

# Modeling user-experience with news Web sites

July 2014

*This work has been accepted for publication in Journal of the Association for Information Science and Technology.*

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## **ABSTRACT**

Although news Web sites are used by a large and increasing number of people, there is a lack of research within human-computer interaction regarding users' experience with this type of interactive technology. In the current research, existing measures to user-experience factors were identified and, using an online survey, answers to psychometric scales to measure Web-site characteristics, need fulfilment, affective reactions, and constructs of technology acceptance and user-experience were collected from regular users of news sites. A comprehensive user-experience model was formulated to explain acceptance and quality judgements of news sites. The main contribution of the current study is the application of influential models of user-experience and technology acceptance to the domain of online news. By integrating both types of variable in a comprehensive model, the relationships between the types of variable are clarified both theoretically and empirically. Implications of the model for theory, further research and system design are discussed.

## **KEYWORDS**

User-experience, technology acceptance, model, online news, partial least squares

## **1. INTRODUCTION**

With the proliferation of personal computing since the early 1990s and the advent of the Internet, information technology has spread outside the workplace-context and was adopted to other purposes, such as leisure (e.g., computer gaming and instant messaging; van der Heijden, 2004), electronic retail and marketing (Barwise, Elberse, & Hammond, 2002) and media 'consumption' (e.g., online news; Chen & Corkindale, 2008). As a consequence, experiential factors, such as aesthetics and enjoyment, began to receive increasing attention in human-computer interaction

(HCI) (Alben, 1996; Hassenzahl & Tractinsky, 2006), and user-experience (UX) became a major area of research (van Schaik & Ling, 2009). The concept of UX is predicated on the idea that the interactive technologies not only deliver functional benefits, they also deliver experiences, and users' intention to (re)live positive experiences is an important driver of use and adoption of technology (Hassenzahl, 2003). A rationale for research in UX is that the success of interactive technologies is fundamentally connected to their ability to promote high-quality experiences, beyond their capacity to support the completion of instrumental tasks.

Consequently, the main aim of UX research is to establish how positive experiences with interactive technologies can be promoted (Law & van Schaik, 2010).

Models of UX have been applied to a wide range of interactive technologies, such as mobile-telephone menu layouts (Thüring & Mahlke, 2007), MP3-player skins (Hassenzahl, 2004) and Web sites (e.g., Hartmann, Sutcliffe, & De Angeli, 2008; van Schaik & Ling, 2011; Zhou & Fu, 2007). However, there is a lack of knowledge about news sites, a specific type of interactive technology, in terms of UX constructs and their structural relationships. As Nielsen (2002) pointed out: "Many academics disdain research topics that are closely connected to real-world needs. For proof, look no further than the appalling lack of Web usability research. There are more papers on unworkable, esoteric 3-D browsers than on how hundreds of millions of people use the biggest real-time collaborative system ever built." Research on the present topic is especially timely, because hundreds of millions are using news sites on a daily basis. Additionally, O'Brien and Lebow (2013) recently proposed that UX is a useful framework for studying interactions with online news media, and called for the joint consideration of both pragmatic and hedonic aspects to promote a broader

conceptualization and evaluation of people's interaction with information-oriented websites.

There is a wealth of research in human-computer interaction and information systems (IS) regarding how people browse (e.g., Toms, 2000) and engage with online news (e.g., O'Brien, 2011a), with many employing experiential variables. For example, Arapakis et al. (Arapakis, Lalmas, Cambazoglu, Marcos, & Jose, 2013) assessed the sentimentality and polarity (positive/negative) of a large sample of online news articles and assessed their relationship with measures of user engagement, such as positive and negative affect, attention and gaze behavior, while McCay-Peet, Lalmas and Navalpakkam (2012) explored the impact of saliency of information on focused attention and (positive) affect in the context of online news. However, research in this area typically considers news articles and their properties to explore what drives engagement and satisfaction, while attributes of news sites as interactive artifacts are not systematically considered in how they contribute to users' experience. In other words, factors contributing to experience are considered on the level of news items, but not on the level of news sites as interactive products.

News sites, as a specific type of information-presenting Web portal, differ from other types of Web site. Information-presenting Web portals in general are sites that provide online information and information-related services, in contrast to transaction-based or retail-oriented Web sites that focus on online transactions (Yang, Cai, Zhou, & Zhou, 2005), which may differ significantly in terms of UX and quality criteria. For example, the secure and confidential management of credit-card details and the fulfilment of deliveries are of central importance in the case of transaction-based sites, whereas it might not be relevant at all in the case of information-presenting portals such as news sites. News sites have several

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characteristics, partly derived from their roots in print journalism, which justify their separate treatment from other types of Web site.

Since most major news providers in the Western world launched online versions of their newspapers in the middle of the 1990s (Hall, 2001), news Web sites have become a favored source of news for many (Allan, 2006). Ever since, the news sector has increasingly used the Web as a publication platform and online news plays a significant role in how people acquire information about the world (Nguyen, 2008). At present, most news sites are not merely online versions of print newspapers. Developers spend a growing amount of effort on enhancing the interactivity of news sites, thereby promoting, for example, ease of access to a wide variety of news, communication among users and user-generated content. The Internet is more than just another medium for journalism. Online news has a great influence on how people access information (e.g., quick access to frequently updated news from Internet-enabled portable devices), how news stories are created and published (e.g., collaborative publishing; Bruns, 2005), and on the roles of journalists and readers (e.g., participatory journalism; Deuze, Bruns, & Neuberger, 2007).

Due to the constantly increasing use of the Internet in the past two decades, and the more recent and rapid spread of Internet-enabled handheld devices (e.g., smart phones and tablets), ease of access to information in general and to (online) news in particular is increasing. For example, an estimated 78% of the population in North America had access to the Internet as of March 2011 (Internet World Stats, 2011) and 47% of the adults in the United States accessed local information and news on mobile phones or tablet computers in 2010 (Rosenstiel & Mitchell, 2011). As another example, 77% of households in Great Britain in 2011 had access to the Internet and

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45% of users used a mobile phone to access the Internet (Office for National Statistics, 2011). Consequently, news sites can be accessed by the majority of readers potentially anytime and anywhere.

Hall (2001) argues that the monopoly of large media conglomerates (such as General Electric, The Walt Disney Company and News Corporation) is harder to defend on the Internet than in the largely monopolized print and broadcast media, due to a large potential number of sources of information and the relative ease and low cost for anybody to publish on the Web; therefore, these companies are forced back into a more competitive business environment when publishing on line. As a consequence, transparency (Karlsson, 2011), trust in news providers (Kohring & Matthes, 2007) and experiential factors (e.g., enjoyment and mental workload) may play a greater role in the success of news Web sites. Therefore, news sites that provide high-quality experiences are expected to promote on-going, repeated interaction. However, despite the growing importance of online news publishing in the media sector and a shifting focus towards experiential factors in HCI, there is a lack of academic research on news sites in terms of UX constructs and their structural relationships. Although the news sector has had an increasing presence on the Web in recent years, there is a lack of knowledge about how news sites can be designed to promote a high-quality UX. It is therefore timely to investigate how various aspects of experience (e.g., antecedents, components and outcomes of experience) are related in a model of UX with news Web sites.

Furthermore, we argue for the joint consideration of technology acceptance and user-experience for the primary reason that even if an artefact is highly usable and delivers high-quality experiences, its potential benefits in terms of effective and efficient task performance and enjoyment will not be realized if potential users are

not willing to employ it. Modeling of acceptance can clarify how UX, together with previously established other factors, influences users' technology acceptance (see van Schaik & Ling, 2011). Modeling UX without considering acceptance may not be enough, because repeated visit of news sites (and conducting repeat business on Web sites in general) requires users' acceptance of the site. Research has found that technology acceptance variables (e.g., perceived usefulness) are antecedents of online loyalty (e.g., Cyr, Head, & Ivanov, 2006; Cyr, Hassanein, Head, & Ivanov, 2007). Therefore, an integrated approach to the study of UX and technology acceptance is justified (see van Schaik & Ling, 2011).

## **2. THEORETICAL BACKGROUND**

Although the HCI and IS literature offers a wealth of models and theoretical frameworks for technology acceptance and user-experience, these models have not been previously applied to and tested using news sites as an interactive artefact. Models of technology acceptance include the technology acceptance model (TAM; Davis, 1989) and the unified theory of acceptance and use of technology (Venkatesh, Morris, Davis, & Davis, 2003). Models of UX include Hassenzahl's UX model (Hassenzahl, 2003) and the components of user-experience (CUE) model (Thüring & Mahlke, 2007).

The scope of the original TAM (Davis, 1986) is restricted to explaining variation in intention to use and subsequent use behavior of computer systems from variation in the behavioral belief constructs of perceived usefulness and perceived ease of use (and the later-removed attitude construct). However, the model has been augmented with a wide range of variables over the past two decades to increase its explanatory power in different fields of application (see Venkatesh & Davis, 2000; Wixom & Todd, 2005). Additional variables include perceived enjoyment (Davis,

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Bagozzi, & Warshaw, 1992), internal and external control, intrinsic motivation and emotion (Venkatesh, 2000), design aesthetics (Cyr et al., 2006), user-interface design and satisfaction (Cho, Cheng, & Lai, 2009). Notably, several of the above variables address experiential aspects of technology acceptance. TAM has been successfully adopted in the study of Web technologies (Lederer, Maupin, Sena, & Zhuang, 2000; Cho et al., 2009), and it is a well-established, robust and powerful model for predicting user-acceptance; therefore, the constructs of the model and their established structural relationships are considered relevant to the current work. Although Chen and Corkindale (2008) adopted the technology acceptance model to online news, their work did not include psychometric measurement of the model's components and testing of the model; rather it was based on interviews with media experts. By contrast, the current study develops a measurement and a structural model of users' experience with news sites, rather than a model of acceptance based on the knowledge and intuition of news providers and developers of news sites.

UX models differ from models of technology acceptance most notably because of their direct focus on experiential aspects, frequently referred to as hedonic or non-instrumental attributes. Hassenzahl's UX model distinguishes pragmatic and hedonic aspects of user-perceived attributes of interactive technologies. While pragmatic attributes encompass utility and usability that allow for the manipulation of systems, hedonic attributes encompass factors that make interaction with a particular technology pleasurable by fulfilling human needs, such as autonomy, competency, stimulation (self-oriented), relatedness and popularity (others-oriented) (Hassenzahl, 2008). Furthermore, Hassenzahl and Roto (2007) argue that while pragmatic attributes emphasize the fulfilment of behavioral goals (do-goals), hedonic



attributes emphasize psychological well-being, in other words, be-goals, which stand closer to the self and are important drives of emotional product attachment<sup>1</sup>.

Hassenzahl (2008) identified the ability of interactive products to support need fulfilment as a source of affective reactions in relation to the use of interactive technologies. Hassenzahl, Diefenbach and Göritz (2010) assessed the relationships between the fulfilment of universal human needs, positive affect and perceptions of product attributes. The study revealed significant relationships between need fulfilment and positive affect, and need fulfilment was related to hedonic quality perceptions. Furthermore, in accordance with the distinction between hygiene factors and motivator factors (Zhang & von Dran, 2000), the role of usability as a hygiene factor<sup>2</sup> was supported. Additionally, O'Brien (2011b) concluded that human-information interactions and UX share a common focus in recognizing the significance of needs and made a case for taking a UX approach to study information interactions.

The components of user-experience (CUE) model (Thüring & Mahlke, 2007) aims to integrate most important aspects of HCI by incorporating various facets of interaction characteristics, UX, and system appraisal. We chose this model as a basis for developing our own model in the current research, as it appears to the most

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<sup>1</sup> Be-goals are derived from the fulfilment of human needs (e.g., stimulation and competence), whereas do-goals are related to achieving certain behavioural goals (e.g., reading news updates of a particular event). According to Carver and Scheier (1989), do-goals are derived from be-goals and do-goals are instrumental in achieving be-goals.

<sup>2</sup> According to Zhang and von Dran (2000), the absence of hygiene factors (such as usability) leads to dissatisfaction, but their presence does not lead to satisfaction. The presence of motivational factors (such as high-level aesthetics), on the other hand, leads to satisfaction and promotes the quality of user-experience.

comprehensive published UX model to date. There are three types of UX components in the model: instrumental qualities, non-instrumental qualities and emotional responses. Instrumental qualities concern usefulness and ease of use, and correspond to pragmatic attributes in the Hassenzahl's UX model. Non-instrumental qualities concern aspects such as aesthetics, the 'look-and-feel' of the system and identification, and correspond to hedonic attributes in Hassenzahl's UX model. The category of non-instrumental qualities generally incorporates aspects that are important to users but are not connected to their performance with a system. Emotional reactions in the model are characterized with multiple components, such as subjective feelings, motor expressions and cognitive appraisals (see Mahlke & Minge, 2008). The model treats UX components as consequences of interaction characteristics, which involve three groups of variables: characteristics of the interactive artefact, characteristics of the user and task/context characteristics. Outcome variables in the model, which are, in turn, predicted from UX components, include both acceptance and overall evaluations. In summary, the CUE model seems to be an adequate conceptual framework for incorporating a wide range of technology-acceptance and UX components.

When TAM was augmented with experiential constructs, empirical evidence showed that the behavioral belief constructs of TAM and the product attributes of the Hassenzahl's UX model are separate underlying dimensions of users' experience (van Schaik & Ling, 2011). Additionally, Hassenzahl's UX model typically operates with overall beauty and goodness evaluations of interactive artefacts as outcomes of interaction, as opposed to behavioral intention in TAM. Therefore, it is reasonable to include factors of both technology acceptance and UX in a comprehensive model of user-experience with news sites in order to facilitate the prediction of UX outcomes.

Given the lack of UX research in this domain, the *aim* of the current study is to develop a model of users' experience with news sites. Rather than focusing on properties of (sets of) news items in accounting for positive experience, we consider user-perceived properties of news sites as interactive artifacts (or products). We use an empirically tested and comprehensive UX model (Thüring & Mahlke, 2007) as a basis for modeling UX with news sites, as well as a qualitative study (Aranyi, van Schaik, & Barker, 2012) of users' self-reported factors of experience with news sites to guide the selection of variables. In summary, the following sections address two main research questions: first, how are user-perceived properties of news sites related to users' experience with the sites and, second, how do various facets of users' experience relate to UX outcomes, such as overall quality judgements of news sites and intention to use?

### **3. METHOD**

#### **3.1. DESIGN**

An online questionnaire was designed to collect responses to items as indicators of variables measuring aspects of users' experience with news sites. The selection of measures for modeling UX with news sites was guided by (a) an exploratory study that was conducted to identify self-reported factors of UX of participants using a particular news site under think-aloud instructions (Aranyi et al., 2012), and (b) by a literature review of models of technology acceptance and user- experience (see Aranyi, 2012). Protocol analysis of the think-aloud recordings in the exploratory study yielded five categories of experience: content, layout, information architecture, diversion and impression. Standardized measures were identified from HCI and IS literature to address the measurement of each self-reported category of experience. The questionnaire was advertised through university newsletters and student e-mail

lists at Teesside University. Additionally, answers were collected from Bangor University, City University London and Kingston University. A prize-draw of £50 was used as an incentive.

### **3.2. MATERIALS AND PROCEDURE**

Because the exploratory study revealed significant differences in UX between regular and novice users of a particular news site (i.e., differences in experience attributable to level of adoption), and in an attempt to avoid the product as a fixed-effect fallacy (Monk, 2004), participants were asked to use a news site of their own choice, which they used regularly, before completing the interaction-experience questionnaire. Survey Monkey (<http://www.surveymonkey.com>), an on-line survey tool was used to collect data<sup>3</sup>. Informed consent was collected by requiring participants to tick a series of checkboxes in order to carry on to the instructions. Participants were then instructed to open a new browser window and use a news site of their own choice for at least a couple of minutes before proceeding to the questions. After their use of a news site, participants completed a set of psychometric scales in the following order. Each of the scales measures one of the constructs that are used as variables in the structural model (that is derived in Section 4.2).

The positive and negative affect schedule (PANAS; Watson, Clark, & Tellegen, 1988) was selected to assess users' affective reactions to using a news site.

PANAS has been applied successfully and extensively in previous research related to positive experiences in general (Sheldon, Elliot, Youngmee, & Kasser, 2001) and experience with interactive systems in particular (Hassenzahl, 2008; Hassenzahl et

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<sup>3</sup> The questionnaire was piloted with seven postgraduate researchers at the authors' institution as respondents.

al., 2010; Diefenbach & Hassenzahl, 2011; Partala & Kallinen, 2012), and it was used together with other measures (such as AttrakDiff2) selected for the current study. The abridged version of the AttrakDiff2 questionnaire (AttrakDiff2-SF; Hassenzahl & Monk, 2010; Hassenzahl et al., 2010) was selected to measure the user-perceived product-attributes of *pragmatic quality* and *hedonic quality*, and overall evaluations of *beauty* and *goodness*. A measure of *perceived enjoyment* was adopted from Sun and Zhang (2008), which can be used to measure intrinsic motivation in the context of HCI (Ryan & Deci, 2000), and research suggests that it has a direct effect on intention to use (Cyr et al., 2006). The perceived disorientation scale (Ahuja & Webster, 2001) was selected to assess the participants' level of *disorientation*, that is, their loss of sense of location in a hyperlinked structure (McDonald & Stevenson, 1998). The reliability, validity and sensitivity of the perceived disorientation scale, in combination with other UX measures, were confirmed in two psychometric studies by van Schaik and Ling (2003, 2007).

To address the measurement of participants' perception of the user-interface, we selected a short, 3-item scale of *perceived user-interface design*, which is an important antecedent of continued usage intention (Cho et al., 2009). To assess the user-perceived aesthetic quality of news sites, an 8-item *perceived aesthetics* scale was selected (Porat & Tractinsky, 2012) that measures two dimensions of aesthetics: classical and expressive (Lavie & Tractinsky, 2004). Measures of two dimensions of information quality, *usefulness of content* and *adequacy of information*, and *accessibility* as a service-quality measure were adopted from Yang and colleagues' (2005) questionnaire of user-perceived service quality of

information-presenting Web portals<sup>4</sup>. A 2-item measure of behavioral intention was included as a technology-acceptance outcome variable (based on Venkatesh & Davis, 2000). Five sub-scales were adopted from Sheldon et al. (2001) to assess the fulfilment of psychological needs identified as tentatively relevant to news-site use in the exploratory study: autonomy, competence, relatedness, stimulation and popularity. Additionally, participants were asked to rate the relevance of the fulfilment of each need to their experience, based on the definitions of each need from Sheldon et al. (2001). All scales were measured using 7-point Likert scales, except for AttrakDiff2, which was measured with 7-point semantic differentials. The questionnaire ended with questions regarding Internet-use behavior and demographics. Upon completing the questionnaire, participants had the opportunity to provide their e-mail address to enter the prize-draw. The full set of measures is presented in Appendix A.

### **3.3. PARTICIPANTS**

Participants had to be over 18 and fluent in English to be eligible for the study. Out of 522 respondents to the online questionnaire, 305 gave full responses to the interaction-experience scales (120 male, 185 female; mean age = 24.63 years,  $SD = 7.52$ ), and these were used in subsequent analyses. The average experience of Internet use was 9.66 years ( $SD = 3.19$ ). Nearly two thirds of the participants used

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<sup>4</sup> Information-presenting Web portals are sites that provide online information and information-related services, in contrast to transaction-based or retail-oriented Web sites that focus on online transactions. The interpretation of service quality may differ significantly between these two broad categories of Web site (e.g., the relevance of secure credit-card transactions).

the British Broadcasting Corporation's (BBC)<sup>5</sup> news site before completing the questionnaire. Other news sites that were visited by more than 1% of participants before completing the questionnaire included The Guardian (6%), Sky News (4%) and The Independent (2%), 22% of the sites were reported by less than 1% of participants, and 2% used a site that was identified as an aggregator (e.g., Google News and Yahoo News). A majority (94%) accessed the Internet on a daily or more frequent basis and 70% reported to use the Internet for an hour or more per day. Nearly half (47%) reported daily or more frequent access to news sites and 56% used these sites for between 10 and 15 minutes duration per visit. Participants mainly used laptop computers (86%), desktop computers (47%) and mobile phones (31%) to access news sites.

### **3.4. ANALYSIS METHOD**

Along with factor analysis to explore the factor structure of the multidimensional scales, partial-least-squares path modeling (PLS) was used for the formulation of the measurement model and the structural model, for the following reasons (see Vinzi, Chin, Henseler, & Wang, 2010). PLS allows for the integrated analysis of a measurement model, which specifies the relationships between latent variables and their manifest variables, and a structural model, which specifies the relationships between latent variables. PLS has less stringent assumptions regarding the distribution of variables and error terms than covariance-based structural equation modeling (CB-SEM), and supports both reflective and formative measurement. The required sample size for PLS is also lower than that of covariance-based structural

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<sup>5</sup> According to the Alexa Web Information Company ([www.alexa.com](http://www.alexa.com)), BBC is the 11<sup>th</sup> highest-ranking news site in the world (with an overall global rank of 61), and the fifth-highest-ranking Web site and the highest-ranking news site in the United Kingdom (as of April 2014).

equation modeling. PLS maximizes the explained variance in dependent variables and it is suitable for estimating complex models (multi-stage models with a high number of latent variables and connections); therefore, it is adequate for prediction-oriented research involving a wide range of variables<sup>6</sup>. Latent variable scores in PLS are exact linear combinations of manifest variables, rather than average scores of manifest variables calculated for each latent variable with satisfactory internal consistency. Therefore, PLS provides more accurate scale values than the technique of averaging item scores. Moreover, recent research has shown that PLS performs at least as well as and, under various circumstances, is superior to covariance-based structural equation modeling in terms of bias, root mean square error and mean absolute deviation (Hulland, Ryan, & Rayner, 2010; Vilares, Almeida, & Coelho, 2010). All PLS analyses in the current study were conducted using the SmartPLS software (<http://www.smartpls.de>). Bootstrapping samples of 5000 were used to test the significance of model parameters, as recommended by Henseler et al. (Henseler, Ringe, & Sinkovics, 2009).

## **4. ANALYSIS**

### **4.1. MEASUREMENT MODEL**

Following the exclusion of items and scales based on exploratory factor analyses of each multidimensional scale, a PLS measurement model of all remaining scales was tested by drawing all possible structural links between the constructs, with the inner-

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<sup>6</sup> Note that contrary to CB-SEM techniques, which focus on measurement-item covariance, PLS focuses on the variances of dependent variables (at item and construct level). Therefore, chi-square statistics and various goodness-of-fit indices for testing covariance structure do not apply to PLS analyses (Chin, 1998). The goodness of PLS structural models is assessed (mainly) with the amount of variance explained in dependent variables.



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weighting option set to factorial scheme in the SmartPLS analysis software (Chin, 2010). Descriptive statistics and reliability coefficients of each scale retained for modeling are presented in Table 1. A detailed description of the measurement model, complete with the exploratory factor analyses, reports of item loadings and cross-loadings, coefficients of convergent and discriminant validity, and scale inter-correlations are presented in Appendix B.

*Table 1.* Descriptive statistics and reliability coefficients.

| Construct                       | Number of items | Average variance extracted | Composite reliability | Mean | Standard deviation |
|---------------------------------|-----------------|----------------------------|-----------------------|------|--------------------|
| Perceived aesthetics            | 8               | 0.58                       | 0.92                  | 4.80 | 1.09               |
| Perceived disorientation        | 7               | 0.69                       | 0.94                  | 2.07 | 1.20               |
| Perceived user-interface design | 3               | 0.87                       | 0.95                  | 5.61 | 1.16               |
| Usefulness of content           | 2               | 0.85                       | 0.92                  | 6.34 | 0.91               |
| Adequacy of information         | 2               | 0.85                       | 0.92                  | 5.59 | 1.16               |
| Accessibility                   | 2               | 0.84                       | 0.92                  | 6.08 | 0.99               |
| Pragmatic quality               | 4               | 0.53                       | 0.81                  | 5.49 | 1.04               |
| Hedonic quality                 | 4               | 0.60                       | 0.86                  | 4.76 | 1.09               |
| Perceived enjoyment             | 3               | 0.82                       | 0.93                  | 4.96 | 1.24               |
| Positive affect                 | 10              | 0.46                       | 0.89                  | 3.77 | 1.16               |
| Negative affect                 | 10              | 0.46                       | 0.89                  | 1.94 | 0.92               |
| Behavioral intention            | 2               | 0.94                       | 0.97                  | 6.26 | 1.18               |
| Beauty                          | 1               | 1.00                       | N/A                   | 4.22 | 1.20               |
| Goodness                        | 1               | 1.00                       | N/A                   | 5.44 | 1.32               |

*Note.* Means and standard deviations were calculated using latent-variable scores.

In summary, statistical analysis supported the use of perceived aesthetics items as a one-dimensional measure. One item was removed from each of the scales *usefulness of content* and *adequacy of information*, because of high cross-loadings. Factor analyses of need-fulfilment subscales did not result in an interpretable structure; therefore, these scales were excluded from further analysis (see Appendix B). In the PLS measurement model, the predictable-unpredictable (PQ2) item of *pragmatic quality* produced a low loading (.39), the item was retained based on

psychometric considerations<sup>7</sup>. The scales *positive affect* and *negative affect* produced average variance extracted (AVE) values lower than .50 (recommended by Chin, 2010). However, the scales' construct validity was supported at the item level (i.e., consistently and markedly higher loadings than cross-loadings); therefore, they were retained for further analysis. The internal consistency, discriminant validity and construct validity of each scale was supported and the factor structure of the measures was confirmed.

#### 4.2. STRUCTURAL MODEL

The CUE model (Thüring & Mahlke, 2007) was used as a framework to integrate each measure collected in the present study. According to this framework, the variables were arranged in three groups in a two-stage causal model: (a) interaction characteristics, which were limited to artefact characteristics in the present study<sup>8</sup>, (b) components of user-experience, comprising emotional responses (positive and negative affect), perceptions of instrumental qualities and non-instrumental qualities, and (c) interaction outcomes, comprising system appraisal (goodness and beauty) and intention to use. An outline of the model is presented in Figure 1.

Hypotheses for structural modeling were derived from the literature from which the measures were collected. In the following sections, hypotheses and their test

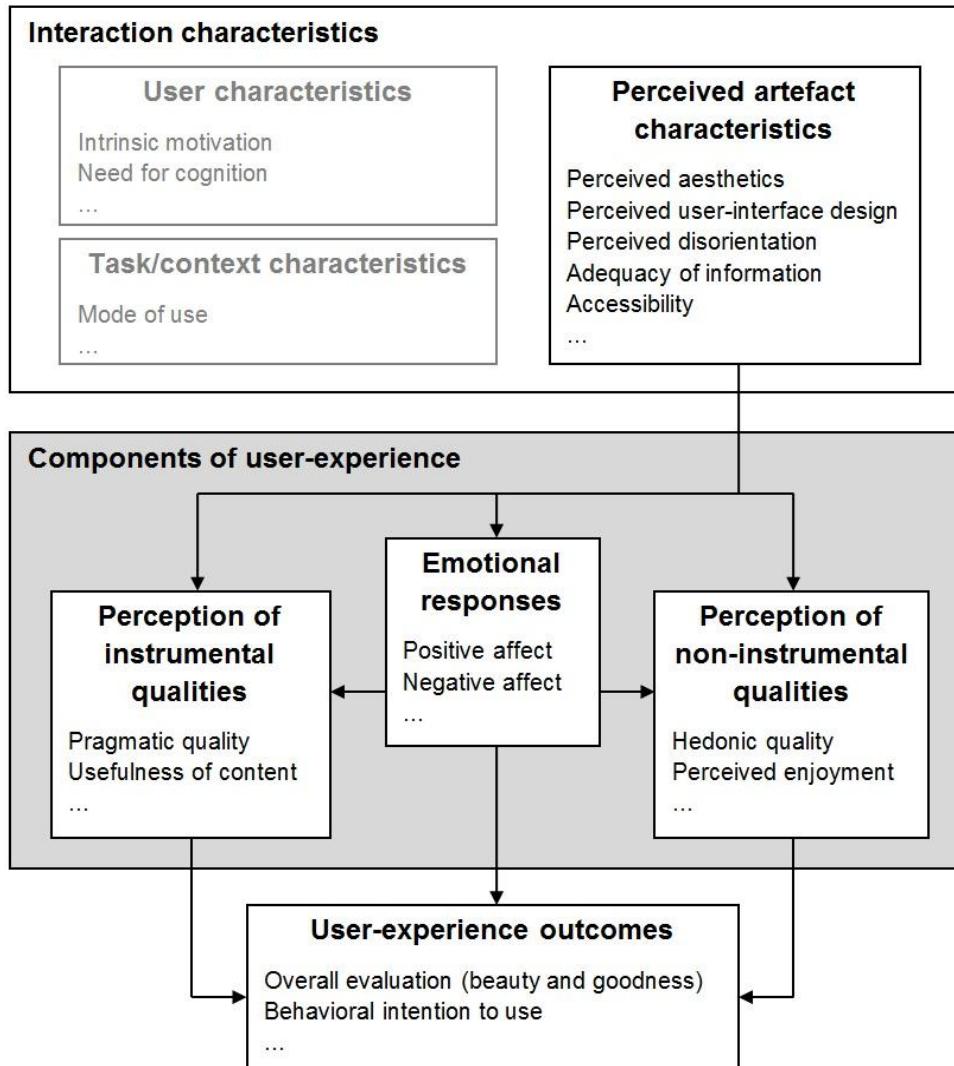
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<sup>7</sup> The item was retained, because (a) it had no significant cross-loadings (largest cross-loading was .15 on *hedonic quality*), (b) its loading on *pragmatic quality* was statistically significant ( $t = 4.57, p < .001$ ), (c) the scale has been previously validated and (d) including weaker items in PLS helps "to extract what useful information is available in the indicator to create a better construct score" (Barroso, Carrión, & Roldán, 2010, p. 433).

<sup>8</sup> According to Thüring and Mahlke (2007), additional categories of interaction characteristics are person- and task/context characteristics. Tentative examples of measures to these categories are displayed in grey in Figure 1.

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summaries are presented separately for two model stages, followed by the presentation of the full model with model parameters (magnitudes of variance explained, path coefficient and effect size), and a general discussion of hypothesis tests and the model.



*Figure 1.* Outline of a comprehensive model of user-experience with news sites (based on Thüring & Mahlke, 2007).

#### **4.2.1. FIRST STAGE: FROM PERCEIVED ARTEFACT CHARACTERISTICS TO UX COMPONENTS**

Components of UX at the first stage of the model contain variables of product attributes from Hassenzahl's UX model (pragmatic quality and hedonic quality), behavioral belief-constructs from TAM (usefulness of content and perceived enjoyment) and affective reactions (positive and negative affect), predicted from perceived artefact characteristics (aesthetics, user-interface design, disorientation, adequacy of information and accessibility).

Visual aesthetics is considered an important non-instrumental product characteristic in the UX literature (see Lavie & Tractinsky, 2004; Hassenzahl & Tractinsky, 2006; Hartmann et al., 2008). Theoretically, *expressive aesthetics* is expected to be an antecedent of *hedonic quality*, because the latter is conceptualized as the pleasure-producing qualities of a particular artefact, and, as such, is a determinant of perceptions of *beauty*. *Classical aesthetics*, on the other hand, emphasizes clearly and orderly design and is also expected to be connected to *pragmatic quality*, as it was found to be related to perceptions of usability (e.g., Lavie & Tractinsky, 2004; van Schaik & Ling, 2009). Aranyi et al. (2012) confirmed these connections between the classical and expressive aesthetics dimensions and product attributes. However, here the two aesthetics dimensions did not reproduce in the measurement model and a composite of the two scales was identified as psychometrically justified solution to measure aesthetics. Therefore, in order to explore the relationships between perceived aesthetics and perceived product attributes, the following hypotheses are proposed:

H1a: *perceived aesthetics* is an antecedent of *hedonic quality*.

H1b: *perceived aesthetics* is an antecedent of *pragmatic quality*.

Regarding the role of aesthetics in technology acceptance, two studies (van der Heijden, 2004; Cyr et al., 2006) have independently established that *perceived aesthetics* is an antecedent of *perceived enjoyment*, as well as of *perceived usefulness* and *perceived ease of use*. Therefore, the following hypotheses are proposed:

H1c: *perceived aesthetics* is an antecedent of *perceived enjoyment*.

H1d: *perceived aesthetics* is an antecedent of *usefulness of content*<sup>9</sup>.

User-interface design concerns the presentation of the interface of a particular technology. The *perceived user-interface design* measure adopted for the current study (Cho et al., 2009) emphasizes the layout of a Web site, that is, whether the functional and graphic elements are presented appropriately. Presentation is part of product features in Hassenzahl's UX model (Hassenzahl, 2004), and therefore it is expected to influence the perception of product attributes. The layout of functional and graphic elements (e.g., textual and multimedia content and links) on the pages of a particular news site may influence perceived usability, and at the same time, it is fundamentally connected to the appearance of the site<sup>10</sup>. To examine the relationships between perceived user-interface design and perceived product attributes, the following hypotheses are proposed:

H2a: *perceived user-interface design* is an antecedent of *hedonic quality*.

H2b: *perceived user-interface design* is an antecedent of *pragmatic quality*.

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<sup>9</sup> *Usefulness of content* is used here as a proxy of *perceive usefulness* of a news site's content.

<sup>10</sup> Although the constructs *perceived user-interface design* and *perceived aesthetics* significantly overlap, the items of the two scales tap different aspects of interface design (see Appendix A), their relative independence was supported in the measurement model (see Appendix B), and they were used separately in previous research; therefore, the two constructs are considered here separately.

In an adaptation of TAM to Web technologies (Cho et al., 2009), *perceived user-interface design* is an antecedent of *perceived usefulness* and *perceived ease of use*. In their model, the effect of *perceived user-interface design* on perceived usefulness is mediated through *perceived functionality*. Because there is no measure of *perceived functionality* involved in the current study, a direct effect of *perceived user-interface design* is expected on *usefulness of content*. In the absence of a measure of *perceived ease of use* in the current study, *perceived user-interface design* is expected to have a direct effect on *perceived enjoyment*. Therefore, the following hypotheses are proposed:

H2c: *perceived user-interface design* is an antecedent of *perceived enjoyment*.

H2d: *perceived user-interface design* is an antecedent of *usefulness of content*.

Ahuja and Webster (2001) found that disorientation and ease of use are distinct, but strongly and negatively related constructs. In an experiment involving information retrieval tasks from a Web site, van Schaik and Ling (2003) confirmed that disorientation and ease of use are different constructs, and by manipulating orientation support, they found that *perceived disorientation* is a more sensitive measure than *perceived ease of use*. Because *pragmatic quality* is essentially the user-perceived usability of a particular artefact (Hassenzahl, 2004), it is reasonable to assume that disorientation affects the pragmatic quality perceptions of a particular artefact. Therefore, the following hypothesis is proposed:

H3: *perceived disorientation* is an antecedent of *pragmatic quality*.

The measures of *usefulness of content*, *adequacy of information* and *accessibility* were adopted from the same instrument measuring user-perceived service quality of information-presenting Web portals (Yang et al., 2005). In the development and

validation of the original instrument, *adequacy of information*, along with *usefulness of content*, was conceptually presented as a determinant of information quality, whereas *accessibility* was a determinant of service quality. In turn, both information- and service quality were determinants of acceptance of technology. *Usefulness of content*, however, is used here as a proxy of *perceived usefulness*. In an adoption of TAM for the domain of news sites (Chen & Corkindale, 2008), perceived core service quality (the quality and presentation of content) is described as an antecedent of *perceived usefulness*. It is therefore proposed that *adequacy of information*, as a measure of information quality, and *accessibility*, as a measure of service quality, are antecedents of *usefulness of content*, as a proxy of *perceived usefulness*, which, in turn, is a determinant of acceptance of technology. Thus, the following hypotheses are proposed:

H4a: *adequacy of information* is an antecedent of *usefulness of content*.

H4b: *accessibility* is an antecedent of *usefulness of content*.

In an integrated model of interaction experience for information retrieval in a Web-based encyclopedia, van Schaik and Ling (2011) found that perceptions of product attributes (*pragmatic quality* and *hedonic quality*) are independent determinants of technology-acceptance constructs (*perceived usefulness*, *perceived ease of use* and *perceived enjoyment*). In an attempt to replicate these findings by examining the relationships between technology-acceptance constructs and product attributes in the application area of online news, the following hypotheses are proposed:

H5a: *pragmatic quality* is a determinant of *usefulness of content*.

H5b: *pragmatic quality* is a determinant of *perceived enjoyment*.

H5c: *hedonic quality* is a determinant of *usefulness of content*.

H5d: *hedonic quality* is a determinant of *perceived enjoyment*.

Hassenzahl et al. (2010) found that *hedonic quality* is positively related to *positive affect* ( $r = .46, p < .001$ ), and found support that it remains a significant predictor of *hedonic quality* after controlling for the effect of need fulfilment. Based on mediation and moderation analyses, the authors theorized that positive affect is an outcome of need fulfilment and “a legitimate predictor of hedonic quality” (p. 361). Similarly, they found that *positive affect* is positively correlated with *pragmatic quality* ( $r = .28, p < .001$ ) and it was a significant predictor of *pragmatic quality*. Here, in the measurement model, the scale inter-correlation between *hedonic quality* and *positive affect* was medium ( $r = .35, p < .01$ ), and the scale inter-correlation between *pragmatic quality* and *positive affect* was small ( $r = .22, p < .01$ ). With regards to *negative affect*, an opposite effect is expected on product attributes. It is expected that *negative affect* experienced during the interaction results in lowered ratings of *pragmatic quality* and *hedonic quality*. To investigate the connections between affect and product attributes, the following hypotheses are proposed:

H6a: *positive affect* is an antecedent of *pragmatic quality*.

H6b: *positive affect* is an antecedent of *hedonic quality*.

H6c: *negative affect* is an antecedent of *pragmatic quality*.

H6d: *negative affect* is an antecedent of *hedonic quality*.

*Perceived enjoyment* is, by definition, an intrinsic motivation variable (Sun & Zhang, 2008) that changes over time and across artefacts. In effect, it may be considered as a state-affect variable, and therefore it is expected to be connected to affective reactions measured in relation to the interaction with a particular artefact. Therefore, the following hypotheses are proposed:



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H6e: *positive affect* is an antecedent of *perceived enjoyment*.

H6f: *negative affect* is an antecedent of *perceived enjoyment*.

Tests of hypotheses regarding the first stage of the model are presented in Table 2.

Only supported hypotheses were retained for the full model.

*Table 2.* Hypothesis tests of the first stage of the model.

| H  | Predictor variable              | Criterion variable    | $t^a$    | Supported (yes/no) |
|----|---------------------------------|-----------------------|----------|--------------------|
| 1a | Perceived aesthetics            | Hedonic quality       | ***8.43  | Yes                |
| 1b | Perceived aesthetics            | Pragmatic quality     | 0.85     | No                 |
| 1c | Perceived aesthetics            | Perceived enjoyment   | ***3.45  | Yes                |
| 1d | Perceived aesthetics            | Usefulness of content | -0.23    | No                 |
| 2a | Perceived user-interface design | Hedonic quality       | 1.85     | No                 |
| 2b | Perceived user-interface design | Pragmatic quality     | ***5.63  | Yes                |
| 2c | Perceived user-interface design | Perceived enjoyment   | ***5.43  | Yes                |
| 2d | Perceived user-interface design | Usefulness of content | 1.69     | No                 |
| 3  | Perceived disorientation        | Pragmatic quality     | ***-3.51 | Yes                |
| 4a | Adequacy of information         | Usefulness of content | ***7.00  | Yes                |
| 4b | Accessibility                   | Usefulness of content | *2.40    | Yes                |
| 5a | Pragmatic quality               | Usefulness of content | 0.94     | No                 |
| 5b | Pragmatic quality               | Perceived enjoyment   | 0.14     | No                 |
| 5c | Hedonic quality                 | Usefulness of content | 0.14     | No                 |
| 5d | Hedonic quality                 | Perceived enjoyment   | **2.93   | Yes                |
| 6a | Positive affect                 | Pragmatic quality     | 1.84     | No                 |
| 6b | Positive affect                 | Hedonic quality       | *2.14    | Yes                |
| 6c | Negative affect                 | Pragmatic quality     | *-2.11   | Yes                |
| 6d | Negative affect                 | Hedonic quality       | -0.08    | No                 |
| 6e | Positive affect                 | Perceived enjoyment   | ***10.23 | Yes                |
| 6f | Negative affect                 | Perceived enjoyment   | ** -2.69 | Yes                |

<sup>a</sup>Bootstrap, N = 5000.

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

With regards to Hypothesis 1 (a-d), perceived aesthetics was a significant predictor of non-instrumental UX components (*hedonic quality* and *perceived enjoyment*), but it did not predict instrumental UX components (*pragmatic quality* and *usefulness of content*). Contrary to *perceived aesthetics*, *perceived user-interface design* was a significant predictor of *pragmatic quality* (H2b). However, *perceived aesthetics* and *perceived user-interface design* were strongly correlated ( $r = .60$ ,  $p < .01$ ; see

Appendix B). When *perceived user-interface design* was removed from the model, the effect of *perceived aesthetics* on *pragmatic quality* became significant ( $t = 4.05$ ,  $p < .001$ ). These results suggest that *perceived aesthetics* and *perceived user-interface design* share a significant portion of variance, presumably the variance of classical-aesthetics items in the composite *perceived aesthetics* measure. The findings imply that interface aesthetics can promote user-perceived ease of use of news sites. Additionally, *perceived user-interface design* was a significant predictor of *perceived enjoyment* (H2c), but not of *hedonic quality* (H2a). Again, the lack of support for H2a can be attributed to the high amount of variance shared between *perceived user-interface design* and *hedonic quality*; when *perceived aesthetics* was removed, the path from *perceived user-interface design* and *hedonic quality* became significant ( $t = 7.16$ ,  $p < .001$ ). On the other hand, neither *perceived aesthetics* (H1d), nor *perceived user-interface design* (H2d) predicted *usefulness of content*, which implies that the perceived usefulness of news sites is not affected by interface aesthetics.

Indeed, instrumental UX components were predicted significantly by perceived artefact characteristics that are not related to interface aesthetics (H3-4). *Perceived disorientation* was a significant, negative predictor of *pragmatic quality* (H3); lower levels of disorientation while browsing a news site were associated with higher levels of user-perceived usability of the site. *Adequacy of information* (H4a) and *accessibility* (H4b) were both significant and positive predictors of *usefulness of content*.

Hypothesis 5 (a-d) was included to test if product attributes are independent determinants of technology-acceptance constructs. Only H5d was supported: *hedonic quality* was a significant predictor of *perceived enjoyment*, which implies that

the perception of pleasure-producing attributes of a news site positively affects users' situation-specific intrinsic motivation to use the site.

Hypothesis 6 (a-d) was related to the relationship between experienced affect during the interaction and the perception of UX components. Overall, the pattern of relationships lends support to the distinction between hygiene- and motivator factors as determinants of UX (Zhang & von Dran, 2000). *Positive affect* was a significant, positive predictor of *hedonic quality* (H6b) and *perceived enjoyment* (H6e), but not of *pragmatic quality* (H6a). On the other hand, *negative affect* was a significant, negative predictor of *pragmatic quality* (H6c), but it did not predict *hedonic quality* (H6d). *Negative affect* was also a significant, negative predictor of *perceived enjoyment* (H6f). In other words, positive affective responses were related to pleasure-producing product attributes and enjoyment, but not to instrumental product attributes, while negative affective was predominantly (negatively) related to instrumental product attributes, but also led to lower levels of enjoyment, without affecting the perception of pleasure producing product attributes.

Additionally, although interaction characteristics are not used to predict emotional responses in the original CUE model, the connections between measures of artefact characteristics and affect dimensions were tested to see if affect experienced during interaction could be connected to perceptions of designable product characteristics. As Hassenzahl (2006) points out, designers of interactive products cannot exert a high level of control over emotional responses in a particular design, but they can design to create the possibility of an experience to occur during future interactions. It is therefore useful to identify connections between artefact characteristics and emotional responses to aid designers. Regarding emotional responses, only two paths were significant: *perceived disorientation* to *negative affect* ( $t = 4.11, p < .001$ )

and *perceived aesthetics* to *positive affect* ( $t = 4.26, p < .001$ ). Therefore, only these paths from perceptions of artefact characteristics to affective reactions were retained for the complete model.

#### **4.2.2. SECOND STAGE: FROM UX COMPONENTS TO UX OUTCOMES**

The second stage of the model concerns the prediction of UX outcomes, composed of overall evaluative judgements (*beauty and goodness*) and *behavioral intention*, from instrumental UX components (*pragmatic quality* and *usefulness of content*), non-instrumental UX components (*hedonic quality* and *perceived enjoyment*) and affective reactions (*positive affect* and *negative affect*). Additionally, the effect of participants' existing use of news sites (*baseline use-frequency*) and *behavioral intention* on use behavior is also considered. Based on Hassenzahl's UX model (2003, 2004) and empirical studies that confirmed these in the context of Web-site use (van Schaik & Ling, 2008, 2011), the following hypotheses are proposed:

H7a: *pragmatic quality* is a determinant of *goodness*.

H7b: *pragmatic quality* is not a determinant of *beauty*.

H7c: *hedonic quality* is a determinant of *goodness*.

H7d: *hedonic quality* is a determinant of *beauty*.

Additionally, in a study involving the integrated modeling of UX and TAM constructs with a Web site, van Schaik and Ling (2011) found that product evaluations (*beauty* and *goodness*) are not independent determinants of intention to use. Therefore, the following hypotheses are proposed:

H7e: *goodness* is not a determinant of *behavioral intention*.

H7f: *beauty* is not a determinant of *behavioral intention*.

*Perceived usefulness* in this study is characterized as the perceived usefulness of the content presented by the news portal a particular participant has been using.

Therefore, *usefulness of content* was used as a proxy of *perceived usefulness* in this analysis. Based on the technology acceptance model (e.g., Davis, 1989; Venkatesh & Davis, 2000), the following hypothesis is proposed:

H8a: *usefulness of content* is a determinant of *behavioral intention*.

According to Sun and Zhang (2008), the effect of *perceived enjoyment* on *behavioral intention* is mediated through *perceived ease of use*. However, *perceived ease of use* was not included in the measurement model; therefore, a direct effect of *perceived enjoyment* on *behavioral intention* can be expected. Furthermore, research confirmed that *perceived enjoyment* is a direct determinant of *behavioral intention* (Cyr et al., 2006, 2007; van Schaik & Ling, 2011). Therefore, the following hypothesis is proposed:

H8b: *perceived enjoyment* is a determinant of *behavioral intention*.

To test the effects of affective reactions on interaction outcomes, the following hypotheses are proposed, in accordance with the hygiene- and motivator factor distinction:

H9a: *positive affect* is a determinant of *beauty*.

H9b: *positive affect* is a determinant of *goodness*.

H9c: *negative affect* is a determinant of *goodness*.

H9d: *negative affect* is not a determinant of *beauty*.

H9e: *positive affect* is a determinant of *behavioral intention*.

H9f: *negative affect* is a determinant of *behavioral intention*.

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Based on TAM (Davis, 1989), it is expected that *behavioral intention* is positively related to use behavior. Use behavior in the current study was assessed by how frequently a particular participant normally accessed the news site that he/she had been using during the study (frequency of use). However, the participants were all in the post-adoption stage (Magni, Taylor, & Venkatesh, 2010), in other words, they have already adopted the news sites they chose to use during the study. Because of this, their actual use-frequency of the particular news sites is expected to be less influenced by *behavioral intention*. Participants were asked to indicate how frequently they accessed news sites in general (*baseline use-frequency*), as well as the frequency of use of the particular news site they had been using during the study. The frequency of use of news sites in general is expected to be positively related to the frequency of use of a particular news site. Therefore, the following hypotheses are proposed:

H10a: *behavioral intention* is a determinant of *frequency of use*.

H10b: *baseline use-frequency* is a determinant of *frequency of use*.

Note that the intention to use (or continue using) a particular news site in the future is not necessarily informative for predicting the frequency of use of that site. The frequency of use of news sites in general, however, is expected to be more strongly related to the frequency of use of particular sites. Therefore, Hypothesis 11a is proposed to test if *behavioral intention* still remains a significant predictor of use behavior after controlling for baseline use. Tests of hypotheses related to the second stage of the model are presented in Table 3.

Table 3. Hypothesis tests of the second stage of the model.

| H   | Predictor variable     | Criterion variable   | $t^a$    | Supported (yes/no) |
|-----|------------------------|----------------------|----------|--------------------|
| 7a  | Pragmatic quality      | Goodness             | ***4.35  | Yes                |
| 7b  | Pragmatic quality      | Beauty               | 0.69     | Yes                |
| 7c  | Hedonic quality        | Goodness             | ***8.25  | Yes                |
| 7d  | Hedonic quality        | Beauty               | ***10.32 | Yes                |
| 7e  | Goodness               | Behavioral intention | *2.47    | No                 |
| 7f  | Beauty                 | Behavioral intention | 0.00     | Yes                |
| 8a  | Usefulness of content  | Behavioral intention | ***4.14  | Yes                |
| 8b  | Perceived enjoyment    | Behavioral intention | ***4.54  | Yes                |
| 9a  | Positive affect        | Beauty               | **2.85   | Yes                |
| 9b  | Positive affect        | Goodness             | 1.89     | No                 |
| 9c  | Negative affect        | Goodness             | *-2.26   | Yes                |
| 9d  | Negative affect        | Beauty               | -0.62    | Yes                |
| 9e  | Positive affect        | Behavioral intention | 0.36     | No                 |
| 9f  | Negative affect        | Behavioral intention | -0.53    | No                 |
| 10a | Behavioral intention   | Frequency of use     | *2.32    | Yes                |
| 10b | Baseline use-frequency | Frequency of use     | ***21.63 | Yes                |

<sup>a</sup>Bootstrap, N = 5000.

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

Hypotheses proposed on the basis of Hassenzahl's UX model (H7a-d) were all supported: *hedonic quality* was a significant, positive predictor of both *goodness* (H7c) and *beauty* (H7d) ratings of news sites, while *pragmatic quality* predicted *goodness* (H7a), but not *beauty* (H7b) ratings. Contrary to the findings of van Schaik and Ling (2011), *goodness* was an independent predictor of *behavioral intention* (H7e not supported)<sup>11</sup>; however, *beauty* was not (H7f). In accordance with TAM, *usefulness of content* (H8a) and *perceived enjoyment* (H8b) were significant (positive) predictors of *behavioral intention*. Therefore, the assumptions of both Hassenzahl's UX model and TAM were supported for the second stage of the model.

<sup>11</sup> However, this path was excluded from the final model (see the next section) for its low effect size ( $f^2 = .03$ ) and in favour of a simpler model structure (i.e., to avoid including an additional model stage for a single, low effect-size path that contradicts previous research).

With regards to the effects of affective reactions on interaction outcomes (H9a-f), *positive affect* was a significant (positive) predictor of both *beauty* (H9a), but not of *goodness* (H9b) ratings, while negative affect was a significant (negative) predictor of *goodness* (H9c), and not of *beauty* (H9d). Positive and negative affect ratings were not direct predictors of *behavioral intention* (H9e and f; however, the indirect effect of *positive affect* on *behavioral intention* through *perceived enjoyment* can be seen in Figure 2).

Behavioral intention was a significant predictor of frequency of use (H10a), even with controlling for baseline use-frequency (H10b). *Behavioral intention* alone accounted for 11% of the variance in *frequency of use*, but it only accounted for 1% of unique variance in *frequency of use* with *baseline use-frequency* included in the model.

This suggests that in the post-adoption stage, the power of *behavioral intention* (the intention to use a particular artefact in the future) to predict the *frequency of use* of a particular new site is diminished; however, the relationship between the two variables remains significant.

### 4.2.3. MODEL PARAMETERS AND DISCUSSION

Following the hypothesis tests, we only retained the significant paths in the model and conducted mediation analyses<sup>12</sup> to test if the effects of perceived artefact characteristics on interaction outcomes were fully mediated through UX components. *Perceived aesthetics* retained a direct effect on *beauty* ( $t = 2.72, p < .01$ ); however,

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<sup>12</sup> Testing mediation effects includes a predictor variable, a target variable and a mediator variable.

Full mediation occurs when the inclusion of a significant mediator into a model changes the path from the predictor variable to the target variable to non-significant; partial mediation occurs when the direct effect of the predictor becomes smaller, but remains statistically significant, as a result of including a significant mediator variable into a model (see Chin, 2010).



the indirect effect through positive affect and hedonic quality ( $\beta = .33$ ) exceeded the direct effect ( $\beta = .22$ ). Therefore, the direct path from *perceived aesthetics* to *beauty* was omitted for a simpler model structure. Similarly, perceived user-interface design retained a direct effect on behavioral intention after controlling for perceived enjoyment ( $t = 4.19, p < 0.001$ ), suggesting partial mediation. The direct path of *perceived user-interface design* was not included in the structural model to promote a clear separation of model stages; however, both the mediated and the direct effects are considered in the discussion.

The final model is presented in Figure 2. Details of model parameters are presented in Table 4. Note that, according to Chin (1998), standardized path coefficients ( $\beta$ ; also referred to as *impact*) should be around .20 (and ideally above .30) to be considered meaningful. Guidance for the interpretation of  $f^2$  effect-size coefficients is provided under Table 4 (based on Cohen, 1988). Semipartial correlations squared ( $s^2$ ) in Table 4 indicate unique variance explained by a particular predictor.  $R^2$  values indicate the proportion of variance explained in target (criterion) variables by all of their predictors.

While Figure 2 provides a general overview of the structural model, Table 4 allows examining UX components and interaction-outcome variables, and their respective predictors separately. Four predictors explained 43% variance in *pragmatic quality*, but the impact and effect-size of affect dimensions were small. *Perceived user-interface design* had the highest impact on *pragmatic quality* with medium effect-size, which suggests a strong relationship between the layout of the interface and user-perceived usability. *Perceived disorientation* was negatively related to *pragmatic quality* with medium effect-size, which indicates that feeling lost on a news site decreases perceptions of its usability. *Pragmatic quality*, in turn, had a high

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impact on *goodness* ratings with medium effect size. Furthermore, *perceived user-interface design* and *perceived disorientation* were strongly and negatively correlated ( $r = -.52, p < .01$ ), which indicates that disorientation in users may be attributed, in part, to interface layout.

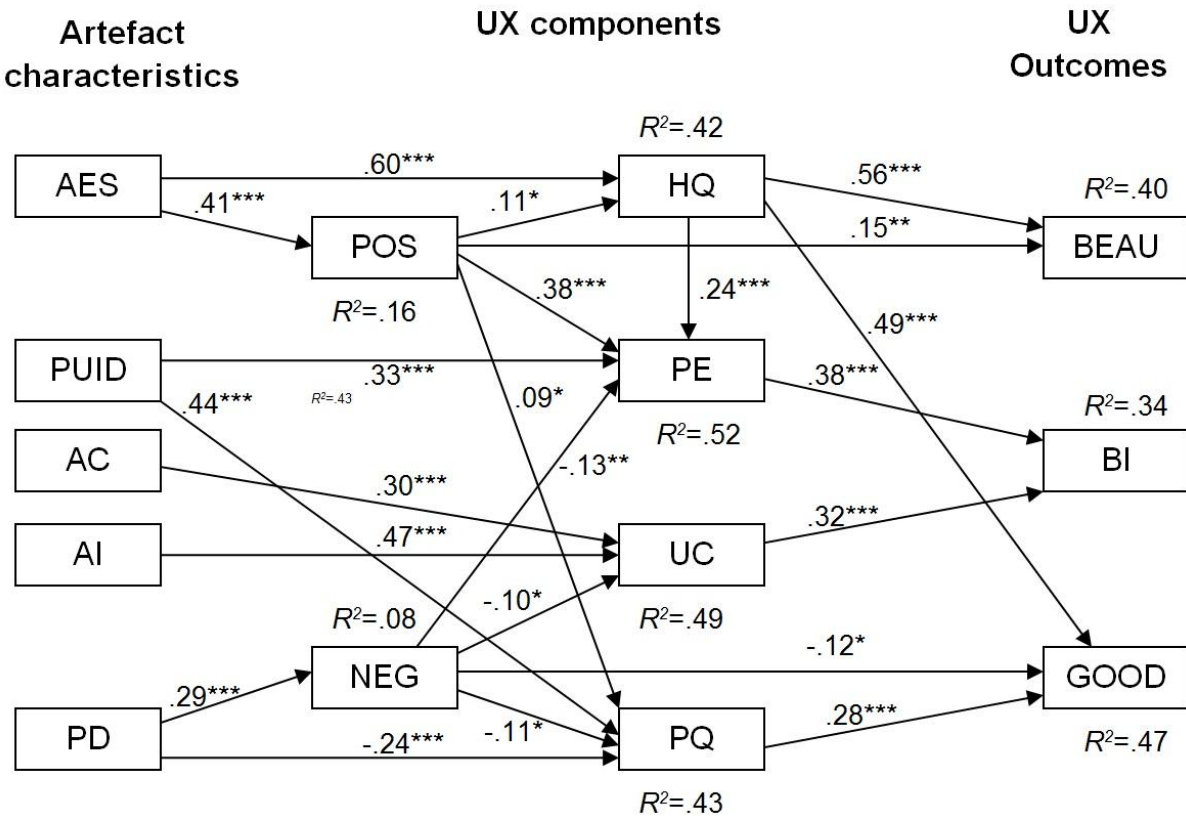


Figure 2. Model of user-experience with news sites.

Note. AES: perceived aesthetics. PUID: perceived user-interface design. AC: accessibility. AI: adequacy of information. PD: perceived disorientation. POS: positive affect. NEG: negative affect. HQ: hedonic quality. PE: perceived enjoyment. UC: usefulness of content. PQ: pragmatic quality. BEAU: beauty. BI: behavioral intention. GOOD: goodness.

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

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**Table 4.** Model parameters of the model of user-experience with news sites.

| Prediction of UX components               |                          |         |          |             |                                       |
|---|--------------------------|---------|----------|-------------|---------------------------------------|
| Target variable<br>(number of predictors) | Predictor variable       | $\beta$ | $t^a$    | $sr^2$      | Effect size<br>( $f^2$ ) <sup>b</sup> |
| Pragmatic quality (4)<br>$R^2 = .43$      | Perceived disorientation | -.24    | ***3.38  | .04         | .07                                   |
|   | Perceived U-I design     | .44     | ***6.84  | .14         | .24                                   |
|   | Negative affect          | -.11    | *2.11    | .01         | .02                                   |
|   | Positive affect          | .09     | *2.00    | .01         | .01                                   |
| Usefulness of content (3)<br>$R^2 = .49$  | Accessibility            | .30     | ***3.97  | .07         | .13                                   |
|   | Adequacy of Information  | .47     | ***6.93  | .17         | .32                                   |
|   | Negative affect          | -.10    | *2.07    | .01         | .02                                   |
| Perceived enjoyment (4)<br>$R^2 = .52$    | Perceived U-I design     | .33     | ***5.70  | .08         | .17                                   |
|   | Negative affect          | -.13    | **3.01   | .02         | .04                                   |
|   | Positive affect          | .38     | ***9.47  | .12         | .24                                   |
|   | Hedonic quality          | .24     | ***3.97  | .04         | .09                                   |
| Hedonic quality (2)<br>$R^2 = .42$        | Perceived aesthetics     | .60     | ***12.15 | .30         | .51                                   |
|   | Positive affect          | .11     | *2.04    | .01         | .02                                   |
| Positive affect (1)                       | Perceived aesthetics     | .41     | ***7.87  | $R^2 = .16$ | .20                                   |
| Negative affect (1)                       | Perceived disorientation | .29     | ***4.85  | $R^2 = .08$ | .09                                   |
| Prediction of UX outcomes                 |                          |         |          |             |                                       |
| Target variable<br>(number of predictors) | Predictor variable       | $\beta$ | $t^a$    | $sr^2$      | Effect size<br>( $f^2$ ) <sup>b</sup> |
| Goodness (3)<br>$R^2 = .47$               | Negative affect          | -.12    | *2.00    | .01         | .02                                   |
|   | Pragmatic quality        | .28     | ***5.05  | .06         | .11                                   |
|   | Hedonic quality          | .49     | ***9.43  | .19         | .35                                   |
| Behavioral intention (2)<br>$R^2 = .34$   | Usefulness of content    | .32     | ***4.53  | .09         | .14                                   |
|   | Perceived enjoyment      | .38     | ***5.95  | .12         | .18                                   |
| Beauty (2)<br>$R^2 = .40$                 | Positive affect          | .15     | **3.08   | .02         | .04                                   |
|   | Hedonic quality          | .56     | ***10.85 | .28         | .46                                   |

<sup>a</sup>Bootstrap,  $N = 5000$ .

<sup>b</sup> $f^2$ : 0.02 - 0.14 small, 0.15 - 0.34 medium and 0.35 - large.

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

*Adequacy of information* (as a measure of information quality) and *accessibility* (as a measure of service quality) accounted for 48% of the variance in *usefulness of content* (both with medium effect-size). These findings suggest that the perceived usefulness of a news site is strongly related to the adequacy of the content provided by the site, along with accessibility to this content (i.e., availability and loading time). In the four longitudinal studies of Venkatesh and Davis (2000), the variance explained in *perceived usefulness* in voluntary use settings ranged from 40% to

60%. Although they used different variables to predict *perceived usefulness*, the variance explained in the current study in *usefulness of content* falls between these values. *Usefulness of content*, in turn, had a strong impact on *behavioral intention* with medium effect-size.

The strongest predictor of *perceived enjoyment* was *positive affect* with medium effect-size, while *negative affect* had a considerably lower, but still significant impact with small effect-size. This finding indicates that positive affect experienced during news-site use drives intrinsic motivation to use the site. With regards to the source of affective reactions, *perceived aesthetics* was a predictor of *positive affect* (medium effect-size), and *perceived disorientation* was a predictor of *negative affect* (small effect-size). *Perceived user-interface design* (medium effect-size) and *hedonic quality* (small effect-size) also had considerable impact on *perceived enjoyment* (52% variance explained). By comparison, in the study of Cyr et al. (2006), 43% of variance in *perceived enjoyment* was accounted for by *design aesthetics* and *perceived ease of use*. In turn, *perceived enjoyment* had a strong impact on *behavioral intention* with medium effect-size.

*Perceived aesthetics* and *positive affect* together accounted for 42% variance in *hedonic quality*. *Perceived aesthetics* had a large effect-size and accounted for the majority of the variance explained. In turn, *Hedonic quality* (large effect-size) and *positive affect* (small effect-size) together accounted for 40% of variance in *beauty* judgements. Including the direct path from *perceived aesthetics* to *beauty* resulted in only 3% variance explained in *beauty*.

With regards to the prediction of outcome variables, *goodness* (47% variance explained) was affected by both *pragmatic quality* and *hedonic quality*, whereas *beauty* (40% variance explained) was not affected by *pragmatic quality*. Notably, the

effect-size of *hedonic quality* on *goodness* was more than three times that of *pragmatic quality* ( $f^2 = .35$  and  $.11$ , respectively), suggesting that *goodness* judgements of news sites in a free-browsing context may be predominantly grounded in hedonic aspects. Thirty-nine per cent of variance in *behavioral intention* was accounted for by *perceived enjoyment*, *usefulness of content* and *perceived user-interface design* (34% without the direct path from perceived user-interface design). This result is consistent with the findings of four longitudinal studies of Venkatesh and Davis (2000) applying the extended version of the technology acceptance model (TAM2), where 34%-52% of variance in intention to use was explained by technology acceptance constructs.

With regards to the role of affect in the model, *positive affect* was predominantly positively connected to the perception of non-instrumental qualities and *beauty* evaluation, and *negative affect* was predominantly negatively connected to the perception of instrumental qualities and *goodness* evaluation. These findings lend supports to the distinction between hygiene- and motivator factors as determinants of UX (Zhang & von Dran, 2000). *Negative affect* experienced during the interaction negatively affected perceptions of instrumental qualities and *goodness*, reducing the quality of experience, whereas *positive affect* was positively related to non-instrumental qualities and *beauty*, promoting the quality of experience. Furthermore, the connection of affect dimensions with perceived product characteristics helps to clarify sources of positive and negative affect that are rooted in system design.

## 5. IMPLICATIONS AND FUTURE WORK

The main aim of the study presented in this paper was to formulate a comprehensive model of user-experience with news sites. Based on an exploratory study and a literature review, variables were collected to measure UX with news sites in an

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online study. Psychometric properties of the scales were confirmed, with the exception of the five need fulfilment scales; consequently, these five scales were not analyzed. A structural model of user-experience with news sites was formulated and tested, based on the CUE model, with hypotheses drawn from TAM and UX literature.

The current research contributes to knowledge predominantly by testing relationships between UX and TAM constructs for the use of news sites, and by bringing together constructs from both models in a comprehensive model to explain variation in UX outcomes. The paths were not only tested for their statistical significance, but a detailed description of inter-relations was provided (in terms of path strength, effect size and variance explained), interpreted and discussed in light of theory and research literature, thereby providing further insight to structure of factors contributing to the experience and acceptance of online news services.

Furthermore, the research presented here contributes to understanding the role of affect in the formulation of UX. Affective reactions were significant predictors of UX constructs and outcome measures, although their direct contribution to prediction was relatively small. However, in system design, promoting positive affective reactions and preventing negative reactions in users may be a goal in its own right. The relative independence of outcome variables from each other, in terms of being predicted from a different set of variables, supports the need to apply various outcome measures and a sufficiently wide range of components of interaction characteristics to predict them.

The model of user-experience with news sites is a specific-to-general model that operates with psychological constructs to account for the high-level outcomes of technology acceptance and overall quality judgements at the same time, including

UX variables and affective reactions in an attempt to tap experiential and emotional aspects of UX. Although there are alternative ways of model specification in modeling UX, for example, general-to-specific inference-perspective models (see Hassenzahl & Monk, 2010; van Schaik, Hassenzahl, & Ling, 2012), we maintained the specific-to-general route applied by the TAM and UX models, because this allows to focus on the prediction of high-level design goals (e.g., acceptance and evaluation).

The model links components of UX to perceptions of artefact characteristics that can be directly connected to and controlled by system design. Therefore, the model can be used in system evaluation to identify areas of improvement for design by mapping the impact (magnitude of path coefficient) of predictors of experience and outcome variables against the system's performance on the variables, producing impact-performance matrices (see Martensen & Grønholdt, 2003). Impact-performance analyses have been successfully applied in other domains (e.g., Martensen & Grønholdt, 2003; Höck, Ringle, & Sarstedt, 2010; Völckner, Sattler, Hennig-Thurau, & Ringle, 2010) and these analyses can be used to assist in design prioritization.

Impact-performance analyses can be applied to the entire model by ranking each predictor variable in terms of impact (standardized regression coefficient) and displaying the corresponding performance scores (rescaled to a common range, for example, 1-100 to aid comparability). Detailed analyses are not presented here, because the model was not developed for particular news sites. However, path coefficients and performance scores were calculated separately for the sub-sample

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of BBC users in the current study ( $n = 202$ ) for demonstration purposes (only statistically significant paths are included below)<sup>13</sup>.

For example, considering only users of BBC in the current study, *hedonic quality*, a high-impact predictor of *goodness* ( $\beta = .44$ )<sup>14</sup> scored relatively low (performance = 61.58 on a 1-100 transformed scale), compared to the other, less strong predictor of *goodness* in the model, *pragmatic quality* ( $\beta = .26$ , performance = 73.92). Therefore, a recommendation can be made to expend effort on addressing interface aesthetics, which is a strong predictor of *hedonic quality* in the model ( $\beta = .59$ , performance = 62.63). Note that the perceived aesthetic rating of the BBC site was far from the maximum score of 100, which indicates plenty of room for design improvement.

Although the models presented in this paper do not identify physical design attributes to provide direct guidance for design improvement (e.g., Kim, Lee, & Choi, 2003; Cho, Park, Han, & Kang, 2011), guidance for improving aesthetics can be drawn from existing HCI, design and ergonomics literature, for example, by addressing visual complexity (Tuch, Presslauer, Stöcklin, Opwis, & Bargas-Avila, 2012), innovativeness (Carbon & Leder, 2005), the balance of novelty and prototypicality (Hekkert, Snelders, & van Wieringen, 2003) and principles of design aesthetics (Hekkert, 2006). Rather than offering direct guidance on how to improve certain design factors, a practical value of the current model-based approach lies in its utility for evaluation and design prioritization.

According to the model, better interface aesthetics is expected to lead to more positive affect experienced by users ( $\beta = .31$ ) and higher levels of hedonic-quality

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<sup>13</sup> See Aranyi (2012) for examples of detailed impact-performance analyses of two news sites.

<sup>14</sup> Note that all  $\beta$  values in the current example are above .20; therefore, these paths are not just statistically significant, but also represent substantial effect size (Chin, 1998).



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attributions ( $\beta = .59$ ), which in turn lead to higher overall *goodness* ( $\beta = .44$ ) and *beauty* ( $\beta = .48$ ) ratings of the site. At the same time, improving levels of *hedonic quality* is expected to lead to higher levels of *enjoyment* in users ( $\beta = .32$ ), which in turn promotes their *intention to use* ( $\beta = .28$ ). Generally, if a UX variable with high impact scores relatively low on performance, a recommendation for improvement can be made by addressing the corresponding artefact characteristics and prioritizing the particular area in design (Martensen & Grønholdt, 2003). With regards to system evaluation and (re)design, a further practical utility of the current model lies in providing a basis for the selection of measures and their structural relationships to collect and analyze data involving a large number of participants, such as questionnaire surveys.

In the current study, variables of interaction characteristics only included measures of perceived artefact characteristics. However, user characteristics and task/context characteristics are considered to be important aspects of UX (Finneran & Zhang, 2003; van Schaik & Ling, 2012a) and their role needs to be addressed in further research. In Figure 1, proposed measures of interaction characteristics are presented in grey; their presence is acknowledged, but their measurement was not included in the current study. Several measures of person characteristics can be considered for inclusion if they were found to be connected to use of Web sites in previous studies. Examples include intrinsic motivation (van Schaik & Ling, 2012a) and need for cognition (Amichai-Hamburger, Kaynar, & Fine, 2007). Demographic properties of participants, such as age and level of education, may also be included among person characteristics to form different groups of users, for example, to specify 'target audiences'.

A task/context characteristic that may be involved in further studies is mode of use. According to Hassenzahl (2003), users of interactive systems in goal mode are pursuing specific goals during their use and their focus is on the attainment of a desired outcome, whereas in action mode their focus is on the action itself of using the system. Research suggests that users' perceptions of a particular system, and consequently their experience, are influenced by the mode in which they use the system (Hassenzahl & Ullrich, 2007; van Schaik & Ling, 2009, 2011). In the case of news-site use, participants in goal mode may look for specific pieces of information and search for certain types of content. Good organization of content and links with high information scent are expected to aid them in finding desired content. In action mode, users may browse a news site to see if anything catches their attention. In this case, exploration of the site may be promoted, for example, by an aesthetically stimulating graphical environment and interesting headlines.

As a further limitation, note that variables for modeling UX in the present study were selected based on categories of experience with a news site derived from an exploratory think-aloud study, and on the technology-acceptance, Hassenzahl's UX and CUE models. Consequently, certain aspects of UX modeling, such as flow (see van Schaik & Ling, 2012b) and time-scale properties of UX (e.g., van Schaik et al., 2012), are not addressed in the current model. Further research includes the testing of the model of user-experience with news sites formulated in the current study in a controlled experimental setting and expanding the model by incorporating measures of additional UX aspects.

## **6. CONCLUSION**

In summary, the present research applied UX modeling to the domain of online news, where UX has not been modelled before to the knowledge of the authors. We

used partial-least-squares structural equation modeling to test a measurement model and a structural model of UX, based on data from an online questionnaire and the CUE model as a framework. The structural model integrated technology-acceptance and UX constructs from HCI and IS literature, and included affective reactions as UX components to predict UX outcomes. In turn, UX components were predicted from perceptions of artefact characteristics. Structural relationships between the variables in the model were tested, quantified, and evaluated in light of previous research and theory. Implications of the model to theory, artefact evaluation and design prioritization were discussed. We look forward to see the CUE model being applied as a framework in future UX-modeling research in information science and technology, and other domains.

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**APPENDIX A: PSYCHOMETRIC SCALES USED IN THE STUDY**

Positive and negative affect schedule (PANAS)

*During the use of the site I felt...*

|      |              |       |            |
|------|--------------|-------|------------|
| POS1 | Interested   | NEG6  | Irritable  |
| NEG1 | Distressed   | POS6  | Alert      |
| POS2 | Excited      | NEG7  | Ashamed    |
| NEG2 | Upset        | POS7  | Inspired   |
| POS3 | Strong       | NEG8  | Nervous    |
| NEG3 | Guilty       | POS8  | Determined |
| NEG4 | Scared       | POS9  | Attentive  |
| NEG5 | Hostile      | NEG9  | Jittery    |
| POS4 | Enthusiastic | POS10 | Active     |
| POS5 | Proud        | NEG10 | Afraid     |

Response format: 7-point Likert scale with anchor points 'not at all', 'moderately' and 'extremely'.

AttrakDiff2-SF

|          |               |   |             |
|----------|---------------|---|-------------|
| PQ1      | Confusing     | - | Structured  |
| PQ2      | Unpredictable | - | Predictable |
| PQ3      | Impractical   | - | Practical   |
| PQ4      | Complicated   | - | Simple      |
| HQ1      | Dull          | - | Captivating |
| HQ2      | Tacky         | - | Stylish     |
| HQ3      | Cheap         | - | Premium     |
| HQ4      | Unimaginative | - | Creative    |
| BEAUTY   | Ugly          | - | Beautiful   |
| GOODNESS | Bad           | - | Good        |

Response format: 7-point semantic differential.

Perceived enjoyment (PE)

|     |   |
|-----|---|
| PE1 | I find using this news site to be enjoyable.            |
| PE2 | The actual process of using this news site is pleasant. |
| PE3 | I have fun using this news site.                        |

Response format: 7-point Likert scale with anchor points 'strongly disagree', 'neutral' and 'strongly agree'.

## Modeling user-experience with news Web sites

### Perceived disorientation (PD)

*During the use of the site...*

---

- PD1 I felt lost.
  - PD2 I felt I was going around in circles.
  - PD3 It was difficult to find a page I had previously viewed.
  - PD4 Navigating between the pages was a problem.
  - PD5 I didn't know how to get to my desired location.
  - PD6 I felt disoriented.
  - PD7 After browsing for a while I had no idea where to go next.
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree' and 'strongly agree'.

### Perceived user-interface design (PUID)

- 
- PUID1 The layout of the site is user-friendly.
  - PUID2 The layout of the site is in good structure.
  - PUID3 Overall, the user-interface design of the site is satisfactory.
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree', 'neutral' and 'strongly agree'.

### Perceived aesthetics (AES)

- 
- CA1 Clean
  - CA2 Pleasant
  - CA3 Symmetrical
  - CA4 Aesthetic
  - EA1 Original
  - EA2 Sophisticated
  - EA3 Spectacular
  - EA4 Creative
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree' and 'strongly agree'. CA: classical aesthetics. EA: expressive aesthetics.



## Modeling user-experience with news Web sites

### Usefulness of content (UC), adequacy of information (AI) and accessibility (AC)

---

- UC1 The site provides relevant information.
  - UC2 The site provides up-to-date information.
  - UC3 The site provides unique content.
  - AI1 The site provides comprehensive information.
  - AI2 The site provides complete content.
  - AI3 The site provides sufficient information.
  - AC1 The pages of the site are accessible.
  - AC2 The pages of the site load quickly.
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree', 'neutral' and 'strongly agree'.

### Behavioral intention (BI)

---

- BI1 I intend to use the site in the future.
  - BI2 I predict that I will use the site in the future.
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree' and 'strongly agree'.

### Need fulfilment

*During my use of the news site I felt...*

---

- AUT1 that my choices were based on my true interests and values.
  - AUT2 free to do things my own way.
  - AUT3 that my choices expressed my 'true self'.
  - COMP1 that I was successfully completing difficult tasks and projects.
  - COMP2 that I was taking on and mastering hard challenges.
  - COMP3 very capable in what I did.
  - REL1 a sense of contact with people who care for me and whom I care for.
  - REL2 close and connected with other people who are important to me.
  - REL3 a strong sense of intimacy with the people I spent time with.
  - STIM1 that I was experiencing new sensations and activities.
  - STIM2 intense pleasure and enjoyment.
  - STIM3 that I have found new sources and types of stimulation for myself.
  - POP1 that I was a person whose advice others seek out and follow.
  - POP2 that I strongly influenced others' beliefs and behavior.
  - POP3 that I had strong impact on what other people did.
- 

Response format: 7-point Likert scale with anchor points 'strongly disagree' and 'strongly agree'. The presentation order of the items was randomized.

## Modeling user-experience with news Web sites

### Need fulfilment relevance

*How important were the following feelings to you in relation to using the news site?*

---

|                          |   |
|--------------------------|---|
| RELAUT<br>(Autonomy)     | Feeling like you are the cause of your own actions rather than feeling that external forces or pressures are the cause of your actions.                   |
| RELCOMP<br>(Competence)  | Feeling that you are very capable and effective in your actions rather than feeling incompetent or ineffective.   |
| RELREL<br>(Relatedness)  | Feeling that you have regular intimate contact with people who care about you rather than feeling lonely and uncared for.                                 |
| RELPOP<br>(Popularity)   | Feeling that you are liked, respected and have influence over others rather than feeling like a person whose advice and opinions nobody is interested in. |
| RELSTIM<br>(Stimulation) | Feeling that you get plenty of enjoyment and pleasure rather than feeling bored and understimulated.  |

---

Response format: 7-point Likert scale with anchor points 'not important at all' and 'extremely important'.

## APPENDIX B: MEASUREMENT MODEL DETAILS

### B.1. EXPLORATORY FACTOR ANALYSES OF MULTIDIMENSIONAL SCALES

Before analysis of the measurement model using PLS, including all psychometrically measured variables selected for the study, a series of factor analyses were conducted to explore the factor structure of the multidimensional scales separately. Factor analyses were conducted using the same extraction and rotation methods that were used in the research publications from which the scales for derived from.

For the two dimensional measure of *perceived aesthetics*, principal component extraction was used with the explicit extraction of two factors (for classical and expressive aesthetics) and varimax rotation ( $KMO = .90$ ; Bartlett:  $\chi^2(28) = 1321.71$ ,  $p < 0.001$ ; total variance extracted: 70%). Only one principal component had an eigenvalue over one and the rotated solution failed to reproduce the original factor structure of the measure. Furthermore, the rotated solution contained several high cross-loadings and simple structure was not achieved. Oblique rotation (direct oblimin) led to a similar structure. However, a single-factor solution with 60% of extracted variance resulted in a simple structure. All items loaded highly on one component and the resulting scale showed satisfactory internal consistency (Cronbach's alpha = .90). The item-loadings of the factor solutions are presented in Table B1.

*Table B1.* Component matrices of perceived-aesthetics items.

|               | Factor (varimax rotation) |     | Factor (direct oblimin rotation <sup>a</sup> ) |      | Single-factor solution |
|---------------|---------------------------|-----|--|------|------------------------|
|               | 1                         | 2   | 1  | 2    |                        |
| Sophisticated | .84                       | .14 | .92  | -.16 | .77                    |
| Creative      | .76                       | .39 | .79  | .14  | .85                    |
| Clean         | .76                       | .11 | .82  | -.16 | .67                    |
| Aesthetic     | .72                       | .44 | .74  | .20  | .84                    |
| Pleasant      | .67                       | .44 | .67  | .23  | .80                    |
| Original      | .63                       | .54 | .62  | .34  | .83                    |
| Symmetrical   | .09                       | .87 | -.04   | .89  | .58                    |
| Spectacular   | .45                       | .75 | .38  | .64  | .81                    |

*Note.* Extraction method: principal components.

<sup>a</sup>The pattern matrix is presented; loadings are regression coefficients.

In order to determine whether a two-factor or a single-factor solution should be used for aesthetics in the measurement model, the factor structure of *perceived aesthetics* was examined using PLS. All perceived aesthetics items produced high cross-

loadings on both subscales. The latent variables *classical aesthetics* and *expressive aesthetics* were highly correlated ( $r = .80$ ). The square of the correlation between the two subscales ( $r^2 = .64$ ) was larger than the average variance extracted (AVE) of the classical aesthetics subscale (AVE = .58), which indicates a lack of discriminant validity, according to the Fornell-Larcker criterion (Fornell & Larcker, 1981).

However, a combined *perceived aesthetics* latent variable with all items included from both subscales retained a satisfactory amount of variance from the items (AVE = .57) and exhibited satisfactory internal consistency (composite reliability = .91).

Therefore, *perceived aesthetics* was treated as a one-dimensional measure in further analyses, measured by the eight scale items.

The measures of *usefulness of content* (UC), *adequacy of information* (AI) and *accessibility* (AC) were adopted from the same instrument (Yang et al., 2005), where the factor structure was established using factor analysis with principal component extraction and varimax rotation. Therefore, the same analysis was used in the current study, with the explicit extraction of three factors ( $KMO = .84$ ; Bartlett:  $\chi^2(28) = 1040.06$ ,  $p < 0.001$ ; total variance explained: 75%). There were two problematic items: UC3 loaded highly on the factor containing the items of *adequacy of information* without loading on the factor containing the other two *usefulness-of-content* items, and AI3 loaded on all three factors. These items were removed and the same analysis was repeated with two items for each scale. The analysis resulted in a simple structure with 84% of variance explained by the factor solution (see Table B2); therefore, this solution was used in further analyses.

*Table B2.* Rotated component matrix of selected usefulness of content, adequacy of information and accessibility items.

|     |  | Factor |     |     |
|-----|--|--------|-----|-----|
|     |  | 1      | 2   | 3   |
| UC1 | The site provides relevant information.      | .25    | .86 | .22 |
| UC2 | The site provides up-to-date information.    | .26    | .85 | .23 |
| AI1 | The site provides comprehensive information. | .85    | .24 | .23 |
| AI2 | The site provides complete content.          | .87    | .25 | .15 |
| AC1 | The pages of the site are accessible.        | .34    | .36 | .74 |
| AC2 | The pages of the site load quickly.          | .12    | .16 | .93 |

*Note.* Extraction method: principal components. Rotation: varimax.

## Modeling user-experience with news Web sites

For the assessment of the factor structure of the positive and negative affect schedule (PANAS), principal component extraction method was used, with the explicit extraction of two factors, and varimax rotation (see Table B3). The factor solution had a moderate fit ( $KMO = .86$ ; Bartlett:  $\chi^2(190) = 2151.59, p < 0.001$ ; total variance explained: 46%), because of the relatively low amount of explained variance. There were four main components with eigenvalue greater than 1, but the scree-plot indicated the plausibility of extracting two factors, because of the marked drop of eigenvalues after the second component (eigenvalues: 1. = 5.44, 2. = 3.85, 3. = 1.19 and 4. = 1.07). Nevertheless, simple structure was achieved with all positive-affect items loading on one factor and all the negative-affect items loading on the other. All cross-loadings were well below .30 and the scale inter-correlation was low ( $r = .20, p < .01$ ), suggesting good discriminant validity. The internal consistencies of the positive and negative scales were satisfactory (Cronbach's alpha .87 and .88, respectively).

*Table B3.* Rotated component matrix of PANAS items.

| Scale           | Item         | Factor |      |
|-----------------|--------------|--------|------|
|                 |              | 1      | 2    |
| Positive affect | Inspired     | .81    | .01  |
|                 | Enthusiastic | .75    | -.02 |
|                 | Determined   | .75    | .18  |
|                 | Active       | .74    | .08  |
|                 | Proud        | .71    | .08  |
|                 | Excited      | .69    | .07  |
|                 | Attentive    | .66    | .04  |
|                 | Strong       | .60    | .15  |
|                 | Alert        | .56    | .16  |
|                 | Interested   | .55    | -.17 |
| Negative affect | Distressed   | -.06   | .76  |
|                 | Afraid       | -.01   | .74  |
|                 | Upset        | .03    | .70  |
|                 | Scared       | .14    | .69  |
|                 | Ashamed      | .05    | .68  |
|                 | Nervous      | .08    | .67  |
|                 | Jittery      | .18    | .61  |
|                 | Hostile      | .18    | .60  |
|                 | Irritable    | -.00   | .59  |
|                 | Guilty       | .01    | .54  |

*Note.* Extraction method: principal components. Rotation: varimax.

Hassenzahl et al. (2010) used principal component analysis with varimax rotation and the explicit extraction of two factors to test the factor structure of AttrakDiff2-SF.

## Modeling user-experience with news Web sites

Therefore, the same analysis was carried out on the items of the *pragmatic quality* and *hedonic quality* scales (four items each). The analysis resulted in a satisfactory solution ( $KMO = .81$ ; Bartlett:  $\chi^2(28) = 695.22, p < 0.001$ ; total variance explained: 59%), with items loading on the appropriate factors (see Table B4). The internal consistencies of the *pragmatic quality* and *hedonic quality* scales were satisfactory (Cronbach's alpha .70 and .78, respectively). Scale inter-correlation was moderate ( $r = .45, p < .01$ ), but smaller than the internal consistencies, which indicates discriminant validity.

*Table B4.* Rotated component matrix of AttrakDiff2 items.

| Scale             | Item                        | Factor |     |
|-------------------|-----------------------------|--------|-----|
|                   |                             | 1      | 2   |
| Hedonic quality   | Unimaginative - Creative    | .81    | .03 |
|                   | Tacky - Stylish             | .77    | .19 |
|                   | Dull - Captivating          | .74    | .29 |
|                   | Cheap - Premium             | .71    | .10 |
| Pragmatic quality | Impractical - Practical     | .28    | .77 |
|                   | Confusing - Structured      | .30    | .75 |
|                   | Unpredictable - Predictable | -.17   | .67 |
|                   | Complicated - Simple        | .27    | .66 |

*Note.* Extraction method: principal components. Rotation: varimax.

Similar to the original study of Sheldon et al. (2001) and that of Hassenzahl et al. (2010), principal component extraction with varimax rotation was used to identify the underlying factor structure of the items of the five selected needs (three items each). Only two components had eigenvalues greater than 1 and the resulting solution with the explicit extraction of five components failed to reproduce, or even to resemble, the original factor structure (see Table B5). Direct oblimin rotation yielded very similar results, and a two-factor solution based on the eigenvalues did not result in an interpretable structure.

Both Sheldon and colleagues and Hassenzahl and colleagues asked their participants to recall 'peak experiences'. However, in the current study, need fulfilment was assessed after use, so the participants were asked to report on the everyday-experience of browsing a news site. It may be that the fulfilment of universal needs, as measured by these scales, is less salient in less satisfying, but nonetheless pleasurable or otherwise rewarding, experiences. It may also be that the statements of the scales are more suitable for the description of outstanding or extraordinarily satisfying experiences, and do not apply to more common

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experiences, such as the use of news sites. Finally, in the aforementioned previous studies, participants were asked to report on an exceptional experience of their past (cumulative account of experiences), whereas in the current study they commented on a 'fresh' experience (episodic account of an experience) (see Roto, Law, Vermeeren, & Hoonhout, 2011, for time-scale considerations in interaction-experience measurement). The immediate reflection on a common experience may differ from the recollection of a memory of an outstanding experience. Because of the unsuccessful reproduction of their original factor structure, the need-fulfilment scales were excluded from further analysis.

*Table B5.* Rotated factor matrix of the selected need-fulfilment scales.

| Item          | Factor |     |     |     |     |
|---------------|--------|-----|-----|-----|-----|
|               | 1      | 2   | 3   | 4   | 5   |
| Popularity 2  | .86    |     |     |     |     |
| Popularity 3  | .84    |     |     |     |     |
| Relatedness 1 | .83    | .32 |     |     |     |
| Relatedness 3 | .82    |     |     |     |     |
| Relatedness 2 | .81    |     |     |     |     |
| Competence 2  | .78    |     | .37 |     |     |
| Popularity 1  | .72    |     |     | .32 |     |
| Competence 1  | .67    |     | .31 |     | .35 |
| Stimulation 1 | .62    |     | .57 |     |     |
| Autonomy 1    |        | .80 |     |     |     |
| Autonomy 3    | .47    | .68 |     |     |     |
| Stimulation 3 | .38    |     | .73 |     |     |
| Stimulation 2 | .48    | .40 | .56 |     |     |
| Competence 3  |        |     |     | .88 |     |
| Autonomy 2    |        |     |     | .30 | .86 |

*Note.* Extraction method: principal components. Rotation: varimax. Loadings < .30 suppressed.

### **B.2. PLS MEASUREMENT MODEL**

Coefficients of reliability and convergent validity are presented in Table B6. Cross-loadings of items are presented in Table B7. Coefficients of discriminant validity are presented in Table B8.

## Modeling user-experience with news Web sites

**Table B6.** Coefficients of reliability and convergent validity.

| Construct/indicator             | Average variance extracted | Composite reliability | Loading | Standard error | $t^a$  |
|---------------------------------|----------------------------|-----------------------|---------|----------------|--------|
| Perceived aesthetics            | 0.58                       | 0.92                  |         |                |        |
| CA1                             |                            |                       | *0.64   | 0.05           | 12.87  |
| CA2                             |                            |                       | 0.83    | 0.02           | 46.27  |
| CA3                             |                            |                       | *0.58   | 0.05           | 10.53  |
| CA4                             |                            |                       | 0.85    | 0.02           | 49.36  |
| EA1                             |                            |                       | 0.80    | 0.02           | 32.09  |
| EA2                             |                            |                       | 0.72    | 0.04           | 16.16  |
| EA3                             |                            |                       | 0.78    | 0.03           | 29.20  |
| EA4                             |                            |                       | 0.85    | 0.02           | 50.40  |
| Perceived disorientation        | 0.69                       | 0.94                  |         |                |        |
| PD1                             |                            |                       | 0.88    | 0.02           | 51.93  |
| PD2                             |                            |                       | 0.85    | 0.03           | 31.10  |
| PD3                             |                            |                       | 0.73    | 0.04           | 16.67  |
| PD4                             |                            |                       | 0.81    | 0.03           | 23.45  |
| PD5                             |                            |                       | 0.85    | 0.02           | 35.20  |
| PD6                             |                            |                       | 0.89    | 0.02           | 43.42  |
| PD7                             |                            |                       | 0.80    | 0.03           | 24.46  |
| Perceived user-interface design | 0.87                       | 0.95                  |         |                |        |
| PUID1                           |                            |                       | 0.92    | 0.01           | 70.38  |
| PUID2                           |                            |                       | 0.95    | 0.01           | 130.37 |
| PUID3                           |                            |                       | 0.93    | 0.01           | 86.83  |
| Usefulness of content           | 0.85                       | 0.92                  |         |                |        |
| UC1                             |                            |                       | 0.93    | 0.01           | 64.68  |
| UC2                             |                            |                       | 0.90    | 0.03           | 31.87  |
| Adequacy of information         | 0.85                       | 0.92                  |         |                |        |
| AI1                             |                            |                       | 0.92    | 0.01           | 62.96  |
| AI2                             |                            |                       | 0.92    | 0.01           | 66.88  |
| Accessibility                   | 0.84                       | 0.92                  |         |                |        |
| AC1                             |                            |                       | 0.92    | 0.02           | 59.96  |
| AC2                             |                            |                       | 0.92    | 0.02           | 51.93  |
| Pragmatic quality               | 0.53                       | 0.81                  |         |                |        |
| PQ1                             |                            |                       | 0.85    | 0.02           | 42.02  |
| PQ2                             |                            |                       | *0.39   | 0.09           | 4.57   |
| PQ3                             |                            |                       | 0.81    | 0.04           | 21.20  |
| PQ4                             |                            |                       | 0.76    | 0.03           | 21.81  |
| Hedonic quality                 | 0.60                       | 0.86                  |         |                |        |
| HQ1                             |                            |                       | 0.80    | 0.03           | 30.97  |
| HQ2                             |                            |                       | 0.80    | 0.03           | 31.52  |
| HQ3                             |                            |                       | *0.69   | 0.06           | 11.13  |
| HQ4                             |                            |                       | 0.81    | 0.03           | 28.35  |
| Perceived enjoyment             | 0.82                       | 0.93                  |         |                |        |
| PE1                             |                            |                       | 0.92    | 0.01           | 77.86  |
| PE2                             |                            |                       | 0.92    | 0.01           | 67.50  |
| PE3                             |                            |                       | 0.88    | 0.01           | 58.13  |

*(Continued on next page)*



Table B6 (continued).

|                      |      |      |       |      |        |
|----------------------|------|------|-------|------|--------|
| Positive affect      | 0.46 | 0.89 |       |      |        |
| POS1                 |      |      | *0.64 | 0.04 | 15.25  |
| POS2                 |      |      | *0.68 | 0.04 | 15.84  |
| POS3                 |      |      | *0.58 | 0.05 | 11.56  |
| POS4                 |      |      | 0.71  | 0.04 | 19.30  |
| POS5                 |      |      | *0.68 | 0.04 | 15.99  |
| POS6                 |      |      | *0.59 | 0.05 | 10.85  |
| POS7                 |      |      | 0.78  | 0.02 | 32.19  |
| POS8                 |      |      | 0.71  | 0.04 | 17.41  |
| POS9                 |      |      | *0.68 | 0.04 | 15.37  |
| POS10                |      |      | 0.70  | 0.04 | 19.12  |
| Negative affect      | 0.46 | 0.89 |       |      |        |
| NEG1                 |      |      | *0.66 | 0.06 | 10.23  |
| NEG2                 |      |      | *0.56 | 0.09 | 6.53   |
| NEG3                 |      |      | *0.67 | 0.06 | 10.60  |
| NEG4                 |      |      | *0.67 | 0.08 | 8.33   |
| NEG5                 |      |      | *0.66 | 0.06 | 10.59  |
| NEG6                 |      |      | *0.69 | 0.05 | 14.01  |
| NEG7                 |      |      | 0.74  | 0.05 | 14.27  |
| NEG8                 |      |      | 0.70  | 0.05 | 13.19  |
| NEG9                 |      |      | 0.72  | 0.05 | 13.14  |
| NEG10                |      |      | 0.70  | 0.07 | 9.88   |
| Behavioral intention | 0.94 | 0.97 |       |      |        |
| BI1                  |      |      | 0.97  | 0.01 | 129.60 |
| BI2                  |      |      | 0.97  | 0.01 | 79.72  |

Of the items of *pragmatic quality*, PQ2 (unpredictable - predictable) had a low loading (.39). When excluded from the analysis, the average extracted variance (*AVE*) of the *pragmatic quality* scale increased to .66 from .53, and the scale's composite reliability (*CR*) increased to .85 from .81. However, the scale's *CR* and *AVE* were still acceptable with PQ2 included. Furthermore, the examination of the cross-loadings of PQ2 revealed that it did not load highly on any other scales and its second highest loading after *pragmatic quality* was on *hedonic quality* with 0.15. Therefore, PQ2 was retained in order to facilitate comparison with previous studies. Square roots of *AVE* values exceeded values of scale inter-correlations, supporting discriminant validity for each scale, according to the Fornell-Larcker criterion (Fornell & Larcker, 1981). According to Henseler et al. (2009), the loading of each reflective measurement item should be .70 or higher (50% or more variance shared by the item and the construct). Note that several items in Table B7 had lower loadings than .70; however, given a lack of cross-loadings, these items were retained to facilitate comparison with previous studies.

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Table B7. Item cross-loadings (continued next page).

| Item  | Scale |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|       | AC    | AES   | AI    | ATT   | BUSE  | BEAU  | BI    | GOOD  | HQ    | NEG   | PD    | PE    | POS   | PQ    | PUID  | UC    | USE   |
| AC1   | 0.92  | 0.40  | 0.50  | 0.13  | 0.12  | 0.17  | 0.35  | 0.29  | 0.25  | -0.12 | -0.45 | 0.31  | 0.19  | 0.46  | 0.55  | 0.55  | 0.14  |
| AC2   | 0.92  | 0.34  | 0.40  | 0.04  | 0.13  | 0.14  | 0.38  | 0.31  | 0.23  | -0.11 | -0.43 | 0.33  | 0.17  | 0.43  | 0.45  | 0.45  | 0.14  |
| AI1   | 0.50  | 0.52  | 0.92  | 0.06  | 0.08  | 0.21  | 0.36  | 0.30  | 0.35  | -0.08 | -0.26 | 0.34  | 0.34  | 0.36  | 0.42  | 0.60  | 0.12  |
| AI2   | 0.41  | 0.50  | 0.92  | 0.06  | 0.10  | 0.21  | 0.35  | 0.36  | 0.40  | -0.17 | -0.20 | 0.34  | 0.24  | 0.33  | 0.36  | 0.56  | 0.13  |
| ATT   | 0.09  | 0.15  | 0.06  | 1.00  | 0.14  | 0.19  | 0.07  | 0.15  | 0.15  | 0.13  | -0.01 | 0.19  | 0.21  | 0.09  | 0.13  | 0.03  | 0.13  |
| BEAU  | 0.17  | 0.54  | 0.23  | 0.19  | 0.13  | 1.00  | 0.24  | 0.54  | 0.61  | -0.03 | -0.11 | 0.41  | 0.34  | 0.32  | 0.36  | 0.14  | 0.17  |
| BI1   | 0.39  | 0.42  | 0.38  | 0.05  | 0.31  | 0.25  | 0.97  | 0.40  | 0.35  | -0.11 | -0.39 | 0.49  | 0.28  | 0.42  | 0.54  | 0.46  | 0.36  |
| BI2   | 0.37  | 0.37  | 0.37  | 0.09  | 0.28  | 0.22  | 0.97  | 0.41  | 0.36  | -0.19 | -0.39 | 0.47  | 0.24  | 0.41  | 0.48  | 0.44  | 0.28  |
| CA1   | 0.49  | 0.64  | 0.52  | 0.06  | 0.21  | 0.22  | 0.37  | 0.34  | 0.32  | -0.09 | -0.31 | 0.32  | 0.24  | 0.41  | 0.47  | 0.48  | 0.20  |
| CA2   | 0.46  | 0.83  | 0.51  | 0.15  | 0.16  | 0.47  | 0.44  | 0.55  | 0.57  | -0.10 | -0.29 | 0.60  | 0.41  | 0.41  | 0.60  | 0.45  | 0.23  |
| CA3   | 0.18  | 0.58  | 0.26  | 0.12  | 0.12  | 0.27  | 0.17  | 0.21  | 0.27  | 0.07  | -0.03 | 0.26  | 0.26  | 0.17  | 0.27  | 0.19  | 0.18  |
| CA4   | 0.35  | 0.85  | 0.43  | 0.13  | 0.21  | 0.51  | 0.38  | 0.43  | 0.56  | -0.07 | -0.22 | 0.46  | 0.32  | 0.34  | 0.53  | 0.30  | 0.25  |
| EA1   | 0.24  | 0.80  | 0.42  | 0.12  | 0.18  | 0.40  | 0.27  | 0.31  | 0.45  | 0.03  | -0.10 | 0.37  | 0.26  | 0.22  | 0.39  | 0.27  | 0.20  |
| EA2   | 0.29  | 0.72  | 0.45  | 0.05  | 0.03  | 0.29  | 0.33  | 0.35  | 0.47  | -0.03 | -0.19 | 0.34  | 0.25  | 0.25  | 0.42  | 0.39  | 0.03  |
| EA3   | 0.15  | 0.78  | 0.36  | 0.18  | 0.14  | 0.53  | 0.18  | 0.40  | 0.56  | 0.10  | -0.02 | 0.39  | 0.38  | 0.20  | 0.36  | 0.16  | 0.24  |
| EA4   | 0.28  | 0.85  | 0.42  | 0.06  | 0.18  | 0.49  | 0.30  | 0.38  | 0.58  | -0.03 | -0.19 | 0.46  | 0.32  | 0.30  | 0.51  | 0.31  | 0.22  |
| GOOD  | 0.32  | 0.50  | 0.36  | 0.15  | 0.24  | 0.54  | 0.42  | 1.00  | 0.62  | -0.18 | -0.35 | 0.53  | 0.30  | 0.52  | 0.47  | 0.34  | 0.27  |
| HQ1   | 0.26  | 0.50  | 0.36  | 0.14  | 0.13  | 0.42  | 0.30  | 0.55  | 0.80  | -0.01 | -0.26 | 0.47  | 0.31  | 0.43  | 0.38  | 0.30  | 0.20  |
| HQ2   | 0.17  | 0.47  | 0.32  | 0.12  | 0.08  | 0.51  | 0.28  | 0.42  | 0.80  | -0.01 | -0.16 | 0.40  | 0.28  | 0.36  | 0.36  | 0.24  | 0.09  |
| HQ3   | 0.18  | 0.38  | 0.25  | 0.14  | 0.12  | 0.33  | 0.30  | 0.45  | 0.69  | -0.08 | -0.19 | 0.29  | 0.18  | 0.27  | 0.25  | 0.25  | 0.08  |
| HQ4   | 0.20  | 0.60  | 0.33  | 0.09  | 0.13  | 0.62  | 0.28  | 0.49  | 0.81  | 0.02  | -0.18 | 0.45  | 0.34  | 0.33  | 0.40  | 0.22  | 0.16  |
| NEG1  | -0.01 | -0.01 | -0.04 | 0.11  | -0.11 | 0.01  | -0.10 | -0.14 | 0.04  | 0.66  | 0.15  | -0.16 | 0.01  | -0.11 | -0.06 | -0.08 | -0.11 |
| NEG10 | -0.03 | 0.01  | -0.07 | 0.13  | 0.01  | -0.01 | -0.02 | -0.12 | 0.06  | 0.70  | 0.10  | -0.02 | 0.10  | -0.06 | 0.02  | -0.12 | 0.03  |
| NEG2  | 0.08  | -0.03 | 0.03  | 0.04  | -0.08 | 0.01  | -0.01 | -0.01 | 0.10  | 0.56  | 0.02  | -0.08 | 0.09  | -0.03 | 0.04  | -0.03 | -0.01 |
| NEG3  | -0.02 | -0.03 | -0.03 | 0.06  | 0.09  | -0.08 | -0.07 | -0.15 | -0.02 | 0.67  | 0.24  | -0.07 | 0.07  | -0.10 | -0.10 | -0.09 | 0.10  |
| NEG4  | 0.00  | 0.08  | 0.00  | 0.12  | 0.04  | 0.00  | -0.03 | -0.05 | 0.03  | 0.67  | 0.09  | 0.03  | 0.16  | -0.10 | 0.05  | -0.06 | 0.07  |
| NEG5  | -0.05 | -0.01 | -0.11 | 0.15  | 0.09  | 0.03  | -0.03 | -0.07 | 0.03  | 0.66  | 0.14  | -0.04 | 0.17  | -0.11 | 0.00  | -0.12 | 0.11  |
| NEG6  | -0.12 | -0.08 | -0.21 | 0.08  | 0.06  | -0.06 | -0.06 | -0.15 | -0.05 | 0.69  | 0.19  | -0.05 | 0.09  | -0.16 | -0.06 | -0.13 | 0.04  |
| NEG7  | -0.09 | -0.04 | -0.14 | 0.00  | 0.04  | -0.04 | -0.14 | -0.13 | -0.02 | 0.74  | 0.21  | -0.08 | 0.12  | -0.22 | -0.10 | -0.21 | 0.09  |
| NEG8  | -0.07 | -0.02 | -0.02 | 0.11  | -0.06 | 0.02  | -0.07 | -0.16 | -0.08 | 0.70  | 0.26  | -0.10 | 0.15  | -0.14 | -0.10 | -0.10 | -0.01 |
| NEG9  | -0.20 | 0.00  | -0.11 | 0.10  | 0.01  | -0.01 | -0.26 | -0.12 | -0.03 | 0.72  | 0.30  | -0.06 | 0.19  | -0.21 | -0.17 | -0.20 | 0.05  |
| BUSE  | 0.14  | 0.20  | 0.10  | 0.14  | 1.00  | 0.13  | 0.30  | 0.24  | 0.15  | 0.03  | -0.16 | 0.37  | 0.26  | 0.23  | 0.19  | 0.09  | 0.81  |
| PD1   | -0.41 | -0.24 | -0.23 | -0.04 | -0.20 | -0.18 | -0.39 | -0.42 | -0.29 | 0.28  | 0.88  | -0.41 | -0.19 | -0.58 | -0.53 | -0.27 | -0.19 |
| PD2   | -0.38 | -0.23 | -0.29 | -0.05 | -0.14 | -0.13 | -0.35 | -0.40 | -0.30 | 0.28  | 0.85  | -0.37 | -0.19 | -0.48 | -0.43 | -0.32 | -0.12 |
| PD3   | -0.35 | -0.09 | -0.21 | 0.08  | -0.03 | 0.02  | -0.24 | -0.11 | -0.10 | 0.16  | 0.73  | -0.12 | -0.04 | -0.25 | -0.31 | -0.19 | -0.03 |

## Modeling user-experience with news Web sites

| Item  | Scale |       |       |       |       |       |       |       |       |       |       |       |       |             |       |       |       |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------------|-------|-------|-------|
|       | AC    | AES   | AI    | ATT   | BUSE  | BEAU  | BI    | GOOD  | HQ    | NEG   | PD    | PE    | POS   | PQ          | PUID  | UC    | USE   |
| PD4   | -0.43 | -0.14 | -0.16 | -0.05 | -0.11 | 0.00  | -0.28 | -0.18 | -0.15 | 0.19  | 0.81  | -0.18 | -0.07 | -0.35       | -0.34 | -0.23 | -0.05 |
| PD5   | -0.38 | -0.17 | -0.19 | -0.03 | -0.11 | -0.05 | -0.29 | -0.25 | -0.16 | 0.25  | 0.85  | -0.25 | -0.09 | -0.40       | -0.44 | -0.19 | -0.11 |
| PD6   | -0.46 | -0.18 | -0.17 | 0.02  | -0.12 | -0.10 | -0.42 | -0.25 | -0.19 | 0.31  | 0.89  | -0.26 | -0.11 | -0.43       | -0.46 | -0.26 | -0.10 |
| PD7   | -0.39 | -0.23 | -0.17 | 0.03  | -0.16 | -0.08 | -0.32 | -0.25 | -0.20 | 0.18  | 0.80  | -0.32 | -0.14 | -0.36       | -0.42 | -0.20 | -0.20 |
| PE1   | 0.29  | 0.47  | 0.34  | 0.15  | 0.34  | 0.33  | 0.52  | 0.48  | 0.46  | -0.15 | -0.33 | 0.92  | 0.45  | 0.42        | 0.51  | 0.37  | 0.38  |
| PE2   | 0.38  | 0.51  | 0.34  | 0.22  | 0.33  | 0.39  | 0.42  | 0.50  | 0.50  | -0.04 | -0.38 | 0.92  | 0.48  | 0.43        | 0.55  | 0.36  | 0.35  |
| PE3   | 0.27  | 0.50  | 0.33  | 0.15  | 0.32  | 0.39  | 0.40  | 0.46  | 0.47  | -0.07 | -0.24 | 0.88  | 0.53  | 0.30        | 0.46  | 0.29  | 0.35  |
| POS1  | 0.30  | 0.35  | 0.35  | 0.07  | 0.26  | 0.21  | 0.49  | 0.35  | 0.38  | -0.09 | -0.33 | 0.51  | 0.64  | 0.39        | 0.37  | 0.38  | 0.27  |
| POS10 | 0.11  | 0.29  | 0.19  | 0.19  | 0.14  | 0.27  | 0.05  | 0.14  | 0.19  | 0.19  | 0.01  | 0.32  | 0.70  | 0.08        | 0.18  | 0.10  | 0.17  |
| POS2  | 0.10  | 0.30  | 0.19  | 0.13  | 0.25  | 0.32  | 0.18  | 0.19  | 0.26  | 0.16  | -0.06 | 0.45  | 0.68  | 0.11        | 0.17  | 0.09  | 0.26  |
| POS3  | 0.10  | 0.25  | 0.15  | 0.14  | 0.07  | 0.24  | 0.07  | 0.12  | 0.15  | 0.23  | -0.05 | 0.21  | 0.58  | 0.05        | 0.09  | 0.05  | 0.14  |
| POS4  | 0.06  | 0.24  | 0.19  | 0.15  | 0.21  | 0.23  | 0.12  | 0.18  | 0.22  | 0.09  | -0.08 | 0.41  | 0.71  | 0.14        | 0.15  | 0.16  | 0.20  |
| POS5  | 0.03  | 0.27  | 0.14  | 0.16  | 0.13  | 0.28  | 0.07  | 0.21  | 0.23  | 0.10  | -0.02 | 0.34  | 0.68  | 0.13        | 0.13  | 0.09  | 0.15  |
| POS6  | 0.16  | 0.18  | 0.15  | 0.15  | 0.09  | 0.10  | 0.09  | 0.12  | 0.20  | 0.21  | -0.12 | 0.24  | 0.59  | 0.16        | 0.23  | 0.14  | 0.02  |
| POS7  | 0.10  | 0.32  | 0.27  | 0.15  | 0.23  | 0.26  | 0.20  | 0.26  | 0.28  | 0.10  | -0.07 | 0.44  | 0.78  | 0.17        | 0.21  | 0.20  | 0.22  |
| POS8  | 0.04  | 0.26  | 0.15  | 0.17  | 0.15  | 0.27  | 0.03  | 0.12  | 0.17  | 0.30  | 0.01  | 0.22  | 0.71  | 0.09        | 0.12  | 0.11  | 0.14  |
| POS9  | 0.15  | 0.23  | 0.20  | 0.17  | 0.12  | 0.20  | 0.17  | 0.16  | 0.22  | 0.13  | -0.13 | 0.29  | 0.68  | 0.13        | 0.25  | 0.20  | 0.12  |
| PQ1   | 0.43  | 0.45  | 0.37  | 0.10  | 0.20  | 0.29  | 0.36  | 0.51  | 0.38  | -0.16 | -0.48 | 0.46  | 0.29  | 0.85        | 0.60  | 0.36  | 0.22  |
| PQ2   | 0.07  | 0.01  | 0.01  | -0.02 | 0.09  | 0.12  | 0.12  | 0.11  | 0.15  | -0.12 | -0.10 | 0.04  | 0.04  | <b>0.39</b> | 0.07  | 0.11  | 0.05  |
| PQ3   | 0.38  | 0.26  | 0.31  | 0.07  | 0.19  | 0.18  | 0.41  | 0.38  | 0.34  | -0.22 | -0.38 | 0.33  | 0.21  | 0.81        | 0.43  | 0.40  | 0.14  |
| PQ4   | 0.38  | 0.23  | 0.23  | 0.06  | 0.16  | 0.32  | 0.27  | 0.39  | 0.39  | -0.13 | -0.40 | 0.24  | 0.09  | 0.76        | 0.44  | 0.25  | 0.19  |
| PUID1 | 0.52  | 0.50  | 0.38  | 0.15  | 0.16  | 0.31  | 0.48  | 0.44  | 0.41  | -0.10 | -0.47 | 0.51  | 0.29  | 0.59        | 0.92  | 0.43  | 0.21  |
| PUID2 | 0.49  | 0.58  | 0.42  | 0.12  | 0.20  | 0.33  | 0.51  | 0.43  | 0.42  | -0.09 | -0.49 | 0.55  | 0.30  | 0.55        | 0.95  | 0.42  | 0.25  |
| PUID3 | 0.51  | 0.59  | 0.40  | 0.10  | 0.16  | 0.37  | 0.50  | 0.44  | 0.44  | -0.12 | -0.49 | 0.51  | 0.28  | 0.55        | 0.93  | 0.46  | 0.17  |
| USE   | 0.15  | 0.26  | 0.13  | 0.13  | 0.81  | 0.17  | 0.33  | 0.27  | 0.18  | 0.06  | -0.15 | 0.40  | 0.27  | 0.22        | 0.22  | 0.10  | 1.00  |
| UC1   | 0.51  | 0.42  | 0.59  | 0.10  | 0.12  | 0.15  | 0.42  | 0.39  | 0.30  | -0.17 | -0.30 | 0.39  | 0.28  | 0.40        | 0.50  | 0.93  | 0.11  |
| UC2   | 0.49  | 0.34  | 0.57  | -0.05 | 0.02  | 0.09  | 0.43  | 0.23  | 0.29  | -0.20 | -0.24 | 0.29  | 0.19  | 0.35        | 0.34  | 0.90  | 0.07  |

*Note.* Grey background indicates the loadings of items belonging to a particular scale. Bold numbers indicate loadings smaller than .50. AC: accessibility. AES: aesthetics. AI: adequacy of information. ATT: attribution. BUSE: baseline use frequency. BEAU: beauty. BI: behavioral intention. GOOD: goodness. HQ: hedonic quality. NEG: negative affect. PD: perceived disorientation. PE: perceived enjoyment. POS: positive affect. PQ: pragmatic quality. PUID: perceived user-interface design. UC: usefulness of content. USE: use frequency.

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Table B.8. Coefficients of discriminant validity and inter-correlation between the scales.

|      | AC      | AES     | AI      | ATT    | BUSE    | BEAU   | BI      | GOOD    | HQ      | NEG     | PD      | PE     | POS    | PQ     | PUID   | UC   | USE  |
|------|---------|---------|---------|--------|---------|--------|---------|---------|---------|---------|---------|--------|--------|--------|--------|------|------|
| AC   | 0.92    |         |         |        |         |        |         |         |         |         |         |        |        |        |        |      |      |
| AES  | ** .41  | 0.76    |         |        |         |        |         |         |         |         |         |        |        |        |        |      |      |
| AI   | ** .49  | ** .55  | 0.92    |        |         |        |         |         |         |         |         |        |        |        |        |      |      |
| ATT  | .09     | * .15   | .06     | 1.00   |         |        |         |         |         |         |         |        |        |        |        |      |      |
| BUSE | * .14   | ** .20  | .10     | * .14  | 1.00    |        |         |         |         |         |         |        |        |        |        |      |      |
| BEAU | ** .17  | ** .54  | ** .23  | ** .19 | * .13   | 1.00   |         |         |         |         |         |        |        |        |        |      |      |
| BI   | ** .39  | ** .41  | ** .39  | .07    | ** .30  | ** .24 | 0.97    |         |         |         |         |        |        |        |        |      |      |
| GOOD | ** .32  | ** .50  | ** .36  | ** .15 | ** .24  | ** .54 | ** .42  | 1.00    |         |         |         |        |        |        |        |      |      |
| HQ   | ** .26  | ** .64  | ** .41  | ** .15 | ** .15  | ** .61 | ** .37  | ** .62  | 0.78    |         |         |        |        |        |        |      |      |
| NEG  | -.12    | -.03    | -.14    | * .13  | .03     | -.03   | * -.16  | ** -.18 | -.02    | 0.68    |         |        |        |        |        |      |      |
| PD   | ** -.48 | ** -.23 | ** -.25 | -.01   | ** -.16 | -.11   | ** -.40 | ** -.35 | ** -.26 | ** .30  | 0.83    |        |        |        |        |      |      |
| PE   | ** .34  | ** .54  | ** .37  | ** .19 | ** .37  | ** .41 | ** .49  | ** .53  | ** .52  | -.10    | ** -.35 | 0.91   |        |        |        |      |      |
| POS  | ** .20  | ** .41  | ** .32  | ** .21 | ** .26  | ** .34 | ** .27  | ** .30  | ** .36  | ** .18  | -.16    | ** .54 | 0.68   |        |        |      |      |
| PQ   | ** .48  | ** .39  | ** .37  | .09    | ** .23  | ** .32 | ** .43  | ** .52  | ** .45  | ** -.22 | ** -.51 | ** .42 | ** .25 | 0.73   |        |      |      |
| PUID | ** .54  | ** .60  | ** .43  | * .13  | ** .19  | ** .36 | ** .53  | ** .47  | ** .45  | -.11    | ** -.52 | ** .56 | ** .31 | ** .60 | 0.93   |      |      |
| UC   | ** .55  | ** .42  | ** .63  | .03    | .09     | * .14  | ** .46  | ** .34  | ** .32  | ** -.20 | ** -.29 | ** .38 | ** .26 | ** .41 | ** .47 | 0.92 |      |
| USE  | ** .15  | ** .26  | * .13   | * .13  | ** .81  | ** .17 | ** .33  | ** .27  | ** .18  | .06     | * -.15  | ** .40 | ** .27 | ** .22 | ** .22 | .10  | 1.00 |

Note. Diagonal elements are square root of average variance extracted for each variable. Off-diagonal elements are correlation coefficients. AC: accessibility. AES: aesthetics. AI: adequacy of information. ATT: attribution. BUSE: baseline use frequency. BEAU: beauty. BI: behavioral intention. GOOD: goodness. HQ: hedonic quality. NEG: negative affect. PD: perceived disorientation. PE: perceived enjoyment. POS: positive affect. PQ: pragmatic quality. PUID: perceived user-interface design. UC: usefulness of content. USE: use frequency.

\* $p < .05$ . \*\* $p < .01$ .