance	13.426***	164.394***	3.358**
Interestingness	10.505***	443.507***	1.120
Thoroughness	6.771***	186.411***	0.714
Reliability	16.010***	23.247***	1.252
Objectivity	48.549***	2.049	0.952

Note: Values shown are F-values.

* $p < .05$, ** $p < .01$, *** $p < .001$.

ported almost neutral emotions throughout all sections. For SAM Dominance, however, the ratings were markedly higher, indicating that the participants generally felt being in control during the news reading. Business showed the lowest Dominance rating while People, City, Culture, and Opinion sections showed the highest (pairwise difference between Business and the lowest rating of the four, Culture, was 0.67, $p = .004$). The Sports section was reported as clearly less relevant and interesting than any other section and was read less thoroughly in our sample, pairwise differences ranging from 0.64 to 1.11 for Relevance, from 0.52 to 0.90 for Interestingness (with the exception of the difference to Culture being only 0.23, ns.), all (other) $ps < .001$, and from 0.32 to 0.67 for Thoroughness, all $ps < .01$ (with the exception of Culture, with a difference of 0.24, $p = .043$). Relevance, Interestingness, and Thoroughness showed very similar patterns in other ways as well: The People and Culture sections were also rated relatively low (but not as low as Sports). City, Opinion, and Business were located in the middle, although the differences were not great (at maximum, People and Culture differing from Business in Relevance, $ps = .013$ and $.001$, and Culture differing from Business in Interestingness, $p < .001$, but Culture differing from Opinion by only $p = .022$ in Thoroughness). This pattern somewhat resembles the actual reading times of the sections (see Table 1). However, although the Foreign section was considered more interesting and was read more thoroughly than others (differing from Culture and People by $p < .001$ and $p = .005$ in Interestingness, and by $p < .001$ and $p = .003$ in Thoroughness), its Relevance was not as high (differing only from Foreign, $p = .026$). Not surprisingly, Reliability and Objectivity of the Opinion section was assessed lower than any other section (all $ps < .001$). Otherwise, Business was rated higher on both scales (comparisons with People, Culture, and Sports > 0.226 , $ps < .016$), and People differing also from City

and Foreign sections ($ps < .035$). When accounting for *a priori* interest, this affected positively and significantly all other self-reports but Objectivity (see Table 2).

3.2 Predictions

Both a selection of psychophysiological signals and self-reports were used to predict reading time during the six week follow-up period (see Table 3). Perhaps not surprisingly, self-reported Interestingness was the only variable that had general predictive power - i.e., the more interested in a section the participant reported to be, the more he or she read news in that section during the follow-up. The analysis estimated that one point of increase in Interestingness (on a 5-point scale) resulted in reading the news of the section in question for 272.13 seconds (2½ minutes) more, constituting a 14% increase compared to the mean of 1937.96 seconds. No other variable predicted directly how long the news sections were read. However, when considering the interaction with the sections, the factors Corrugator and Orbicularis EMG, Heart rate, SAM Valence, Arousal, and Dominance, and Relevance, Interestingness and Thoroughness, all predicted actual use significantly. Notably, self-reported Objectivity and Reliability did not predict news reading time, although this may be explained by the small variation in the two variables as we only used news from the largest newspaper of the country.

The main finding is that, when predicting actual news usage, apart from reported interest one must take into account the differences between sections. Although the actual reading times followed the self-reports to some extent, these prediction results show that more information can be captured if one does not simply assume that every section is read in the same way. Instead, when the idiosyncratic differences of the sections are taken into account, a more detailed picture emerges.

Table 3:
Overall effects of predictors when predicting actual reading time

	Predictor	Section × predictor
Zygomatic EMG	1.354	0.432
Corrugator EMG	0.083	4.493***
Orbicularis EMG	0.058	4.156***
Heart rate	3.56	3.419**
SAM Valence	0.025	2.624*
SAM Arousal	0.372	2.35*
SAM Dominance	3.37	4.169***
Relevance	0.191	5.378***
Interestingness	8.288**	2.854*
Thoroughness	2.918	2.525*
Reliability	1.447	1.739
Objectivity	1.372	1.338

Note: Values shown are F-values.

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4 shows the relative differences in estimates of the interactions by section. The Sports section has been chosen as the reference section (i.e., all the values are in relation to the reference section for that predictor), as its mean reading time was the closest to the overall mean.

From the table it can be seen that for example, for corrugator EMG activity, the Opinion section shows a strong positive association (in relation to the reference

section) and the Business section an almost as strong negative association, while for Relevance the associations are reversed (note that while both show negative associations in relation to the reference section, the Opinion section shows a more negative association than the Business section). This demonstrates that a) different sections may have opposite associations with a predictor, and b) different predictors may have opposite patterns of associations in the same sections.

Table 4:
Relative differences in estimates of Section × Predictor interactions for all predictors, by section

Predictor	People	City	Culture	Opinion	Business	Foreign
ZM EMG	-0.23	-0.189	-0.192	-0.332	-0.465	-0.188
CS EMG	0.313	-0.324	0.426	0.57*	-0.493	-0.126
OO EMG	-0.054	-0.837**	0.102	0.062	-0.383	0.548
HR	-0.024	-0.072***	-0.061**	-0.056**	-0.066**	-0.072***
Valence	-0.219*	-0.107	-0.094	0.03	-0.383**	-0.191
Arousal	-0.062	0.069	-0.157	0.092	-0.068	-0.214*
Dominance	0.066	0.259**	-0.126	-0.144	-0.027	0.127
Relevance	-1.12***	-0.753**	-0.818**	-0.944***	-0.553*	-0.841***
Interestingness	-0.433	-0.136	-0.979**	-0.271	-0.689*	-0.981**
Thoroughness	0.74*	0.492	0.864**	0.848**	0.967**	0.505
Reliability	0.513	0.079	0.462	1.107**	0.56	0.082
Objectiveness	-0.379	0.298	-0.433	-0.2	-0.12	0.329

Note: Values shown are the estimates for interaction between the predictor and the section, when the Sports section is used as a reference.

Asterisks show the significance of the difference to the reference section. This means that the values should not be considered as absolute values but relative differences between the sections demonstrating the point that different sections are predicted differently with different predictors

* $p < .05$, ** $p < .01$, *** $p < .001$

As a more in-depth example, we have calculated the predicted changes in reading time for some sections (in relation to the reference section) when corrugator EMG activity was used as a predictor and other variables are assumed to be fixed (Figure 3). The test estimates that an increase of 1 (a deepening of the frown) predicts a

decrease from 1347.31 seconds to 770.98 seconds (a drop of 57.2%) during the six-week follow-up period in the use of the Business section, and use of the Opinion section is predicted to increase from 107.43 seconds to 177.99 seconds (a rise of 60.4%) in the same time period for the same increase.

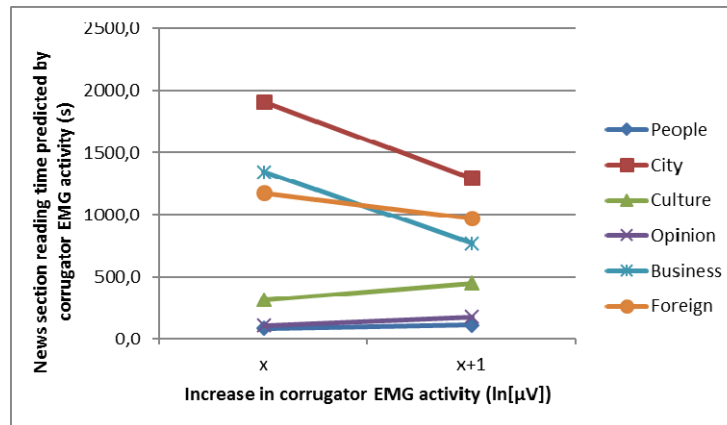


Figure 3: Effects of Section \times Predictor interaction for corrugator EMG activity. The difference between x and $x+1$ represents a deeper frown measured as an increase of one in corrugator activity unit, and the graphs show how much reading time in the sections change with that increase

4. Discussion

4.1 Interpretations

Our results illustrate how news from different sections elicited different reactions. Our interpretation is that the core affects assessed using psychophysiology were very similar for all sections but that in self-reports, differences could still be reported, partly due to other factors such as reading habits influencing the reporting and simply because in self-reporting replies are commonly relative and participants are capable of always finding some differences when encouraged to do so. For example, the participants reacted differently to news from the Sports section (characterized in self-reports as non-interesting, not relevant and not carefully read) than to news from the Business section (characterized in self-reports as relevant and inducing low valence and dominance). Also, both psychophysiological measurements and self-reports predicted news reading during the follow-up period. However, it was only partly the same measures that differentiated the sections from each other as those that predicted further behavior.

Taken together, the results from self-reports, psychophysiology and usage data can be interpreted as forming two sets of patterns. One set describes the collection of variables that differentiates the sections from each other. The selection of significant variables varies from section to section, thus forming a pattern that describes each section. For example, news from the Opinion section can be described as low valence, high dominance, moderately relevant, interesting and thoroughly read but low on reliability and objectivity, whereas the Business section can be described as low valence and lowest dominance of all sections (though still quite high), also similarly moderate in relevance, interestingness and thoroughness and high on reliability and objectivity. These descriptive traits combined from psychophysio-

logy and self-reports can be thought of as a description of the news section based on the reactions they elicit in the reader.

The second set describes the collection of variables that predict for how long news from that section would be read during the six week follow-up period. Only self-reported interestingness rating predicted all sections - all other variables form an individual pattern for each section. For example, higher negative emotion (CS fEMG activity), higher attention (often associated with the lower HR activity, we found) and high reliability and thoroughness predict the reading of the Opinions section. This finding supports the notion that the ability of psychophysiological methods to predict further behavior is notable, but it is highly context dependent which signals are reactive to the relevant emotional reactions in each case. We have chosen not go through all these individual profiles in depth here, as they are gathered from one local newspaper only and presumably rather idiosyncratic. Instead, we emphasize the general principles present in our findings.

It is notable that, for all news sections, these two patterns - the descriptive and the predictive - are distinct. In other words, the traits that best describe and differentiate news sections are only partly the same ones that predict reading times in real life. Our interpretation is two-fold: firstly, this supports the findings of a previous study regarding the predictive capabilities of psycho-physiological methods (cf., Kivikangas et al., 2013) where it was found that which physiological signals will predict further behavior is context dependent and no single measure is able to consistently do so, regardless of the media content consumed. This emerging pattern also emphasizes that, while sections elicit manifold reactions that have significant differences be-

tween each other, not all of those reactions are relevant when it comes to actual consumer behavior. A certain section might elicit certain kinds of reactions but it is another set of reactions that is linked to actual reading habits of the users. In theory, it might be that an optimally designed newspaper could emphasize those features that predict reading more and minimize others. However, as evident from the complexity of the variables and the patterns they form, in practice, this is nearly impossible. Secondly, this separation into two different sets of patterns reflects other relevant variables that were not measured. Reading habits, cultural value statements, etc., are all reflected in the actual reading times. For example, Business section news elicit negative emotions and stress, but are evidently read out of habit and because people feel it necessary to read them regardless of the emotional impact they have.

4.2 Limitations

Our results only shed light on a limited part of the newspaper media experience and more extensive studies should be conducted in order to cover more ground so that a more holistic picture could be formed of how various forms of newspaper media is reacted to and how those reactions are in connection to further consumer behavior. In this study, the consumer behavior was simplified as reading times, something that is easily measurable, but it is clear that consumer behavior and the reading of a newspaper cannot truly be simplified in this way (cf., Malthouse and Calder, 2002). Other studies are required to more extensively study additional reading elements with regard to media experience.

Our study was conducted using content from the largest national newspaper in Finland, but naturally the generalizability of the results is somewhat limited as, e.g., other newspapers may use different divisions into sections, etc. Further studies would be required to affirm the applicability of our results to other newspapers as

well. Conducting a similar study with a wider range of demographics and larger sample size would also be beneficial with regard to generalizability. Some results - such as the clearly negative attitudes towards sports - indicate that the sample was at least somewhat biased. However, such biases should not diminish the value of the main findings of this study.

Ultimately a meta-analysis binding all the results from a series of studies together would be in order. Regardless of these short-comings, the results of this explorative study illustrate a clear emerging pattern where news sections elicit distinct reactions. Another separate pattern also emerges that predicts reading behavior; it is our belief that this holds throughout the newspaper media field - both digital and paper - while it is likely that the patterns themselves vary depending on the newspaper in question and the reader demographics.

4.3 Conclusions

The news media field should find our results thought-provoking; in addition to the more obvious results on how sections are different with regard to the reactions they elicit and that the immediate reactions to news reading has an impact on further reading behavior, the fact that these two emerging patterns are not identical is worth delving into. These findings also offer a view on how psychophysiological methods can be utilized in studying news reading behavior and media experience.

The ability of these methods, together with self-report measures, to assess aspects of media experience that are relevant also in long term consumer behavior enables them to be utilized fruitfully throughout the on-going changes in digital media development. On a wider scale, the development of the psychophysiological method and its application to various fields by mapping out the extent of its behavior predicting capabilities is important and this works contributes to that effort.

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