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The Dual Pathway to Information Avoidance in Information Systems Use

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Abstract

This article develops an explanatory model of information avoidance behavior from extant theory and examines its hypotheses using psychophysiological methods. It integrates existing but partially conflicting explanations into a coherent positivist model based on Coping Theory. The existence of two distinct but interlinked causal pathways to information avoidance will be outlined. Both pathways are cause by defects in the information quality. The first pathway is grounded on being threatened by the information's inconsistency. The second pathway is based on being distressed by the information's complexity. Due to the involvement of cognition as well as affect, the usefulness of traditional measurement methods alone is deemed to be limited. Thus, we will draw upon recent advances from NeuroIS research in order to integrate psychophysiological measures into an extended, triangulated measurement protocol. This article intends to contribute to this special issue in three ways. First, it shapes a theoretical model for studying information avoidance which has received little attention in IS research. Second, it exemplifies the derivation and instantiation of a NeuroIS measurement model and the selection of appropriate NeuroIS methods for scrutinizing the theoretical information avoidance model. Third, based on the evidence of an experiment, it provides guidelines for how to conduct eye-tracking, pupillometry, and facial electromyography measurements as well as how to subsequently derive meaning from the initial data collected.

Introduction

Information systems (IS) are ubiquitous in today's business environment and have become an indispensable success factor for organizations. Users of information systems have access to a growing pool of information and the reductionist assumption in the majority of contemporary IS research is that all available and relevant information will eventually be used ("*homo informaticus*", Kuhlmann, 1983). Surprisingly, researchers have paid little attention to the consideration that although information is available and relevant, individuals may decide to use only parts of it or ignore the information altogether. For example, a procurement manager using a supplier relationship management system may start an in-depth search for a supplier of a specific product, but, conversely, interrogates the results superficially or ignores some of the database findings. Likewise, a treasurer stumbling over a dunning notice whilst screening payment positions may choose to ignore this information. Since only absorbed and utilized information can contribute to better decisions which in turn offer the potential to foster organizational success, this phenomenon of *information avoidance* remains a serious threat to the use and the design of IS. Since the vast amount of information available in today’s work environment may require effective filtering techniques, the neglect of some information chunks is sometimes not disadvantageous, especially when the decisions have to be made under time pressure. What is disadvantageous, however, is a divergence between the users’ information needs, the available decision-relevant information and the information that gets absorbed and utilized. Non-absorbed, i.e. avoided information has the potential to cause significant dysfunctional effects. Thus, we would like to shed more light onto the largely unknown contingencies of such information avoidance behaviors in order to better understand the use of information systems. Since the causes of avoiding behaviors are difficult to observe with the help of conventional empirical research methods, we extend conventional empirical methods with NeuroIS methods in order to better understand the complex intertwinement of cognitive and affective behaviors in the light of information avoidance. Thus, our research questions are the following:

1) *What are primary contingency factors and (causal) mechanisms of information avoidance in computer-mediated work?*

2) *How can NeuroIS methods be applied to better measure and understand the interaction of cognitive and affective mental processes?*

In order to answer these two research questions, we will first provide an overview of the extant literature. Based on the existing knowledge in IS and neighboring disciplines, especially psychology and the neurosciences, we will develop a theoretical model which integrates mental and emotional processes as the key contingency factors of information avoidance. Furthermore, we describe how the respective theoretical constructs can be mapped onto psychophysiological *correlates*. In the light of our theoretical model, we then exemplify how NeuroIS methods can be applied to disentangle the intertwinement of mental and emotional processes. The transformation of our theoretical model into a measurement model is based on extant knowledge in the fields of NeuroIS, Psychology, and Neuroscience. Our intention is to provide a preliminary blueprint for subsequent studies in the field of IS where, both, conscious and unconscious cognitive processes are important contingencies for human (information) behavior (Davern et al., 2012).

Foundations of Information Avoidance Research

Little efforts have been made to study human information behavior in IS research (Hemmer and Heinzl, 2011; 2012). In contrast, substantial research activities are notable from neighboring disciplines, which will be scrutinized in the following. According to theories dealing with the perception of uncertainty (Berger and Calabrese, 1975; Bradac, 2001; Kellermann and Reynolds, 1990), individuals are expected to reduce uncertainty by obtaining and processing *more* information rather than to avoid it. Circumstances where individuals exhibit contrary behaviors like information hiding have, however, attracted the interest of multiple scientific communities. The phenomenon has been studied extensively in the context of health care, personal health risks, and medical information behavior (Howell and Shepperd, 2012; Miles et al., 2008). In mass media research, information avoidance has been studied in relation to political information selection during elections (Sears and Freedman, 1967). It has also been connected to knowledge management and organizational information processing (Scholl, 2004). Furthermore, the neglect of information is prominent in the field of decision-making and, in particular, in research related to consumption behavior (Kardes et al., 2004; Mills, 1965; Schmidt and Spreng, 1996). Although the causes which constitute information avoidance vary significantly, they have one aspect in common: they are considered as a form of misguided human information behavior (Case et al., 2005; Wilson, 1999; 2000). Avoidance behaviors can be characterized in which (temporal) phase of an information search and use model they occur (Wilson, 1999; 2000). As most information behaviors are goal driven and part of a task scenario (Byström and Järvelin, 1995; Leckie et al., 1996), users first develop a **subjective information need** based on the task to fulfill (Wilson, 1999). The subjective information need describes what information is deemed necessary to solve the task. The formation of information needs is followed by a phase of **information seeking**. The seeking leads to the **perception** of which information is available. Subsequently, individuals may engage in information **absorption**, as e.g. in selecting and reading a document or listening to an audio file. Information **integration** is the last phase in the stage model and refers to the fact whether the absorbed information is actually used, e.g. whether it influences a decision. In the following, we will review existing research on information avoidance along this phase model of human information search and use.

Individuals do not necessarily need to develop a specific **information need** in the first phase of the phase model. Mills (1965) refers to desires to read or not to read something - a definition clearly putting the formation (or non-formation) of information *needs* at the center of the construct. Accordingly, Miles et al. (2008) see information avoidance as the preference to not think, read, watch TV, and listen about a topic. They ask participants about hypothetical desires for information. Hence, their definition must be understood as aiming at avoidance at the level of (potential future) information needs rather than at avoidance of actual search.

With respect to the phase of **information seeking**, individuals may actively or passively avoid encountering information. In this stage, information avoidance is any behavior directed at preventing or delaying the acquisition of available but potentially unwanted information (Sweeny et al., 2010). This definition has three implications: first, it includes delaying information, and, thus, introduces a concept of temporarily avoiding (cf. also Wilson, 1995). Second, it is directed to the activity of seeking and acquiring information (p. 341) which is different from utilizing the information. Third, it restricts information avoidance to phenomena which are caused by *cognitive dissonant* (e.g. unwanted or threatening) information in contrast to phenomena caused by the complexity or the comprehensibility of information including the required mental efforts to cope with it. In their experiments, Howell and Shepperd (2012) conceptualize information avoidance as actions taken to prevent the *exposure* to a particular piece of information. Sweeny et al. (2010) also emphasize the *acquisition* of information and place less relevance on whether the information may subsequently be used or not (cf. also Melnyk, 2009). In a similar vein, Case et al. (2005) define information avoidance as not seeking for information, without establishing further constraints on this definition, especially not concerning its actual use. Mills and Jellison (1968) capture information avoidance during seeking as decreased self-exposure to information and measure it as reading time. With respect to limiting one's self-*exposure* to information, two distinctions have been made. Narayan et al. (2011) propose a distinction into active and passive information avoidance behavior. Passive refers to long-term habitual behaviors that aim at preventing exposure to a specific topic in general. Active refers to behaviors that aim at preventing the further mental processing of situational undesirable information. In Melnyk (2009), active refers to actions for *avoiding* information and passive refers to non-actions for *obtaining* information.

In the phase of **information use**, individuals may circumvent the integration of absorbed information for their decision-making or task-fulfillment activities. This distinction can be found, for instance, in Narayan et al. (2011). Based on a diary study, these authors were able to show that information avoidance in the use phase can be separated from information avoidance in the seeking phase (p. 5). In a similar vein, Greenwald (1997) theorizes about the avoidance of drawing inferences from obtained information.

Additional attempts have been made to unify the separate concepts mentioned above as well as to provide an account for information avoidance behavior at all stages. Blumberg (2000) distinguishes between pre-attention avoidance, blunting (avoidance of attention), suppression (avoidance of inference), and counter-argumentation (defensiveness). According to him, pre-attention avoidance is the pre-selection of *all* information on the attentional level and the avoidance of assigning attentional resources to it. Blunting in Blumberg's definition denotes that the information is perceived on the attentional level, but that the threatening parts of the information are neglected by omission. Finally, suppression entails the perception and the processing of information, but the individuals avoid drawing inferences based on the information. *Suppression* is hence closely related to the *non-use* of information.

Delineating Information Avoidance from Related Constructs

A plentitude of malfunctions in human information behavior exist (Case, 2012). Behaviors that evolve around the avoidance of information are a subgroup of these malfunctions. They have been discussed under deceptively similar names although their underlying mechanisms and boundary conditions vary significantly. The following section reviews these concepts, identifies common themes, and points out their differences. The phenomenon of **confirmatory search** describes the formation of *information needs* according to a predefined set of expectations towards the information (Croyle and Sande, 1988). In situations of confirmatory search, individuals built information needs in order to satisfy a perceived predetermined answer. Accordingly, these confirmatory information needs translate into confirmatory search behavior during the information gathering process (Skov and Sherman, 1985). Out of a set of potential search queries, only those are selected and executed which are expected to deliver confirmatory results. Confirmatory search has mainly been associated with processes that challenge existing beliefs and cause negative affect, such as the anchoring effect (Frederick et al., 2010). **Selective exposure** refers to the tendency to actively prefer decision-confirming information or to actively neglect decision-inconsistent information (Ehrlich et al., 1957; Festinger, 1957; Fischer et al., 2005; Lowin, 1967). A defense motivation rationale underlies this phenomenon, where existing world-views and perceptions face external informational challenges (Fischer and Greitemeyer, 2010; Fischer, et al., 2011a). The concept is tightly bound to the concept of cognitive dissonance (Adams, 1961; Cooper and Worchel, 1970; Festinger, 1957). It predicts the preference for supporting (consonant) compared to conflicting (dissonant) information, if people have committed themselves for one decision alternative (Schulz-Hardt et al., 2000). An individual can either approach or avoid elements of information and dissonant information leads to turning away from the particular information (Lowin, 1967). On the organizational level, this phenomenon has been studied as *information acceptance* in group scenarios (Propp, 1997). For the context of mass media, Sears and Freedman (1967) defined selective exposure by its outcome, namely any systematic bias in the composition of an audience. Following this definition, selective exposure can also be understood as a selective search for the facing information (Knobloch-Westerwick et al., 2005). Notably, this describes a phenomenon where already the information *intake* is disturbed, and does not account for the phenomenon of successful information *perception* but the failure to *utilize* the information. Sweeny et al. (2010) argue that selective exposure is limited to phenomena where the information content is *known* but unwanted. This excludes the situation where the information is unknown but unwanted because of e.g. fear of its content. **Information non-use** is another closely related concept. Machlup (1979) defines the *use* of information as looking, listening, or reading. Notably, this definition sees information as being used as soon as an individual starts the search process. Todd (1999) contrasts this from the definition of information use which requires that the information directly leads to specific decisions or actions. Todd further states that "the end-states are the evidence of information utilization" (p. 853). Green (1991) requires that people actively and purposefully do something with the information to satisfy their information needs. Based on Dervin's (1998) notion of sense-making, Todd (1999) argues, that information must also have an impact, change the thoughts of an individual, and bring the person forward in order to qualify as information use.

Observed Causes of Information Avoidance

The causes of information avoidance have been studied in various disciplines. Sweeny et al. (2010) report three prominent determinants of information avoidance: the fear of having to change own assumption(s), the reluctance of performing an undesired activity, and the experience with unpleasant emotions. In all three cases, perceptions triggered by information content determine information avoidance. Similarly, Case et al. (2005) link disagreeable information to its avoidance. Research on the causes of information avoidance has concentrated on characteristics of the individual actor, the surrounding situation, and the information's properties as determinants. **Individual differences** have been studied as potential causes for information avoidance behavior. Whether individuals avoid information has been discussed in the context of coping styles, such as the distinction in blunters and monitors (Miller, 1987), and with regard to general personal trait characteristics (Hart et al., 2012). Likewise, different styles of information absorption emerge from the state of *uncertainty orientation (*Brouwers and Sorrentino, 1993; Sorrentino, Bobocel, et al., 1988; Sorrentino, Holmes, et al., 1995). The role of affective (temporary) states has been studied, too. Positive affect and, in particular, positive self-esteem stand in relationship to less information absorption prior to decision-making (Fischer et al., 2011b; Martin et al., 1993; Wiersema et al., 2012). Negative affect has been reported to be associated with deficiencies in information absorption in several ways. Emotions related to avoidance behavior are fear (Miles et al., 2008), anger (Ehrich and Irwin, 2005), discomfort (Sweeny et al., 2010), and the perception of a threat to someone's belief system and attitudes in general (Brannon et al., 2007; Case et al., 2005; Fischer et al., 2008; Fischer and Greitemeyer, 2010; Fischer et al., 2011b; Maier and Richter, 2013; Van Zuuren and Wolfs, 1991). Moreover, **situational characteristics** have been described as another contingency factor of information avoidance. These studies focus primarily on time pressure, noise and distraction (Fischer et al., 2011c). Many of what has been discussed as situational determinants can partially be seen as task characteristics. Scholl (2004) has found characteristics of the co-working environment and office politics to determine information avoidance behavior.

Sweeny (2010) has included the situational factor of *access to resources* into her model. The role of the **information characteristics** in determining information avoidance has been studied less intensively, but existing results denote its significance. Most intuitively, limitations of the information's relevance are positively associated with information avoidance (Peshkam et al., 2011). As ignoring irrelevant information is not deemed to be a dysfunctional behavior, but rather an effective and efficient heuristic, information characteristics move into the focus of interest. Scholars have studied the relationship between several information characteristics and avoidance behavior. One emphasis has been put on the quantity of information. Increases in the quantity of information are related to increases in the likelihood of information avoidance as the mental working capacity is limited. Thus, humans are prone to engage in reduction strategies which consequently lead to (a partial) information avoidance (Fischer et al., 2008; Streufert and Suefeld, 1965; Wilson, 1995). A second important characteristic is information consistency which is a facet of information quality. Being exposed to information can cause priming and mind-setting effects. A later exposure to information, which deviates from the mind-set, causes dissonance. Hence, an important information characteristic in determining information avoidance is the consistency of the supplied information (Frey, 1982; Jonas et al., 2001; Knobloch-Westerwick and Meng, 2009; Mills and Jellison, 1968; Sherman and Cohen, 2002), and related to that, the ease of refuting a particular chunk of inconsistent information (Lowin, 1967). The desire to refute the disconfirming information stems from ego-protective motivations and defensive biases (Sherman and Cohen, 2002). Information that challenges held beliefs is associated with the perception of threat, and is linked to lowered information acceptance (Harris and Napper, 2005).

In summary, the literature reports manifold causes for information avoidance behavior. However, a dichotomy of the underlying mechanisms emerges: On the one hand, psychological explanations based on the perception of fear, anger, doubt, and anxiety exist. These explanations are based on the idea, that a particular piece of information is a *threat* to the individual. On the other hand, psychological explanations based on the perception of high cognitive demand, overload, and exhaustion exist. These explanations are based on the idea, that a particular piece of information is a stressor to the individual that causes *distress*. The first explanations is linked to the information's content. The second explanation is linked to the information's quantity and complexity. Table 1 summarizes the threat-related affective explanations and the distress-related affective explanations.

Table 1: Synopsis of two separate affective complexes underlying information avoidance behavior.

Threat-related affective explanations	**Distress-related affective explanations**
Anxiety, doubt, discomfort, dissonance	Too complex information, high workload, being overwhelmed
Brannon et al., 2007; Case et al., 2005; Fischer et al., 2008; Fischer and Greitemeyer, 2010; Frederick et al., 2010; Knobloch-Westerwick et al., 2005; Krohne and Hock, 2011; Maier and Richter, 2013; Miles et al., 2008; Sherman and Cohen, 2002; Van Zuuren and Wolfs, 1991	Chen, Shang, and Kao, 2009; Fischer et al., 2008; Jacoby, 1984; Malhotra, 1982; Savolainen, 2007; Streufert and Suefeld, 1965; Wang and White, 1999; Wilson, 1995

Theoretical Reasoning for Explaining Information Avoidance

Conceptualizing Information Avoidance

The previous conceptualizations of information avoidance have relied on phenomenological descriptions of behaviors during the phases of information seeking and use. However, the related behaviors are not conclusive but the mechanisms behind them are. From observation alone and without knowledge about the circumstances, it is hardly possible to distinguish avoidance behavior from simple *disinterest* or *ignorance*. We define information avoidance behavior in terms of its most central construct: information. Information avoidance is one of several behaviors that emerge from defects in the information supply. They cause malfunctions in the individual's behavior whilst searching and absorbing information for decision-making. In order to denote it as a information pathology, the information has to be *decision-relevant* (Scholl, 2004). This is in line with Sweeny et al. (2010) and Narayan et al. (2011) who postulate that decision-relevance is necessary to distinguish information avoidance from related phenomena such as lack of interest, time pressure, and economically sound behaviors such as the avoidance of irrelevant (noise) information (Poulsen and Roos, 2010). Wang (1999) refers to a similar notion as information *topicality*, and Stvilia et al. (2007) depict it as *aboutness*. Accordingly, we delineate information avoidance behavior from related constructs by emphasizing that information is essential for shaping decisions.

We define information avoidance behavior as limiting or terminating the search, absorption, or use of *decision-relevant* information by individuals. Terminating refers to entirely blocking the perception of a stimulus, whereas limiting refers to reducing the perception of the stimulus. This distinction implies that information avoidance is not a binary construct but a continuum. Users can avoid information to different degrees. Completely blocking information is the most extreme end of the avoidance continuum. Less extreme is, for instance, the superficial processing of information. In our definition, information avoidance is an overarching construct to the related phenomena confirmatory search, selective exposure, and non-utilization. Information avoidance may occur at every stage of human information behavior, whereas the related phenomena are bound to specific phases. In contrast to existing definitions of the related constructs and in line with Sweeny et al (2010) and Narayan et al. (2011), our definition requires that the avoided information is decision-relevant. The delineation from related phenomena is depicted in Figure 1.

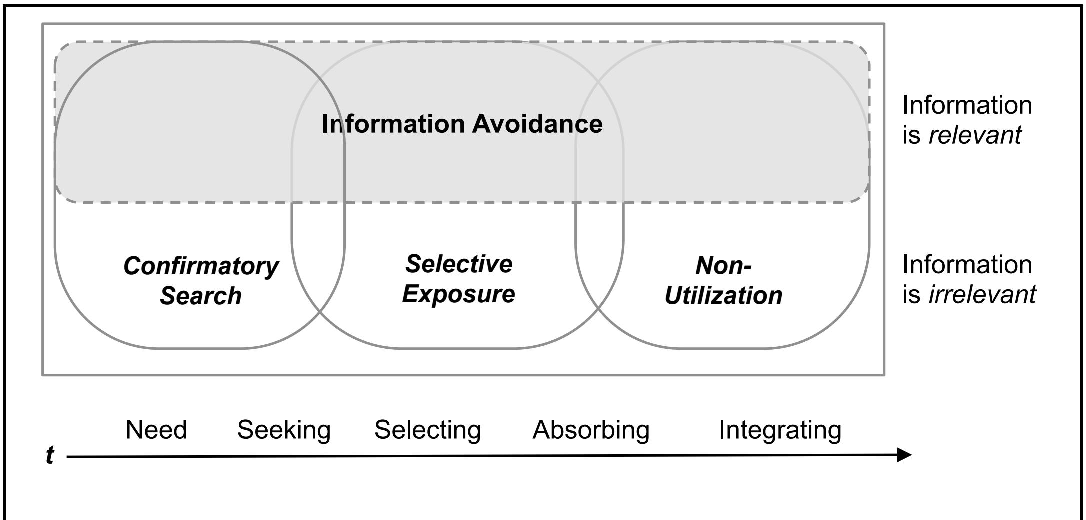

Figure 1. Contrasting the information avoidance construct from related phenomena

A Coping Theory Meta Framework

The review of the information avoidance literature has shown that no single clear definition of information avoidance is available. Nevertheless, a multitude of conceptualizations exist, that differ with regard to the temporal dimension (*when)* (e.g. during seeking or use) and the content dimension (*what)* (e.g. only relevant or all information) of information avoidance. A clear gap emerges concerning the following two research questions: (1) What is the role of the *information* in determining avoidance behavior and what are mere mediating variables? Is, for instance, the perception of doubt the cause of information avoidance or is the information defect, like inconsistencies, that *causes* the doubt the actual determinant? (2) How can the separate explanations of information avoidance be integrated into a coherent explanatory model that accounts for threat-based as well as distress-based negative affect? Our reasoning and model development is build on Coping Theory as it provides a general framework for stimulus perception, appraisal, and the subsequent choice of response behaviors. Coping Theory explains the relationship between the psychological response to a stressor and the choice of a coping behavior in order to reduce the stress (Krohne, 2001). Individuals encounter a stressor and assess its importance, relevance and potential consequences during a *primary* appraisal which results in an emotional perception. During a secondary appraisal, individuals evaluate possible adaptation options or strategies regarding the question “What can I do?” (Folkman and Lazarus, 1990; Lazarus, 1966; Lazarus and Folkman, 1984). The resulting coping choice(s) refers to performing activities to deal with the situation (Folkman and Lazarus, 1980). Coping can either be emotion-focused, which aims at regulating the negative emotion, or problem-focused, which aims at changing the problem causing the emotional distress (Lazarus and Folkman, 1984). Emotion-focused coping occurs frequently in situations when individuals appraise a situation as not changeable, whereas problem-focused coping is prevalent in situations where the cause appears changeable. Most coping behaviors, however, addresses both functions in parallel (Folkman and Lazarus, 1980; 1985; Lazarus, 1996; Weinert et al., 2013). In addition, some researchers have proposed *avoidance* to be a third and independent class of coping strategies (e.g. Amirkhan, 1990; Endler and Parker, 1994; Feifel and Strack, 1989). However, the literature describes information avoidance behavior as aiming to reduce negative affect, and such behaviors, arguably, fall well into the definition of emotion-focused coping. It is not evident, that a third class of coping behaviors beyond the dichotomy of problem- versus emotion-focused coping is required. As a consequence, we consider information avoidance behavior as an emotion-focused coping strategy.

This perception receives support from the model of coping modes by Krohne and Hock (2011), which describes and predicts attention, appraisal, and coping behaviors in stressful situations. Similar to classical models of coping, it posits the existence if two main coping strategies. First, *vigilance* is the orientation towards the stressor. Second, *cognitive avoidance* is drawing attention away from the stressor. Thus, vigilance represents actions to control the *stressor*, and cognitive avoidance represents actions to control the *negative affect* that is caused by the stressor.

The presented body of knowledge on human coping behavior provides three important insights to our study. First, it provides a simplified stage model along stimulus perception, appraisal, coping selection, and coping behavior that is helpful for encapsulating the phenomenon of information avoidance. Second, it permits to conceptualize the initial psychological response to a stressor as an affective state (Derakshan et al., 2007). Third, it accounts for information avoidance behavior as a form of emotion-focused coping.

Development of an Explanatory Model of Information Avoidance

We seek to explain information avoidance behavior in the context of computer-mediated information and knowledge work. In the literature, we have identified several factors, such as task and situational characteristics (Fischer et al., 2010; Scholl, 2007) as well as personal (Brouwers and Sorrentino, 1993; Sorrentino et al., 1988) and informational characteristics (Jonas et al., 2001; Knobloch-Westerwick and Meng, 2009; Sherman and Cohen, 2002) which are associated with the phenomenon. In the following, we will emphasize the importance of the *information supply* as a determinant of information avoidance. This can be justified for two reasons. First, existing research indicates that many of the constructs discussed as determinants of information avoidance may in fact be mediators. Arguably, the emotional states standing in relation to information avoidance, such as fear, doubt, or anger, do not emerge randomly, but are triggered by properties of the information construct. Hence, it is the information itself which is at the center of the information avoidance phenomenon. Second, we see the information construct as being of central importance to the *information* systems discipline. Thus, understanding and explaining this construct is a precondition for including further auxiliary variables, such as task complexity or personality.

Drawing on Coping Theory, we postulate defects in the information supply as a key stressors to the individual. The stressor causes a negative affective state, which will be perceived and judged in an initial phase of appraisal. Negative affect, which is perceived as a threat, evokes defense mechanisms and self-deception that materialize in biases. Negative affect as a result of being *stressed* and overwhelmed by the information's amount or complexity is related to minimizing strategies, shortcuts, and satisficing. Hence, the phenomenon of information avoidance is comprised of two separate behavioral pathways which are depicted in Figure 2. In the following, we will postulate and substantiate the according hypotheses.

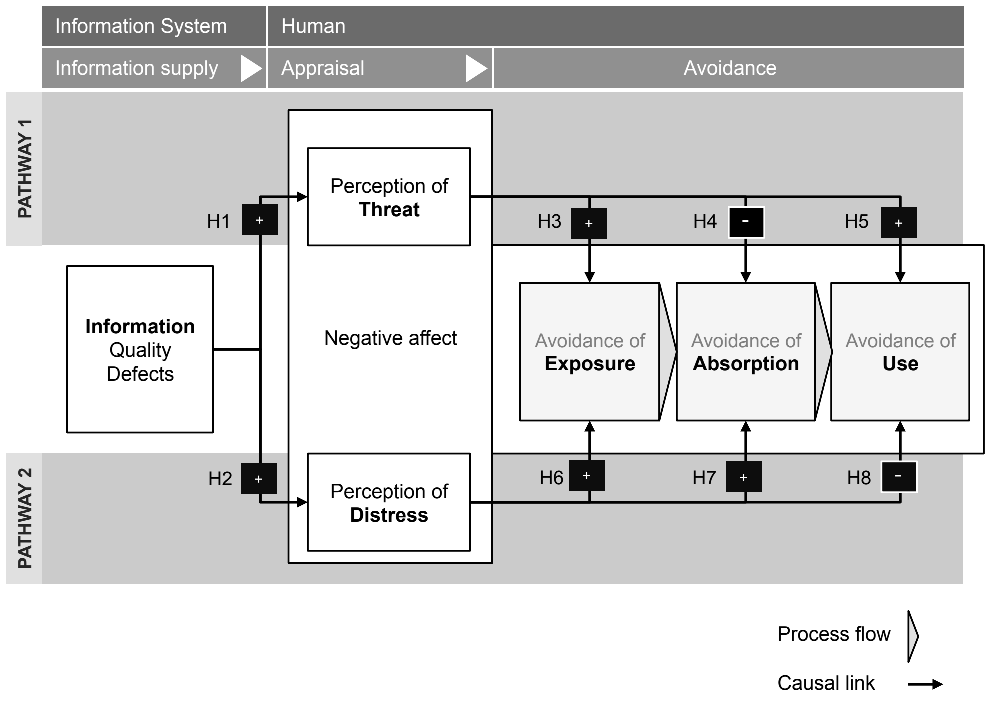

Figure 2. Theoretical Model Explaining Information Avoidance

Defects in the Information Quality and Negative Affect

Computer-based Information systems have the potential to increase the information supply for individuals or organizations by magnitudes. If information is sought and absorbed, it turns into a stimulus to the mental system of an individual. Through the lens of Coping Theory, the information and its characteristics are an input to the appraisal and coping-selection processes. Coping Theory, at its first stage, assumes stimuli to cause emotions that subsequently feed into the initial appraisal process (Derakshan et al., 2007). This linkage between stimulus perception and the initial evaluative response as an affective state is evident in other psychological models (Cacioppo, 2004). Greenwald (1997) denotes it as an unconscious first stage and a conscious second stage of stimulus analysis.

Pathologies in the information behavior are potentially caused by poor information quality. Consequently, the valence of the arising affective states will be negative. As an example, an individual experiences frustration when information is inconsistent or incomplete across different sources (Kuhlthau, 1991; 1993; Nahl, 2001). Other negative affective states arising from information quality defects are uncertainty, irritation, anxiety, doubt, or rage (Fischer et al., 2005; Nahl, 2004). Accordingly, we expect deficits in the information quality to cause negative affective states. What is understood under the notion of a poor information quality has been discussed along several dimensions (Arazy and Kopak, 2010; Arazy et al., 2011; Wang and Strong, 1996). *Incompleteness* denotes that certain task-relevant information is missing (Miller, 2005; Stvilia et al., 2007; Wand and Wang, 1996). *Ambiguity* signifies that the information can be interpreted in multiple, potentially contradicting ways (Wand and Wang, 1996).

Inaccuracy means that the information is wrong or provided at an inappropriate level of aggregation (Arazy et al., 2011; Stvilia et al., 2007). *Inconsistency* refers to the notion the information contradicts itself (Hunter and Konieczny, 2005; Wand and Wang, 1996). *Redundancy* implies that the information contains the same elements multiple times (Stvilia et al., 2007). We follow Baker and Anderson (1982) in seeing information as having quality deficits if one or more of theses deficiencies is present.

The specific information defects of inconsistency and ambiguity are seen as being associated with the arising of threat-related affect (cf. Table 1). This is based on effects of confirmation bias, priming and anchoring effects, and the perception of dissonance (Adams, 1961; Frey, 1982; Kuhlthau, 1991; 1993; Nahl, 2001; Nickerson, 1998). The specific information pathologies of incompleteness, inaccuracy, and redundancy are perceived as being associated with the arousal of stress-induced affect. The information is consistent in its message, but the handling of incompleteness, inaccuracy, and redundancies requires additional mental processing effort that causes distress (Chandler and Sweller, 1991; Sweller et al., 1998).

Thus, we hypothesize deficits in the information quality to cause negative affective states in the individual. In particular, we postulate:

> **H1:** *Consistency and ambiguity related information quality defects are associated with higher levels of threat-related affect.*
>
> **H2:** *Incompleteness, inaccuracy, and redundancy related information quality defects are associated with higher levels of stress-based affect.*

Three Types of Information Avoidance

So far, we have proposed a differentiation of the avoidance construct depending on its temporal dimension, i.e. *when* it occurs. Furthermore, we have defined information avoidance behavior as terminating or limiting the search, absorption, or use of *decision-relevant* information by individuals. Accordingly, we hypothesize the existence and observability of these temporal dimensions of information avoidance. **Exposure avoidance** is the termination or limitation of one's search for and exposure to decision-relevant information. **Absorption avoidance** is the termination or limitation of one's processing of decision-relevant information, like reading, hearing or viewing. **Use avoidance** refers to the neglect of incorporating decision-relevant information into one's solution model or the desistance to draw conclusions from the absorbed information, i.e. not drawing inferences from the information. According to our previous arguments, hypotheses H1 and H2 postulate the existence of two separate pathways to information avoidance. One pathway is based on the perception of being threatened by the information, and the other pathway is based on the perception of being overwhelmed by the information amount and its complexity. Following the notion of temporal stages of information avoidance, we will hypothesize how these two pathways relate to *exposure*, *absorption*, and *use* avoidance in the following.

The Role of Threatening Information

Threatening and dissonant information leads to biases and defense mechanisms (Bawden and Robinson, 2009; Cheikes et al., 2004; Jones and Sugden, 2001; Kuhlthau, 1991; 1993; Nahl, 2001; Savolainen, 2007; Scherer et al., 2013). If an idea or thought threatens individuals, the likelihood that these individuals expose themselves to this information decreases (Frey and Stahlberg, 1986). Hence, negative emotions such as threat, fear, or doubt are considered to be related to exposure avoidance.

However, if an exposure to threatening information is insurmountable, individuals engage in active and problem-centric coping strategies. This leads to more *intense* information absorption, in an attempt to resolve the stressor by, for instance, identifying weaknesses or counter arguments. An alternative explanation is based on the distinction between central versus peripheral processing. Negative stimuli increase attention and the depth of cognitive processing as they are evolutionary associated with threats and dangers (Ditto et al., 1998; Pratto and John, 1991). Accordingly, the absorption of dissonant information leads to more intensive cognitive processing than consonant (expected) information (Bless et al., 1996; Ditto et al., 1998; Mackie and Worth, 1989; Sherman and Cohen, 2002). A similar line of reasoning underlies the Elaboration-Likelihood Model (Petty and Cacioppo, 1984; 1986) which predicts high degrees of elaboration and involvement ("central processing"), if the informational cue is unexpected, arousing or threatening. The requirement for this effect, however, is that the absorption of the dissonant or threatening information has already take place, which is different from the aforementioned case of exposure avoidance (cf. e.g. Roth and Cohen, 1986).

For the stage of information use, it is predicted that dissonant and threatening information will not be used during and neglected for decision-making (Harris and Napper, 2005; Sherman and Cohen, 2002). The literature reports ego-protective motivations defensive biases as the underlying mechanisms (Sherman and Cohen, 2002).

The consequences of these literature findings yields a somewhat paradoxical situation, where the anticipation of encountering dissonant or otherwise unpleasant and threatening information increases the likelihood that individuals avoid the exposure. However, if an exposure cannot be avoided or if the absorption (e.g. through reading, viewing or listening) of dissonant or threatening information has already been initiated, the attention paid to this information as well as the level of mental processing actually increases. In the subsequent stage of information use, however, this information has an increased likelihood of not being used for inference and decision-making. Thus, we postulate the following hypotheses:

> **H3:** *Increases in the perception of threat are associated with an increase of exposure avoidance.*
>
> **H4:** *Increases in the perception of threat are associated with a decrease of absorption avoidance.*
>
> **H5:** *Increases in the perception of threat are associated with an increase in the likelihood of use avoidance.*

The Role of Complex Information

In situations of high cognitive demand, individuals employ a variety of mental information strategies. They resemble filter strategies, and reduce the cognitive load by neglecting parts of the information in order to arrive at simpler judgments (Jacoby, 1984; McGuire, 1976). These inference heuristics or short-cut strategies, lead to information avoidance as a by-product (Chen et al., 2008).

They are reported to involve rationalizing and excuse-finding of why filtering the information is justified. Examples are inference strategies that rely on sampling from the available information (Greenwald, 1997), such as "Take the Best" (Bröder, 2000; Gigerenzer and Goldstein, 1999) or satisficing behavior (Schwartz et al., 2002; Simon, 1972).

Satisficing-based reduction strategies lead to decision-making process which is grounded on subset of the available relevant information (Malhotra et al., 1982). In order to find this subset of information, users have to decide which information shall be avoided. Hence, we postulate that these behaviors lead to information avoidance as defined in this article. However, since individuals aim to reduce high cognitive load (Lee and Lee, 2004), a tendency to use already absorbed information exists in situation of high cognitive load. This is based on the assumption that already absorbed information is instantly available to the individual and does not require the absorption of additional information, which would further increase the experienced cognitive load. Accordingly, we hypothesize:

> **H6:** *Increases in the perception of distress are associated with an increase of exposure avoidance.*
>
> **H7:** *Increases in the perception of distress are associated with an increase of absorption avoidance.*
>
> **H8:** *Increases in the perception of distress are associated with a decrease of use avoidance.*

In the following, we will describe the derivation of a measurement model that is based on the psychophysiological measurement methods eye-tracking, pupillometry, skin conductance, and facial electromyography. Furthermore, we will apply both, the measurement model as well as the measurement methods, to conduct an initial experiment for studying information avoidance on the basis of its data analysis.

Deriving a measurement model

Subsequently, we instantiate the process of developing measurements for the concepts of negative affect and information avoidance. A common problem for human-centered studies is that emotional processes are difficult to assess via observations or post-hoc self-assessment questionnaires. Recent years have brought promising advances in the field of NeuroIS (Dimoka, 2009; Dimoka et al., 2012; Liapis and Chatterjee, 2011; Loos, 2010; Riedl et al., 2012; Wang et al., 2011), and the use of neurophysiological methods has proven particularly fruitful in fields where variables are latent and beyond the awareness of the participants (de Guinea, et al., 2012b; Dimoka, 2009; Montag et al., 2011; Riedl et al., 2012). Thus, it seems plausible to adopt psychophysiological methods for testing our model. To arrive at a valid measurement model, we propose and follow the subsequent process described below.

First, the concepts necessary to answer the research question need to be identified and mapped to existing theoretical constructs. This step involves studying theory and deriving constructs from it. Neuro- and psychophysiological methods seem expedient if the derived theoretical constructs involve psychological states or fast as well as unconscious behaviors. Second, to transform the relevant psychological states into operational definitions, the relevant neuro- or psychophysiological complexes need to be identified. This step involves examining NeuroIS literature as well as previous research in psychophysiology and neuroscience. Third, based on the involved neurophysiological complexes, one or multiple methods emerge as applicable. Fourth, combining the neurophysiological complex and the method allows to derive concrete neurophysiological correlates as markers for the psychological processes of interest. This step also involves studying of and deriving from NeuroIS literature as well as previous research in psychophysiology and neuroscience.

All but the first step are highly iterative, as researchers go back and forth between theory and the literature on neurophysiological complexes and correlates. The general process for developing the measurements is depicted in Figure 3.

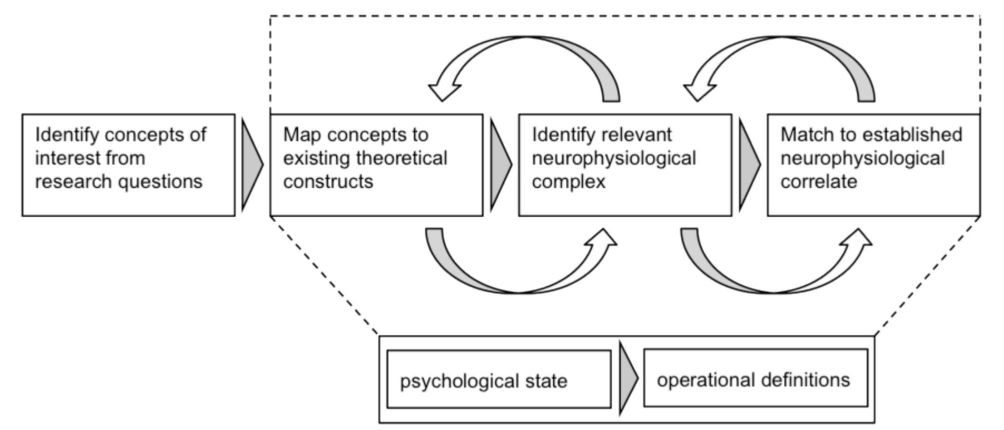

Figure 3. General Process for Linking Theory to Neuro- and Psychophysiological Correlates

The general process is concerned with identifying relevant neuro- or psychophysiological correlates. It provides no recommendations concerning the measurement *method*. For most psychological states, more than one method is applicable. Researchers have to choose which method to use. Issues such as availability and economic constraints may influence this choice. In addition, neuro- and psychophysiological methods almost never map onto exactly *one* psychological state. As Fairclough (2008) notes, the relationship between physiology and psychology is often not isomorphic. He identifies four prototypical relationships between physiological measures and psychological states: one-to-one, one-to-many, many-to-one, and many-to-many. The one-to-one scenario is the ideal case that, unfortunately, almost never exists. In reality, one physiological method may reflect multiple psychological states, and multiple methods may be used to measure one psychological state. One approach to overcome this issue of *mapping* is to use experimental task designs that are known to elicit specific psychological states and "known consequences" (Fairclough, 2008, p. 5).

To guide the process of method selection, we propose the following three fundamental considerations: First, the method must be capable of measuring the theoretical concept of interest and of delivering valid and reliable results. In particular, previous studies must have been successful in identifying as well as linking neuro- or psychophysiological correlates to the theoretical concepts of interest and should have demonstrated the method’s ability to measure these. O'Donnell and Eggemeier (1986) refer to this as sensitivity and diagnosticity. Second, the method must fit into a work-task scenario that is typical for the IS field. A plausible minimum standard requires that informational stimuli are presented and that the subjects are provided the opportunity of interacting with the system. O'Donnell and Eggemeier (1986) refer to this as intrusiveness. Third, the method should be characterized by a “low threshold, high ceiling” to allow for the fact that most IS researchers are not formally trained in neuro- or psychophysiological methods. It must, therefore, be possible to become familiar with the new method and perhaps even collect preliminary data within months rather than years (low threshold). Related to that, initial investments into mastering the new method should enable the researcher to address diverse research questions and allow further methodological learning and method expertise development (high ceiling). O'Donnell and Eggemeier (1986) refer to this as implementation requirements and operator acceptance.

With these constraints in mind, we subsequently review and justify our method selection and measurement approach for the constructs of negative affect and information avoidance behavior. The reviewed methods are facial electromyography, eye-tracking, pupillometry, blink measurement, and the measurement of electrodermal activity.

Review of Measures for Negative Affect

The explanatory model of information avoidance behavior entails *negative affect* as a mediating construct. The model distinguishes two types of negative affect: the perception of threat, based on dissonant and disconfirming information, and the perception of distress based on too much or too complex information. We will subsequently review which neuro- and psycho-physiological methods have been used to study negative affect.

Facial expressions (e.g. of emotions) result from the contraction of the facial muscles in certain combinations (Rinn, 1984). **Facial electromyography** (fEMG) measures electrical activity produced by facial muscles (Cacioppo et al., 1986). Recording these muscles by fEMG is, hence, a measure for emotions (Ekman and Oster, 1979; Huang et al., 2004). Criswell (2010) reports the lower frontalis (forehead) area and, in particular, the corrugator muscle (medial end of the eyebrow) to be related to non-verbal expression of *negative* emotions. Besides anger, fear, and surprise, it is activated under intense mental concentration. Likewise, Sloan et al. (2002) as well as Capa et al. (2008) use increased corrugator activity as a measure for negative affect. More specific, Martinie et al. (2013) find increased corrugator activity to be a valid measure for cognitive dissonance and van Boxtel (2010) relates it to the perception of fear as well as anger. In this context, the corrugator activity stands in a negative relationship to the perceived valence: the more negative the affect, the more active the corrugator. However, van Boxtel notes that distinguishing between specific positive or negative emotions based on fEMG alone remains challenging. Nevertheless, a series of studies successfully used fEMG as a marker for negative affect (Larsen and Norris, 2009; Martinie et al., 2013; Neta et al., 2009; Schrammel et al., 2009; Sloan et al., 2002; Weyers et al., 2009).

Electrodermal activity (EDA) is a measure for arousal that is based on activation in the sympathetic part of the autonomic nervous system (Adam et al., 2011; Boucsein, 2011; Figner and Murphy, 2011). The human skin contains eccrine sweat glands that produce sweat fluid, and the amount of sweat produced affects the electrical properties of the skin. These variations are measured with EDA equipment (Sequeira et al., 2009), with the recording conducted at specific skin areas such as the feet or the hands. Sweating in these areas is not thermoregulation but is an indication of arousal, and is perceived as emotional sweating (Sequeira et al., 2009). EDA recordings consist of two components: a slow-changing (tonic) baseline level, and a fast-changing (phasic) response to stimuli. The former is referred as the skin conductance level (SCL), and the latter as the skin conductance response (SCR). EDA has been used study to arousal, especially in the context of auctions, or in the sense of cognitive absorption, concentration, or flow experience (Adam et al., 2011; Léger, Davis, Perret, and Dunaway, 2010). As EDA is a measure of emotional quantity, not emotional quality, only the strength of the affect is recorded, not it's kind. In conclusion, EDA is a valid marker for arousal. It allows the researcher to infer about temporal (when) as well as quantitative (strengths) aspects of the emotional processing.

Pupillometry has previously been used to study human cognitive processing. Schluroff (1982) as well as Iqbal et al. (2004) find levels of high task complexity to predict increases in pupillary size. Similarly, Just and Carpenter (1993) link high workload levels to increases in pupil size. The magnitude of the pupil dilation is an indicator of the cognitive demand. This means that a higher workload causes a larger pupil's dilation. This physiological response of the pupil can lag behind the increased workload by several seconds (Palinko et al., 2010). As one pathway to information avoidance was hypothesized to involve the perception of distress caused by the workload characteristics of the information (H6, H7, and H8), and as pupil dilation is an established measure for high cognitive workload, it appears reasonable to include this method into our measurement model.

The human eye blink varies according to multiple situational and psychological factors (Baumstimler and Parrot, 1971; Wolkoff et al., 2003). The biological purpose of blinking is to moist and protect the eye (Skotte et al., 2006). In addition, blinks are influenced by information processing (Karson et al., 1981; Orchard and Stern, 1991). Accordingly, eye blinks have been studied in several contexts, such as attention, reading, and deception (Fukuda, 2001; Leal and Vrij, 2008). Blink *frequency* stands in relationship to cognitive effort. Existing literature converges on the observation, that blinking is suppressed during heavy cognitive processing, but occurs in *bursts* immediately after the processing is completed (Chen et al., 2011; Fukuda, 1994; 2001; Holland and Tarlow, 1972; Nourbakhsh et al., 2013; Ohira, 1996; Poole and Ball, 2006; Siegle et al., 2008; Van Orden et al., 2001). The blink frequency is, hence, a promising psychophysiological correlate of intense and sustained information processing. Corresponding to the argumentation for the usefulness of pupillometry data, which is based on the relationship between cognitive workload and the negative emotion of *distress*, it appears reasonable to include blink frequency into our measurement model.

Measuring Information Avoidance Behavior

Our definition of information avoidance draws on the three phases of avoidance: exposure, absorption, and use. They are defined in relation to decision-relevant information in order to delineate the phenomenon from economically grounded behaviors, such as ignoring *irrelevant* information. Because these phases differ in the point of time *when* they occur during an idealized process of human information behavior (e.g. search or use), they also differ with regard to what measurable *evidence* they evoke.

Exposure avoidance has been defined as not accessing or retrieving decision-relevant information. This refers to observable behaviors such as not searching, not opening a file, or not requesting more information. Hence, two things are necessary to establish exposure avoidance. First, users must be aware of the availability of (more) decision-relevant information. This refers to a measure of attention. Second, users must choose not to request, disclose, or differently access the information. Such observations can be made on various levels, as e.g. on the document level (not opening a file) or on the text passage level (not requesting to “read more”) (Kim et al., 2000). The eye-tracking methodology has previously been used to measure attention (Cyr et al., 2009; Granka et al., 2008; Hermens and Walker, 2010; Hoffman and Subramaniam, 1995). In particular, eye-movements (saccades) and focus (fixations) have been used to study whether a particular area has been paid attention to (Cyr et al., 2009). The second prerequisite for exposure avoidance, that is, not *accessing* or requesting information, can be measured with observations such as screen recordings. Experimenters can replay the users’ interaction and determine post-hoc what information has been requested and accessed.

Absorption avoidance has been defined as preventing the in-take of decision-relevant information after it has become available. In the case of text-based information, this refers to the avoidance to read parts or the entire text. The eye-tracking methodology has previously been used to study reading behavior (see Rayner (2009) for an overview). It was used to study the effects of text characteristics on the reading process. These studies are concerned with the syntactic and semantic properties of the text and the ease of its recognition (Clifton et al., 2006). Eye-tracking was also used to study the psychological process behind the reading process. For example, Ajanki et al. (2009) looked at participants' scan-path information (fixations and saccades) to make inferences about perceived text *relevance*. Several eye-tracking measures have been discussed for making inferences about text processing *intensity*. Based on that, the use of eye-tracking appears feasible for measuring absorption avoidance behavior

Use avoidance has been defined as not integrating absorbed information into one's decision-making or neglecting to make inferences based on it. Whether a person has used information in a decision-making process can be studied in two ways. First, an experiment can be designed in a way so that subjects can arrive at a certain conclusion (decision) *only* if they have used a particular piece of information. This means that decision *outcomes* are recorded. Second, retrospective inquiry such as interviews can be used to assess whether the information was used or not. One such method is the retrospective think aloud approach (Doherty et al., 2010; Hyrskykari et al., 2008), were probates are asked to spontaneously say what they think.

In the light of this special issue, we aim to demonstrate the use of psycho-physiological methods for a understudied but yet important phenomenon in IS research: information avoidance. For the reason of cohesion, we constrain our measurement development to the constructs that provide the opportunity to exemplify the use psychophysiological measures. Since the use phase does - as outlined above - not necessarily require the utilization of such methods, we will subsequently focus on measuring *exposure* and *absorption* avoidance in the remainder of this article.

In summary, the use of eye-tracking appears feasible for measuring exposure and absorption avoidance behavior. Overall and with regard to the test of our theoretical model, our triangulated mixed-method approach consists of EDA, fEMG, and Pupillometry (blink frequency and pupil dilation) to measure and differentiate the negative affective states of threat and distress, and the use of eye-tracking and user behavior observations (information requests) to measure exposure and absorption avoidance. Our method mix is summarized in Table 2.

Table 2: Set of methods selected

Method	Negative affect	Avoidance behavior	Related work
Pupillometry	X		Bentivoglio et al., 1997; Chen et al., 2011; Nourbakhsh et al., 2013; Ohira, 1996; Siegle et al., 2008; Van Orden et al., 2001.
Electrodermal activity	X		Boucsein, 2011; Fairclough, 2008; Hazlett and Benedek, 2007; Matthews et al., 2002 Setz et al., 2010.
Facial electromyography	X		Capa et al., 2008; Criswell, 2010; Larsen and Norris, 2009; Martinie et al., 2013; Neta et al., 2009; Sloan et al., 2002; van Boxtel, 2010; Weyers et al., 2009.
Eye-tracking		X	Ajanki et al., 2009; Claypool et al., 2001; Kelly and Teevan, 2003; Loboda et al., 2009; Salojärvi et al., 2005.

Deriving Specific Measurement Expectations

Following a positivist research stance (Comte, 1865; Popper, 1973) in information systems (Boudreau et al., 2001; Gregor, 2006; Straub et al., 2004), we have derived a set of falsifiable hypotheses. In the following, we will develop the accompanying measurement model and define 14 specific and falsifiable measurement *expectations* (Figure 4).

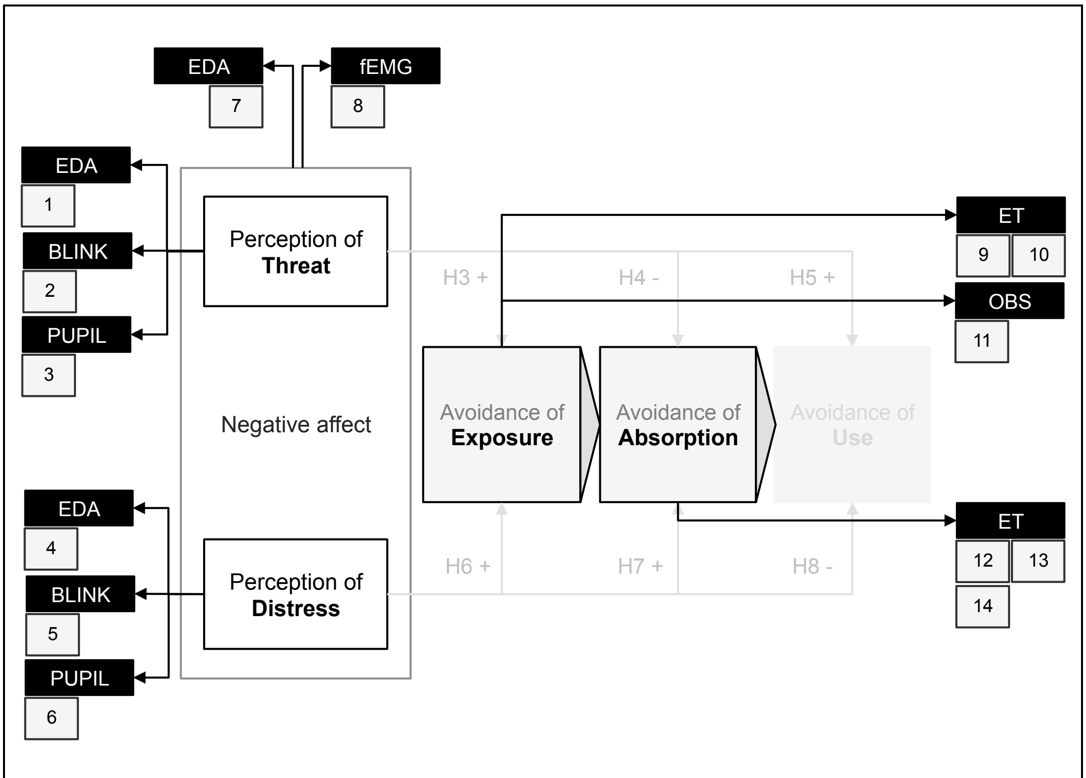

Figure 4. Measurement model

The measurement model depicted in Figure 4 connects the explanatory model of information avoidance (Figure 2) with the measurement approaches identified in the previous section. Each theoretical construct is depicted with the identified measurement method of choice. For each construct and method, a detailed description of measurement, a justification of the approach, and a falsifiable expectation is provided.

Electrodermal Activity as a Measure for Arousal

Psychological states, such as fear, anxiety and distress can vary in their intensity. The physiological evidence corresponding to these variations is the level of arousal (Fairclough, 2008; Matthews et al., 2002). The measurement of **electrodermal activity (EDA)** has been introduced as a measure for the arousal attribute of emotions. EDA data can be decomposed into the skin conductance response (SCR) and the skin conductance level (SCL) (Lim et al., 1997; Nagai et al., 2004). The SCR depends on changes in the sympathetic nervous system, which are caused by internal or external stimuli (Boucsein, 2011; Figner and Murphy, 2011). SCR reflects stimulus-bound, time-discrete, and more abrupt changes in (phasic) activity (Frith and Allen, 1983; Öhman and Soares, 1994; Tranel and Damasio, 1994). The SCL on the other hand, refers to the overall degree of arousal and is less prone to change quickly based on short-lived stimuli. It reflects general psycho-physiological states such as tension and relaxation as well as moods (Malmo, 1959). It is computed by averaging multiple measurement points that span a relatively long time period, such as several minutes (Boucsein, 2011). Though EDA does not allow distinguishing between types of emotions (valence), it is a measure for emotion strength (arousal). Thus, we use EDA for two purposes: First, EDA provides markers for temporal changes in emotional processing (e.g. sudden SCR activity). Second, it allows intra-individual comparison of arousal strength (e.g. based on the SCR amplitude). In particular, we expect sudden SCR peaks to reflect increased emotional processing. The larger the amplitude and the longer the duration until recovery to the baseline condition, the stronger is the arousal. Furthermore, we expect SCL changes to reflect long lasting, general emotional states and moods.

Increases in the SCL lasting several seconds or even minutes reflect enduring emotional processing.

Facial Electromyography as a Measure for Negative Affect

We follow extant research in using corrugator activity as a measure for negative affect (Larsen and Norris, 2009; Martinie et al., 2013; Neta et al., 2009; Schrammel et al., 2009; Sloan et al., 2002; Weyers et al., 2009). This refers to measuring the mean EMG amplitude in microvolts (μV) on the surface area over the corrugator muscle (Capa et al., 2008). The recorded data are compared to the electrical activity during baseline (resting) conditions. The baseline is calculated based on the electrical reactivity prior to stimulus onset. Because muscle activity varies significantly between humans, an individual baseline is established for every subject. Studies differ in their strategies for establishing the baseline value. Capa et al. (2008) use a four minutes time window to establish the baseline reactivity. Schrammel et al. (2009) record baseline based on 300ms before stimulus onset. Because the physiological correlates measured by EMG have a lower temporal resolution than, for instance, correlates measured with EEG (Dimoka et al., 2011; Riedl et al., 2009), several hundred milliseconds can lay in between the stimulus perception and EMG reactivity onset. Emotional responses measured with fEMG occur as early as 300ms after stimulus onset, but the strongest muscle activity is measured at 500-1.000ms after stimulus perception (Achaibou et al., 2008; Dimberg et al., 2000). As van Boxtel (2010) notes, fEMG provides a valid measure for distinguishing negative from positive affect. It is not trivial, however, to distinguish between emotions of the same valence (e.g. different *types* of negative affect). Thus, we use fEMG as a measure and marker of negative affect in general (H1 and H2), but not for distinguishing threat- from distress-based negative affect. Based on the previous arguments, we expect increased corrugator activity to start 300-1.000ms after the perception of the information defect. Furthermore, we expect the increased corrugator activity to last 1.000-3.000ms. In conjunction with the above-described expectation to measure emotional arousal with EDA, we expect increases in corrugator activity to correlate with increases in phasic skin conductance response (SCR) activity.

Figure 4 depicts the use of EDA (item 7) and fEMG (item 8) as measures for *negative affect*. For distinguishing *threat* from *distress*, we rely on the following set of expectations that we base on a triangulation of electrodermal activity, blink frequency, and pupil dilation measurements.

Distinguishing Distress from Threat

For disentangling threat-related negative affect from distress-related negative affect, we rely on a triangulation of electrodermal activity, blink frequency, and pupil dilation measurements.

The distress-based pathway (H2) to information avoidance is based on the idea that defects in the information supply, specifically *incompleteness*, *inaccuracy*, and *redundancy,* increase the cognitive demands. Very high cognitive demands lead to distress. Our measurement approach for distress uses the fact that high cognitive load is a predecessor for distress. In a first step, we establish the presence of high levels of perceived cognitive demand by measuring pupil dilation and blink frequency. In a second step, we establish the presence of an affective response and its associated degree of arousal with EDA measurement. In a third step, we establish that the valence of the affective response is in fact *negative* using fEMG. The following describes the three steps in more detail.

Two common **pupillometric measures** are directed at measuring cognitive demands. Both are based on the observation that the pupil diameter increases with rising cognitive load (Beatty, 1982; Hess and Polt, 1960, Kahneman and Beatty, 1966; Siegle et al., 2008). First, the index of cognitive activity (ICA) uses the *frequency* of dilations of the pupil within pre-defined time frames (Marshall, 2002). The pupil responds to increases in cognitive effort with a reflex reaction. The ICA is based on measuring this reflex reaction. High frequency and near distance recording of the pupil is necessary to measure the ICA. This violates our "low threshold, high ceiling" prerequisite for method selection. The second pupillometric measure is the mean pupil *diameter* (Hyönä et al., 1995; Karatekin et al., 2004; Nuthmann and Van der Meer, 2005; Piquado et al., 2010; Siegle et al., 2008). The mean pupil diameter can be measured and calculated more easily. It requires less sophisticated technology and can be measured with the equipment of most eye-tracking vendors. Another advantage of measuring the mean pupil diameter is the averaging process itself, which makes it more resistant to noise. Iqbal et al. (2004) propose two operationalizations for measuring this effect: percent change of pupil size (PCPS) and average percent change of pupil size (APCPS). PCPS is calculated as the difference between the measured pupil size during treatment and the baseline pupil size, divided by the baseline pupil size. Based on that, we expect increases in cognitive demand to positively correlate with increases in APCPS (Iqbal et al., 2004; Laeng et al., 2012). Furthermore, we expect pupil diameter changes to become significant at about 2.000ms after stimulus onset (Laeng et al., 2012).

Blink frequency is a measure of mental processing (Hall, 1945; Skotte et al., 2006). Bentivoglia (1997) find blink frequency to average at 17 blinks per minute in the resting condition. Similarly, Karson et al. (1981) find 19 blinks per minute for their resting condition. Most researchers find the blink frequency to *decline* with greater workload (Brookings et al., 1996; Holland and Tarlow, 1972; Nourbakhsh et al., 2013; Van Orden et al, 2001). Interestingly, some researchers find blink frequency to *increase* with greater workload (e.g. Tanaka and Yamaoka, 1993). However, as the authors note, these contradictory findings may result from different experimental tasks designs. In general, findings converge on the observation that blinking frequency is suppressed with increasing mental workload. Adding to this, further studies have revealed that high cognitive load is followed by burst of blinks (Fukuda, 1994, 2001). Similarly, Ohira (1996) finds the blink frequency to be suppressed during demanding tasks, but to peak right after task performance is completed. In this context, blinks are described as "mental punctuations" and correlates of the mental reordering after phases of intense demand (Boehm-Davis et al., 2000; Siegle et al., 2008). In accordance, we expect the blink frequency to decline during phases of high cognitive load, but to peak immediately after the load decreases. These expectations towards the validation of hypotheses 2 are summarized in Table 3.

Table 3: Measurement expectations for hypothesis 2 and its dependent variable *distress*

Hypothesis 2			
H2: *Incompleteness, inaccuracy, and redundancy related information quality defects are associated with higher levels of distress-based affect.*			
Measure	Construct	Method	Expectation (Correlate)
4	Distress	EDA	SCL: long-enduring increase in amplitude, duration until return to baseline > 15.000ms. SCR: No systematic difference from baseline condition.
5		BLINK	Decrease in blink frequency during high mental workload. Sharp above-baseline increase in blink frequency after mental workload decreases.
6		PUPIL	Pupil mean dilation increase.
Confirmed if:			
The perception of distress is characterized by an enduring increase in *SCL* with no systematic SCR differences from baseline condition. The pupil diameter (APCPS) increases. The *blink frequency* decreases during distress, but returns to an above-baseline frequency (“bursts”) shortly (2-5s) after the distress is reduced.			

The threat-based pathway (H1) to information avoidance is based on the idea that defects in the information supply, specifically *inconsistency* and *ambiguity*, lead to the perception of dissonance and result in defensive biases. Our testing strategy towards hypotheses H2 has introduced the pupil diameter dilation as a measure for cognitive demand. Notwithstanding, a series of early psychophysiological studies had originally suggested that pupil dilations primarily measure *emotional* processing (Hess, 1965; Tryon, 1975). Janisse (1973) as well as Stanners et al. (1979) challenged this assumption and later posited that pupil dilation relates to mental workload. Throughout the last decades, the effect of processing load and mental effort on the pupil diameter has repeatedly been shown (e.g. Gardner, 1975; Piquado et al., 2010). However, strong evidence exists that even though the effect of cognitive effort on pupil dilation is dominant, affective states such as fear and anxiety still affect the pupil diameter (Sturgeon et al., 1989; Laeng et al., 2012). Based on that, we expect the perception of threat-based negative affect (H1) to correlate with smaller increases in pupil diameter than in the distress-based explanation (H2).

Similar to the distress-based explanation of hypotheses H2, it is expected that the blink frequency will decrease during the threat-based pathway of hypothesis H1. This assertion is based on previous studies that relate threat stimuli to suppressed blinking Hall (1945). However, different from the distress-based condition, no evidence exists that the blink frequency increases above baseline after recovery. Threat-based blinking as opposed to workload-based blinking does not involve "mental punctuations" (Boehm-Davis et al., 2000; Siegle et al., 2008). Thus, we expect the blink frequency to return to baseline condition shortly (2-5s) after the threat perception. Our expectations for testing hypothesis H1 are summarized in Table 4.

Table 4: Measurement expectations for hypothesis 1 and the perception of *threat*

Hypothesis 1			
H1: *Consistency and ambiguity related information quality defects are associated with higher levels of threat-related affect.*			
Measure	Construct	Method	Expectation (Correlate)
1		EDA	SCL: Slightly increased amplitude for a duration < 7.000ms. SCR: Increased amplitude, duration until return to baseline < 5.000ms after stimulus onset.
2	Threat	BLINK	The blink frequency will decrease during threat perception, and return to baseline frequency after 2.000ms to 5.000ms.
3		PUPIL	The pupil diameter will not increase from baseline condition.
Confirmed if:			
The perception of threat is characterized by a stark but short increase in *SCR*, and only slight and short increases in *SCL*. No changes in *pupil diameter* are expected. The *blink frequency* decreases during threat perception, but returns to baseline frequency shortly (2-5s) after.			

Exposure Avoidance

In order to speak of information exposure avoidance, individuals need to be aware that more decision-relevant information is available. In addition, they must choose not to request or in any other way access this information. We rely on eye-tracking and user observation for testing the hypotheses that relate to exposure avoidance (H3 and H6). Eye-tracking allows establishing that users have paid attention to those parts of the screen that indicate the availability of more decision-relevant information (Beymer et al., 2008; Cutrell and Guan, 2007; Hermens and Walker, 2010; Hoffman and Subramaniam, 1995). In particular, eye-tracking allows measuring *how much* attention has been paid to these indicators. In the scenarios where the availability of more decision-relevant information is indicated by presenting a short excerpt ("teaser") of it, eye-tracking allows to measure whether or not this excerpt was (fully) read. User observations help in establishing that users have not requested *more* information. We hence draw on these two measures for testing hypotheses H3 and H6. Table 5 summarizes our expectations.

Table 5: Measurement expectations for hypothesis 3 and 6 and their dependent variable *exposure avoidance*

Hypothesis 3 and 6			
H3: *Increases in the perception of threat are associated with an increase of exposure avoidance.* H6: *Increases in the perception of distress are associated with an increase of exposure avoidance.*			
Measure	Construct	Method	Expectation (Correlate)
9	Exposure avoidance	ET	Reading speed measured as words and sentences per minute increases.
10		ET	Gaze and fixations indicate that the users are aware of the availability of more relevant information.
11		OBS	Users do not request more relevant information.
Confirmed if:			
Gaze and fixations are placed on the areas indication more decision-relevant information. Excerpts ("teasers") of this information are read with low intensity (high speed, below average word fixations). The users do not choose to request *more* information.			

Absorption Avoidance

Eye-tracking allows studying the psychological processes behind human reading behavior. In particular, the issue of information absorption has been discussed. For example, Ajanki et al. (2009) looked at participants' scan-path information (fixations and saccades) to make inferences about perceived text *relevance*. Salojärvi (2005) discusses the duration of the first fixation of a word, the total number of fixations during reading of a passage, the mean fixation duration, and the probability that a word will be re-fixated. Further, **regressions** (returning to a previous reading position) make up about 15% of all fixations when reading a text under normal conditions. Increases in the number of regressions may also be an indicator for more intense text processing (Salojärvi, 2005). **Reading speed** averages at around 250 words per minute (wpm). Lower wpm than a control group on the same text may indicate more intense processing (Claypool et al., 2001; Kelly and Teevan, 2003; Loboda et al, 2009). Rayner et al., (2009) as well as Loboda et al. (2009) calculate the number of **words skipped**. A word is skipped if it is not read. To account for the human perception span that is wider than most fixated words, a word is counted as *read* if it is either fixated or if it immediately follows a fixated word. Measures of word skipping are the number of skipped words and the ratio between skipped and not skipped words. Advancing on the idea of looking at reading behavior on the word level, Loboda et al. (2009) infer about perceived text relevance by looking at the sentence-terminal words, i.e. the sentence's last words. This is based on the assumption that a sentence's meaning is integrated at its end. Whether the end of a sentence is read indicates its perceived relevance.

The reviewed literature has provided evidence that relying on a combination of several eye-tracking metrics seems most promising. In particular reading speed, mean fixation length and mean fixation count, decreased number of regressions, and the skipping of text have appear to be valid indicators of information avoidance. A summary is provided in Table 6.

Table 6: Measurement expectations for hypothesis 4 and 7 and their dependent variable *absorption avoidance*			
Hypothesis 4 and 7			
H4: *Increases in the perception of threat are associated with a decrease of absorption avoidance.* H7: *Increases in the perception of distress are associated with an increase of absorption avoidance.*			
Measure	Construct	Method	Expectation (Correlate)
12	Absorption avoidance	ET	Reading speed measured as words and sentences per minute increases.
13		ET	Skipping of words, sentences and paragraphs increases.
14		ET	Overall gaze coverage of the information (area) decreases.
Confirmed if:			
The reading speed and the fixation word counts are below subjective average (baseline). The overall gaze (dwell) does not cover the entirety of the information (text).			

Experimental Design and Protocol

We aim to test our hypothetico-deductively posited associations between the developed constructs on the basis of empirical evidence. Several methodologies for providing such empirical evidence exist. One methodology prominent in IS research is the scientific experiment (Benbasat and Schroeder, 1977; Benbasat and Taylor, 1978; Jarvenpaa et al., 1985; Gallupe et al., 1988). This method uses repeatable procedures for testing specific and prescribed assumptions about constructs and the relationships between those constructs. They establish causality by manipulating the independent constructs, measuring the dependent construct, and holding all other factors constant ("ceteris paribus"). The range of research methods within the experimental methodology is vast. Recent advances in NeuroIS have introduced methods that allow researchers to elicit neuro- and psychophysiological data for providing empirical evidence.

The emotional and behavioral processes which underlie our study are difficult to assess via observations and retrospective self-assessment alone. Hence, we suggest relying on NeuroIS methods for eliciting the relevant empirical evidence. We choose the methodology of a controlled scientific experiment for testing our model and for establishing causality. We apply the particular set of (NeuroIS) methods because they allow us to collect empirical evidence about mental processes. These processes reflect latent phenomena that are hard to elicit for traditional empirical methods. The following describes our experiment, the experimental task, the equipment procedures, the handling of the participants, and the experiment layout.

Experimental task

To demonstrate the usefulness of psychophysiological methods in testing the explanatory model of information avoidance, we conducted an initial experiment and collected preliminary data. Our experimental block design was guided by an existing decision task adopted from psychology. The “Mr. Miller” decision case was developed to study the post-decisional use of information (Frey, 1981; Jonas et al., 2003). Subjects are put in the position of a fashion storeowner that has to decide about the working contract extension of an employee (Mr. Miller). Subjects receive information about Mr. Miller’s past achievements and failures. They are then asked to make a preliminary decision about the contract extension. Afterwards twelve additional expert opinions about Mr. Miller in the form of textual "teasers" or excerpts become available. One half of the texts speak in favor of Mr. Miller and the other half speak against him. The additional information is non-redundant and becomes available as short excerpts (“teasers”) with the option to click “receive full text”. Subjects use checkboxes to indicate their desire to receive zero, one, or many of the additional expert opinions. The chosen experimental setting allowed manipulating our independent variable (information supply defects) and measuring our dependent variable (information avoidance behavior). Subjects had to make a preliminary decision whether to extend Mr. Miller’s contract or not. The subjects were told that they would be asked to make a final decision later in the experiment. This had two purposes. First, the preliminary decision caused one half of the subsequently offered additional expert opinions to be inconsistent (dissonant) to the subject’s choice. Second, because the final decision was still to be made, additional information could still be *decision*-relevant. The additionally offered expert opinions were used to measure the concepts of exposure and absorption avoidance (cf. Table 6 and 7). Figure 5 illustrates the layout of the screen. The left side depicts how subjects were made aware of the availability of additional decision-relevant information. Subjects could choose to receive the full information by checking a box (exposure). The right side depicts how reading behavior was studied to calculate the metrics summarized in Table 7. The orange lines and dots represent saccades and fixations. The gray area indicates the parts of the text that were not absorbed.

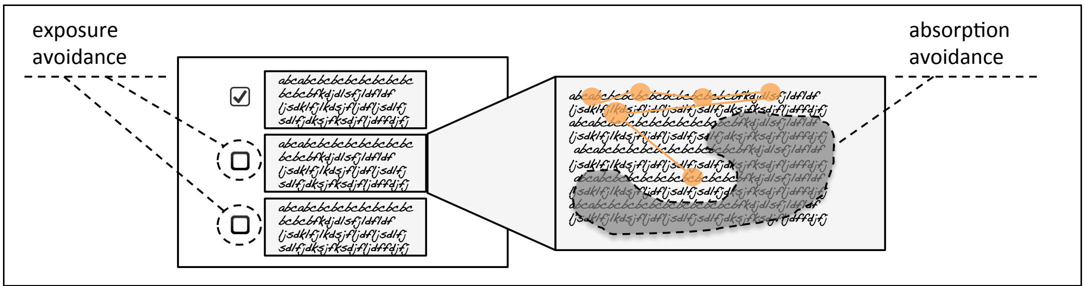

Figure 5: Task design for measuring exposure and absorption avoidance

Participants

Five healthy participants (2 female and 3 male) volunteered to participate in the preliminary conduct of the study. Each participant received a 5 € coffee shop voucher for participating as a small incentive.

Equipment precautions

The eye-tracking measurement was conducted using a RED250 eye-tracker apparatus produced by SensoMotoric Instruments (Teltow, Germany). The sampling rate was 250Hz and latencies were below 10ms. The eye-tracker was mounted below a 22'' widescreen LCD monitor. The stimulus presentations were designed using the SMI Experiment Center 3.1 software.

EDA and EMG were recorded using a V-Amp (16 channels) device manufactured by BrainVision (Gilching, Germany). Data was recorded using

BrainVision Recorder 1.20. Standard miniature Ag/Ag-Cl electrodes filled with a gel for EMG and a skin conductance electrode paste for EDA (TD-246 by Discount Disposables) were placed bipolarly on the forehead (EMG) and palm (EDA) of the participants. The skin over the corrugator area was rubbed with high-chloride abrasive electrolyte gel and was then disinfected with skin disinfection spray before EMG electrodes were attached. For EDA recording, subjects were asked to wash their hands without soap prior to the experiment as soap decreases the skin's conductivity (Bouscein, 2004). To ensure that the skin conductance paste matches the ion concentration of the skin, we attached the electrodes several minutes before the recording (Gramann and Scandry, 2009). A BrainVision bipolar-to-auxiliary (BIP2AUX) adapter was used to generate an EDA signal (1 channel) from the two sensors attached to the non-dominant hand of a participant. Finally, a keyboard and a mouse were provided for task execution, whereas only the space-bar and the mouse were required for task execution.

Procedure

Environment

The experimental facilities consisted of the laboratory room for conducting the experiment and an experimenter room for observing live recording. The laboratory room was purely artificially lid in order to reduce eye-scanner artifacts due to differences in luminescence. The laboratory's temperature was artificially held constant at 24.5 degrees.

Layout

The layout of the experiment procedure consisted of a preparation, experiment, and closure part. The preparation phase included the briefing of the subjects, reading and signing the informed consent, and the setup and calibration of the measurement devices. Furthermore, subjects were given a five-minute relaxation period in order to establish natural EMG and EDA baseline conditions. After the experiment, the electrodes were detached and subjects were debriefed. This included the revelation of the purpose of the study and the handover of the incentive. The full layout of the experiment is depicted in Figure 6.

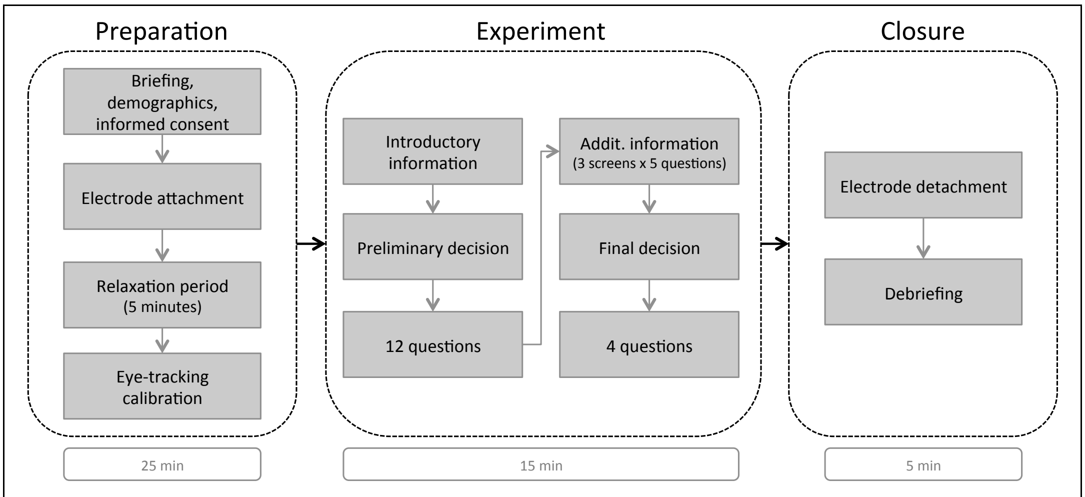

Figure 6: The layout of the conducted experiment

Preliminary Data Analysis

Drawing on the derivation of an explanatory model for information avoidance behavior, the instantiation of the corresponding measurement model and on the description of the experiment protocol, we now elaborate an analysis of the data collected during our initial experiment. In this experiment, we obtained data for all hypotheses, but constrained the data analysis to a subset of associations and constructs in order to effectively exemplify the practicability of our measurement protocol. Therefore, we focus on *distress*, *exposure avoidance*, and *use avoidance* constructs in order to demonstrate the utility of our methodological approach. The underlying selection has been motivated by two considerations. First, the Mr. Miller task allowed for a manipulation and control of the *threat* condition. As a consequence, hypotheses 3 and 4 predict a paradoxical situation, in which the anticipation of dissonant or otherwise unpleasant and threatening information increases the likelihood that individuals avoid exposure. However, if exposure cannot be avoided or if the absorption of dissonant or threatening information has already been initiated (e.g. through reading, viewing or listening), the attention paid to this information as well as the level of mental processing actually increases. From a methodological point of view these theoretical associations are particularly interesting since they place additional requirements on our apparatus. Thus, we included H3 and H4 in our experiment. Second, since our main objective at this state of our study is to contribute methodologically, the selection has been affected by the scope of the expected *methodological* contribution. Our measures for *exposure avoidance* (H3, H6, measurement items 9, 10) and *use avoidance* (H4, H7, measurement items 12, 13, 14) are based on awareness- and reading-related eye-tracking metrics that offer a considerable potential with respect to the objectives of this study. Since proven demonstrations exist for the use of EDA in IS context (Léger et al, 2010; Adam et al., 2011), we have chosen to further contribute to the emerging interest in pupillometry (Xu and Riedl, 2011; Sheng and Joginapelly, 2012; Buettner, et al., 2013). Hence, we demonstrate the pupil-based data analysis of *distress* (H2, measurement item 6). The following describes the preliminary analysis of the outlined subset of our collected data.

Distress and Pupil Dilation

Our explanatory model integrates two pathways leading to information avoidance behavior. One pathway is grounded on being *threatened* by the information's inconsistency. The second pathway is grounded on being *distressed* by the information's complexity. The measurement strategy for the *distress* construct (measure 4, 5, and 6) introduced above draws on its close conceptual proximity to increased mental effort and workload. Following measurement expectation 6, we exemplify the use of the pupil dilation as a measure for mental effort leading to distress.

Data acquisition

During the experiment, subjects' pupil diameter was continuously, binocularly recorded with a rate of 250Hz.

Data Analysis

The closing of the eyelid during blinking obstructs the scanning process of the eye-tracking device. This results in over- and underestimation of the pupil diameter during blinks. We inspected the raw data manually for these outliers, and removed individual blink artifacts. To further smooth the data, we collapsed the microsecond-timed raw measurement points into intervals ("bins") of 100ms

(100.000μs). We calculated the mean pupil diameter and the standard deviation for each bin.

Results

Theoretical *reasoning* determines *why* to expect meaningful changes in the pupil diameter. The experimental *design* determines *when* to expect meaningful changes in the pupil diameter. Figure 7 depicts an exemplary trial of our experiment with a time range of 1 minute and 45 seconds after onset of increased mental effort. Collapsing the raw data resulted in 1055 bins of 100ms (x-axis). The last bin (1056) covered slightly above 130ms. The y-axis depicts the mean pupil diameter. An ordinary least squares regression revealed a significant positive linear relationship ($p<0.001$) between sustained mental processing and the mean pupil diameter (adj. $R^2=0.3917$). With every additional 100ms of cognitive processing, the pupil dilated by additional 0.0002mm. This supports previous studies, which provided evidence that the pupil diameter correlates with mental effort and distress.

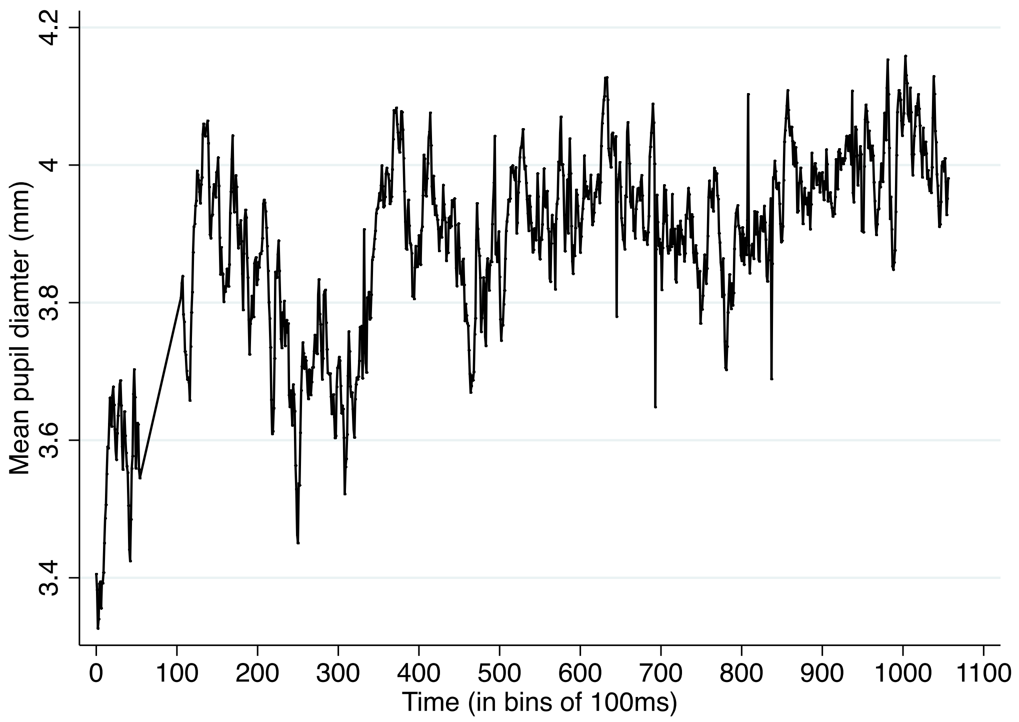

Figure 7: Increase in mean pupil diameter with sustained cognitive effort

Exposure Avoidance and Observations

During the experiment, the information supply was manipulated to induce and control the perception of *threat*. Subjects made a preliminary decision for or against extending Mr. Miller's employment. Following this, more decision-relevant information was offered as excerpts ("teasers") with the option to request the full document. Excerpts spoke either clearly for or against Mr. Miller. Hence, the information speaking in *favor* of him was dissonant for participants who decided against him in the preliminary decision. Under this condition, we expected subjects to engage in *exposure avoidance* (H3).

Data acquisition

Exposure avoidance was defined as not requesting or accessing available decision-relevant information. The experimental setting allowed subjects to request additional decision-relevant information (cf. Figure 5). The decision to request more decision-relevant information was recorded for each subject based on an eye-tracker and a click stream replay of the user interaction.

Data analysis and results

A subsequent comparison of means revealed that the preference for requesting consonant (M=5.25, SD=1.5) over dissonant (M=3.25, SD=3.2) information was initially not statistically significant (t(3)=-1.6330, p=0.20). However, after excluding one participant who simply requested all information, a marginally significant preference for consonant (M=4.66, SD=1.15) over dissonant (M=1.66, SD=0.577) information emerged (t(2)=-3, p=0.09). From a theoretical standpoint however, this subject's non-avoidance of exposure is relevant and interesting. Requesting all available information may be an alternative information processing heuristic which has to be carefully studied, if the phenomenon prevails in context of more experiments. Related to that and building on Coping Theory, the behavior may be explained by the presence of problem-oriented coping strategy (approach) over an emotion-based coping strategy (avoidance).

Absorption Avoidance and Eye-Tracking

Hypothesis H4 posits a negative relationship between the perception of threat and absorption avoidance. Information absorption is not a binary construct. In contrast, humans can absorb information more or less intensively. According to the measurement expectation 13, several eye-tracking measures are applicable for testing hypothesis H4 and the intensity of information absorption.

Data acquisition

For testing this expectation, we calculated fixation, glance, and revisit metrics for dissonant as well as for consonant texts. These calculations were based on areas of interest (AOIs). An AOI is a geometrical shape assigned to a certain region of the screen that is of significance to the respective experimental study (Granka, Feusner, and Lorigo, 2008). During the subsequent data analysis, eye-tracking data can be processed for each AOI individually. For studying the absorption of text, we defined one AOI for each line of text. The eye-tracking device recorded all eye-movements and fixations inside and outside these areas.

Data analysis and results

For testing the expectation 13, we conducted analyses of variance (ANOVAs) with *dissonance perception* as the between-groups factor. The data analysis revealed that the absorption of dissonant information was more intense than of consonant information. Despite the small number of participants, this effect was significant for all proposed measures, in particular *dwell time* ($p=0.01$), *glance duration* ($p=0.01$), *glance count* ($p=0.03$), *revisit count* ($p=0.03$), *fixation count* ($p=0.03$), and *fixation time* ($p<0.001$) were higher for dissonant than for consonant information. This indicates that dissonant information is absorbed more intensely that consonant information, and thus, supports hypotheses H4.

In conclusion, we performed a preliminary analysis of psychophysiological data for the constructs of distress (pupil dilation, in relation to H2), exposure avoidance (eye-tracking and observation, in relation to H3), and absorption avoidance (several eye-tracking measures related to text-use, in relation to H4). Because the current sample size is small, it is problematic to make inferences based on these results. The purpose was, however, to demonstrate the applicability and utility of the methodological apparatus. Table 8 summarizes our preliminary test results.

Table 8: Summary of the preliminary test results (n=5)

	Hypothesis	Method and expectation	Preliminary results
H2	*Incompleteness, inaccuracy, and redundancy related information quality defects are associated with higher levels of distress-based affect.*	*Expectation 6:*	Pre-test established a *significant* relationship between mental distress and changes in the pupil diameter.
		Increase in pupil diameter measured by pupillometry	
H3	*Increases in the perception of threat are associated with an increase of exposure avoidance.*	*Expectation 10:*	*Marginally significant preference* for exposing to consistent over inconsistent information.
		Awareness measured by gaze (eye-tracking)	
		Expectation 11:	
		Information requests assessed by observations	
H4	*Increases in the perception of threat are associated with a decrease of absorption avoidance.*	*Expectation 13:*	*Significant* increase in absorption amongst all proposed measures.
		Dwell time	
		Glance count and duration	
		Fixation count and duration	
		Regressions (revisits)	

Discussion

In this section, we will discuss our major findings. We will discuss the methodological contributions of our research in the light of our theoretical research problem. Subsequently, we will briefly outline our theoretical contribution. Then, we will frame our contributions in the light of the objectives of the underlying special issue and finally, we will point out the article's limitations.

We attempt to advance information systems research **methodologically** by introducing relevant measures, demonstrating the development and the implementation of a NeuroIS experiment, and by explaining the analysis of psychophysiological data for testing the measurement expectations. Subsequently, we will elaborate on these three methodological contributions.

According to our knowledge, our first contribution is made by proposing and demonstrating a set of new and relevant psychophysiological measures. Affective processes are important contingencies for human (information) behavior. In particular, *negative affect* is an enduring issue in information systems research, e.g. in the context of decision-making (Yin et al., 2013), IS acceptance (e.g. Lowry et al., 2012), and IS use (e.g. Beaudry and Pinsonneault, 2010; Thatcher and Perrewe, 2002). However, emotional processes are often brief and occur subconsciously. Thus, they are difficult to assess by the means of self-rating scales. In order to overcome this shortcoming, we have developed psychophysiological measures for the construct of negative affect based on facial electromyography (valence) and electrodermal activity (arousal). Furthermore, we have developed psychophysiological measures for the specific negative states of *threat* and *distress*, and provide a measurement strategy for distinguishing between them based on measurements of the pupil dilation and the blink frequency. Along these efforts, our work offers the potential to enable subsequent IS studies that are concerned with threat- and distress-related phenomena to make use of these measures.

In addition, we have developed eye-tracking-based measures for two specific human information behaviors, namely for the constructs of *exposure* and *absorption* avoidance. Eye-tracking allows studying individual user behavior. In the IS discipline, it has been primarily used for measuring visual *attention* (e.g. Cyr et al., 2009). However, because many IS phenomena involve behaviors that go beyond mere attention allocation, researchers are in need for more advanced eye-tracking measures. We have introduced several measures related to human information processing. Today, most information is text-based. Thus, we have shaped several measures related to reading and in particular to the intensity of absorption. Although, we have demonstrated these measures in the context of one specific information pathology, they can be deemed valid in virtually every research scenario that involves human processing of text. Potential domains of application include the research on flow (Agarwal and Karahanna, 2000; Léger et al., 2013), interruption and distraction (Zhang, 2000), and deception (Xiao and Benbasat, 2011).

Our second methodological contribution is the problem-centric combination of multiple psychophysiological measures. We have introduced and demonstrated to the IS discipline the combination of pupil diameter with blink frequency measures for disentangling two intertwined, but separate states of negative affect. Furthermore, we have introduced and demonstrated to the discipline the problem-centric combination of facial electromyography (fEMG) and electrodermal activity (EDA) measures. Drawing on extant knowledge from other disciplines, we have particularly scrutinized the role of fEMG in measuring valence, and the role of EDA in measuring arousal. Combining both measures in future experimental designs has the potential to allow researchers to better understand emotional processes in IS use scenarios.

Our third methodological contribution is the design and provision of a comprehensive experimental protocol, which integrates multiple NeuroIS methods. According to our knowledge, this could manifest a contribution since we have elaborated the process of conducting an experiment that involves psychological states (negative affect) as mediating variables. For inducing this psychological state in the subjects, the independent variable (information quality defects) must be designed and experimentally controlled according to the a priory specified theoretical assumptions. In order to not reveal the purpose of the experiment, the presentation of the independent variable is usually embedded into a task or story. We have exemplified this process by explaining and demonstrating Mr. Miller's task. Furthermore, we contribute methodologically by explaining the data preprocessing and subsequent data analysis. Instead of solely reporting our results, we demonstrate the data reduction and smoothing procedures, the removal of outliers, and the subsequent statistical analysis.

In addition to these methodological contributions, we are confident that our study offers a series of important **theoretical contributions**. First, this study can be deemed as another early contribution to address the focal field of computer mediated human information behavior. Human information behavior, in general, has been comprehensively explored in other disciplines, especially psychology, neuroscience, as well as information science (Case, 2012; Dervin, 1998; Kahlor et al., 2006; Savolainen, 1993; Wilson, 1999, 2000). As indicated by Hemmer and Heinzl (2012), the IS discipline has been lacking a cumulative research tradition with respect to information and information behavior from an IS use and design perspective. Except contributions by authors such as Benbasat, Siau, Kim, Wand, Browne, Hemmer, McKinney Jr., and Vandenbosch, which primarily focus on phenomena of information search (Benbasat et al., 1982; Kim et al., 2012; Vandenbosch et al., 1997) and information stopping (Browne et al., 2004, 2007; Hemmer and Heinzl 2012), little efforts have been made to study further phenomena of computer mediated information behavior. The latter differentiates from the literature in neighboring disciplines since it assumes that stationary and mobile computers (including mobile devices) have the potential to fundamentally change the way humans seek, absorb and utilize information. Furthermore, our study sheds additional light in another information pathology (Scholl 2004) from an IS use perspective. In this context, it adds to the work of Browne et al. (2004, 2007) and Hemmer and Heinzl, (2012) who have been focusing on computer-mediated information stopping behavior which is clearly another important information pathology.

Second, we are not aware of other studies in the field of IS and computer-mediated information behavior in which the information construct, particularly an array of attributes of information quality defects, is at the very core of the study. We perceive this as "cognitive dissonant" by the IS discipline, since information is one of the central concepts in *information* systems. Understanding the relationship between information characteristics and human behavior can be deemed of utmost importance to our discipline. If the information's characteristics lead to malfunctions in the human information behavior, we characterized this as *information pathologies*. One such phenomenon is the issue of information avoidance, which stands at the center of this article. Isolated research on information avoidance exists in disciplines such as library science. However, to the best of our knowledge, we are the first in the IS community to systematically address the issue of computer mediated information avoidance as a pathology.

Third, we **contribute to theory** by deriving an explanatory model of information avoidance behavior that is based on Coping Theory. Following the tenets of this theory, we hypothesize that the initial *appraisal* reaction towards a computer mediated stimulus leads to an affective evaluation. Based on separate explanations from the literature, we identified two pathways that lead to the phenomenon. For one pathway the affective evaluation takes the form of *threat*, and for the other pathway it takes the form of *distress*. This contributes to theory, because it explains how two existing but conflicting explanations relate to each other. Moreover, we consider our study to be the first to differentiate the information avoidance construct into specific phases. We propose the distinction into the concepts exposure, absorption, and use avoidance, which each describes a distinguishable and separate temporal sub-phenomenon. Further research on information avoidance behavior can build on this distinction and address specific research questions related to one or many subtypes of avoidance.

Moreover, we advocate that our study **contributes to this special issue** in yet another three ways. First, we have described and exemplified guidelines for conducting NeuroIS experiments. Starting from a theoretical deduction, we arrive at corresponding measurement expectations that we relate to an experimental block design. Second, the involved theoretical construct (information quality defects, affective psychological states, and human information behavior) can be considered of vast relevance to the IS discipline. Hence, advancing our understanding of the relationship between *psychophysiology* and these constructs is in line with the objective of this special issue. Third, we have exemplified how to conduct a triangulation study based on multiple psychophysiological methods. We have been trying to create awareness for the difficulties arising from ambiguous relationships between psychology and physiology (Fairclough, 2008), and have been proposing ways how to address the arising challenges.

Nevertheless, our paper has several **limitations**. These limitations relate to the sample size, the semantics of the *threat* and *distress* constructs, our conceptualization of information quality, the choice of the theoretical lens, and the experimental design and measurement. The following will discuss these limitations and how they can be addressed in future research.

Since we aimed at *preliminary* testing our theoretical and measurement model as well as the posited measurement expectations, the resulting **sample size** (n=5) was small and has to be treated with care. Our primary objective in this article was not to discuss the acceptance or rejection of our postulated hypothesis. Our objective was to advance and better ground the theoretical reasoning of information avoidance and to combine this interesting but complex phenomenon with contemporary NeuroIS measures in order to better intertwine the relationship of information behavior constructs and NeuroIS methods. Once the theoretical and methodological reasoning converges, we plan to increase the number of participants in our future experiments. Thus, we will hopefully be able to increase the statistical power of our findings in order to further demonstrate the theoretical value of our arguments.

Until now, we have derived two separate pathways to information avoidance, as a review of the literature has revealed two main groups of determinants. One set of arguments has evolved around the perception of *threat* because of phenomena such as cognitive dissonance and confirmation bias. The second set of arguments has evolved around the perception of *distress* caused by the information's complexity. Although our reasoning and initial findings seem to support this dichotomy of explanations, the **applied semantics** (*threat* versus *distress*) may require further precision. At the moment and to the best of our knowledge, there has not yet emerged a better semantics for these two pathways. One potential venue for extending this semantics, for instance, is relating the *distress* construct to the body of research on the issue of techno stress (Riedl et al., 2013).

A further limitation can be considered in the assumption that the independent construct of *information quality defects* can be assessed **objectively**. In contrast, one could argue that the constituents of an information defect and its severity, are rather subjective phenomena. Nevertheless, we argue that the assumption of an objective perception is justifiable. Although all judgments are inherently subjective, we believe that a core set of information attributes can be identified that is universally decisive (Heinrich et al., 2007). This is comparable to the *objectified* approach to measuring the subjective construct of *task complexity* (Wood, 1986). We believe, that the identified information quality dimensions (e.g. consistency, redundancy, ambiguity) are valid and reliable for approximating an objective information quality construct (Arazy and Kopak, 2010; Hunter and Konieczny, 2005; McKinney and Yoos, 2010; Pipino et al., 2002).

Additional limitations could be seen in the utilization of Coping Theory as a major **theoretical lens**. First, the choice of any theoretical lens introduces an abstraction concerning which core elements are included and which elements appear to be out of scope. Second, some may challenge our definition of information avoidance behavior as being a form of emotional coping. This is because our definition of exposure, absorption, and use avoidance entails activities directed at carving out the problem (e.g. the dissonant information). However, even though we cannot totally refute this point, we believe that those activities do not aim at *solving* the problem but at making it *less visible*. The problem being less visible simply makes emotional coping mechanisms (e.g. playing it down, detaching emotionally) easier. The main coping mechanism, however, is very likely to remain an emotional coping strategy.

Furthermore, the article has some **methodological limitations**. First, and in line with Fairclough (2008), the relationship between physiology and psychology remains somewhat fuzzy in certain contexts. This entails that for most psychological states, multiple psychophysiological correlates and measures exist. Second, we did not elaborate on the third subtype of information avoidance, i.e. use avoidance, in greater detail. We briefly described potential experimental approaches to measuring use avoidance that involve retrospective think aloud protocols. However, we assume that information use can be sufficiently measured without NeuroIS methods and, in the light of this special issue, we have not been trying to "shoot with cannons on the remaining sparrows".

The article has minor limitations concerning the **experiment**. We built our experiment on the established “Mr. Miller” task (Jonas et al., 2003). This task was specifically designed to induce the perception of consonance and dissonance, which is related to the *threat* pathway. In its current form, the task does appear only somewhat useful for testing the hypothesized pathway of *distress*, which is based on information *complexity*. Hence, our main set of experiments may expand the experimental task design accordingly.

The article has also limitations concerning the conducted **data analysis**. Although the experiment was able to demonstrate how to conduct a study that involves fEMG, eye-tracking, electrodermal activity, as well as blink frequency and pupil dilation measurements, our data analysis has been limited to a subset of three deliberately selected hypotheses. It is needless to state that a more comprehensive and exhaustive data collection and analysis, which involves all constructs and associations of our theoretical model, has the potential to shed more light on the yet unknown patterns of human information avoidance behavior - especially if NeuroIS methods like fEMG and EDA will be deployed.

Finally, we did not yet include **self-reports** for triangulating the psychophysiological measurements. In order to further increase the validity and reliability of our results, we plan to triangulate the proposed NeuroIS methods (e.g. fEMG) with well-established self-reports (e.g. PANAS for measuring negative affect) in future studies as well.

Conclusion

This article demonstrates the use of NeuroIS methods in the context of experimentally testing a theoretical core phenomenon in the IS discipline: information avoidance. It draws upon recent advances from NeuroIS research in order to integrate psychophysiological measures into an extended, triangulated measurement design. Furthermore, it exemplifies the derivation and instantiation of a NeuroIS measurement model and the selection of appropriate NeuroIS methods, and it provides guidelines for how to conduct eye-tracking, pupillometry, and facial electromyography measurements as well as how to subsequently derive meaning from the data collected.

We propose new measures for the constructs of negative affect, threat, distress, and for the behaviors of exposure avoidance and absorption avoidance. These measures are based on facial electromyography as well as on the measurement of electrodermal activity, blink frequency and pupil dilation.

A preliminary data analysis exemplifies the testing of the measurement expectations. Because of the small sample size (n=5), the conclusions are limited. However, it indicates that our theoretical and methodological design offers promising evidence as well as specific directions how to perfection our reasoning and measurements. Future steps offer the potential to involve a series of incremental improvements. First, in its current form the experimental task is designed to specifically induce the *threat* condition. Thus, it is necessary to advance the experimental design to better induce the *distress* condition. Second, the sample size has to be increased. The psychophysiological data collected during the initial experiment provides information about the effect sizes to expect and about further statistical parameters necessary for performing a power analysis. Based on this calculation, we plan to increase the number of participants. During the initial experiment we recorded fEMG and EDA. However, this data has not yet been processed and used for testing the remaining hypotheses. Further steps will address this issue and integrate the data into the analysis procedures, extending the scope and depth of data analysis.

References

Achaibou, A., Pourtois, G., Schwartz, S., & Vuilleumier, P. (2008). Simultaneous recording of EEG and facial muscle reactions during spontaneous emotional mimicry. *Neuropsychologia*, *46*(4), 1104–1113.

Adam, M. T., Gamer, M., Krämer, J., & Weinhardt, C. (2011). Measuring emotions in electronic markets. *Proceedings of the Thirty Second International Conference on Information Systems, Shanghai 2011*, 1–19.

Adams, J. S. (1961). Reduction of cognitive dissonance by seeking consonant information. *The Journal of Abnormal and Social Psychology*, *62*(1), 74–78.

Agarwal, R., & Karahanna, E. (2000). Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage. *Management Information Systems Quarterly*, *24*(4), 665–694.

Ajanki, A., Hardoon, D. R., Kaski, S., Puolamäki, K., & Shawe-Taylor, J. (2009). Can eyes reveal interest? Implicit queries from gaze patterns. *User Modeling and User-Adapted Interaction*, *19*(4), 307–339.

Amirkhan, J. H. (1990). A factor analytically derived measure of coping: The Coping Strategy Indicator. *Journal of Personality and Social Psychology*, *59*(5), 1066–1074.

Arazy, O., & Kopak, R. (2010). On the measurability of information quality. *Journal of the American Society for Information Science and Technology*, *62*(1), 89–99.

Arazy, O., Nov, O., Patterson, R., & Yeo, L. (2011). Information Quality in Wikipedia: The Effects of Group Composition and Task Conflict. *Journal of Management Information Systems*, *27*(4), 71–98.

Baker, L., & Anderson, R. I. (1982). Effects of inconsistent information on text processing: Evidence for comprehension monitoring. *Reading Research Quarterly*, *17*, 281–294.

Baumstimler, Y., & Parrot, J. (1971). Stimulus generalization and spontaneous blinking in man involved in a voluntary activity. *Journal of Experimental Psychology*, *88*, 95–102.

Bawden, D., & Robinson, L. (2009). The dark side of information: overload, anxiety and other paradoxes and pathologies. *Journal of Information Science*, *35*(2), 180–191.

Beatty, J., & Beatty, J. (1982). Task-evoked pupillary responses, processing load, and the structure of processing resources. *Psychological Bulletin*, *91*(2), 276–292.

Beaudry, A., & Pinsonneault, A. (2010). The other side of acceptance: studying the direct and indirect effects of emotions on information technology use. *Management Information Systems Quarterly*, *34*(4), 689–710.

Benbasat, I., and Schroeder, R. G. (1977). An experimental investigation of some MIS design variables. *Management Information Systems Quarterly*, 1(1), 37–49.

Benbasat, I., and Taylor, R. N. (1978). The impact of cognitive styles on information system design. *Management Information Systems Quarterly*, 2(2), 43–54.

Benbasat, I., & Taylor, R. N. (1982). Behavioral aspects of information processing for the design of management information systems. *IEEE Transactions on Systems, Man and Cybernetics*, *12*(4), 439–450.

Bentivoglio, A. R., Bressman, S. B., Cassetta, E., Carretta, D., Tonali, P., & Albanese, A. (1997). Analysis of blink rate patterns in normal subjects.

Movement Disorders, *12*(6), 1028–1034.
Berger, C. R., & Calabrese, R. J. (1975). Some explorations in initial interaction and beyond: Toward a developmental theory of interpersonal communication. *Human Communication Research*, *1*(2), 99–112.
Beymer, D., Russell, D., & Orton, P. (2008). An eye tracking study of how font size and type influence online reading, 15–18.
Bless, H., Clore, G. L., Schwarz, N., Golisano, V., Rabe, C., & Wölk, M. (1996). Mood and the use of scripts: Does a happy mood really lead to mindlessness? *Journal of Personality and Social Psychology*, *71*(4), 665–679.
Blumberg, S. J. (2000). Guarding against Threatening HIV Prevention Messages: An Information-Processing Model. *Health Education & Behavior*, *27*(6), 780–795.
Boehm-Davis, D. A., Gray, W. D., & Schoelles, M. J. (2000). The Eye Blink as a Physiological Indicator of Cognitive Workload. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, *44*(33), 6–116–6–119.
Boucsein, W. (2011). *Electrodermal activity*. Springer.
Boudreau, M.-C., Gefen, D., & Straub, D. W. (2001). Validation in information systems research: A state-of-the-art assessment. *Management Information Systems Quarterly*, *25*(1), 1–16.
Bradac, J. J. (2001). Theory comparison: Uncertainty reduction, problematic integration, uncertainty management, and other curious constructs. *Journal of Communication*, *51*(3), 456–476.
Brannon, L. A., Tagler, M. J., & Eagly, A. H. (2007). The moderating role of attitude strength in selective exposure to information. *Journal of Experimental Social Psychology*, *43*(4), 611–617.
Brookings, J. B., Wilson, G. F., & Swain, C. R. (1996). Psychophysiological responses to changes in workload during simulated air traffic control. *Biological psychology*, *42*(3), 361–377.
Brouwers, M. C., & Sorrentino, R. M. (1993). Uncertainty orientation and protection motivation theory: The role of individual differences in health compliance. *Journal of Personality and Social Psychology*, *65*(1), 102–112.
Browne, G. J., Pitts, M. G., & Wetherbe, J. C. (2005). Stopping rule use during web-based search. *Proceedings of the 38th Annual Hawaii International Conference on System Sciences, 2005*, 271b–271b.
Browne, G. J., Pitts, M. G., & Wetherbe, J. C. (2007). Cognitive stopping rules for terminating information search in online tasks. *Management Information Systems Quarterly*, *31*(1), 89–104.
Bröder, A. (2000). Assessing the empirical validity of the “Take-the-best” heuristic as a model of human probabilistic inference. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(5), 1332–1346.
Buettner, R., Daxenberger, B., Eckhardt, A. & Maier, C. (2013). Cognitive Workload Induced by Information Systems: Introducing an Objective Way of Measuring based on Pupillary Diameter Responses. *Proceedings of the SIGHCI 2013*, 1–2.
Byström, K., & Järvelin, K. (1995). Task complexity affects information seeking and use. *Information Processing & Management*, *31*(2), 191–213.
Cacioppo, J. T. (2004). Perspectivism in social psychology: The yin and yang of scientific progress. In *Asymmetries in affect laden information processing* (pp. 85–95).
Cacioppo, J. T., Petty, R. E., Losch, M. E., & Kim, H. S. (1986).

Electromyographic activity over facial muscle regions can differentiate the valence and intensity of affective reactions. *Journal of Personality and Social Psychology*, *50*(2), 260–268.
Capa, R. L., Audiffren, M., & Ragot, S. (2008). The effects of achievement motivation, task difficulty, and goal difficulty on physiological, behavioral, and subjective effort. *Psychophysiology*, *45*(5), 859–868.
Case, D. (2012). *Looking for information*. Emerald Group Publishing.
Case, D. O., Andrews, J. E., Johnson, J. D., & Allard, S. L. (2005). Avoiding versus seeking: the relationship of information seeking to avoidance, blunting, coping, dissonance, and related concepts. *Journal of the Medical Library Association*, *93*(3), 353.
Chandler, P., & Sweller, J. (1991). Cognitive load theory and the format of instruction. *Cognition and Instruction*, *8*(4), 293–332.
Cheikes, B. A., Brown, M. J., Lehner, P. E., & Adelman, L. (2004). *Confirmation Bias in Complex Analyses* (pp. 1–23). MITRE Center for Integrated Intelligence Systems.
Chen, S., Epps, J., & Chen, F. (2011). A comparison of four methods for cognitive load measurement. *Proceedings of the 23rd Australian Computer-Human Interaction Conference*, 76–79.
Chen, Y.-C., Shang, R.-A., & Kao, C.-Y. (2009). The effects of information overload on consumers' subjective state towards buying decision in the internet shopping environment. *Electronic Commerce Research and Applications*, *8*(1), 48–58.
Claypool, M., Le, P., Wased, M., & Brown, D. (2001). Implicit interest indicators. *Proceedings of the 6th international conference on Intelligent user interfaces*, 33–40.
Clifton, C., Staub, A., & Rayner, K. (2006). Eye Movements in Reading Words and Sentences. In R. P. G. van Gompel, M. H. Fischer, W. S. Murray, & R. L. Hill (Eds.), *Eye movements: A window on mind and brain* (pp. 342–353). Elsevier Ltd.
Comte, I. A. M. F. X. (1865). *A general view of positivism*.
Cooper, J., & Worchel, S. (1970). Role of undesired consequences in arousing cognitive dissonance. *Journal of Personality and Social Psychology*, *16*(2), 199–206.
Criswell, E. (2010). *Cram's introduction to surface electromyography*. Jones & Bartlett Publishers.
Croyle, R. T., & Sande, G. N. (1988). Denial and Confirmatory Search: Paradoxical Consequences of Medical Diagnosis. *Journal of Applied Social Psychology*, *18*(6), 473–490.
Cutrell, E., & Guan, Z. (2007). What are you looking for?: an eye-tracking study of information usage in web search. *Proceedings of the SIGCHI conference on Human factors in computing systems*, 407–416.
Cyr, D., Head, M., Larios, H., & Pan, B. (2009). Exploring human images in website design: a multi-method approach. *Management Information Systems Quarterly*, *33*(3), 539.
Davern, M., Shaft, T., & Te'eni, D. (2012). Cognition Matters: Enduring Questions in Cognitive IS Research. *Journal of the Association for Information Systems*, *13*(4), 274–314.
de Guinea, A. O., Titah, R., Léger, P.-M., & Micheneau, T. (2012a). Neurophysiological Correlates of Information Systems Commonly Used Self-Reported Measures: A Multitrait Multimethod Study (pp. 562–571). Presented at the 2012 45th Hawaii International Conference on System

Sciences (HICSS), IEEE.
Derakshan, N., Eysenck, M. W., & Myers, L. B. (2007). Emotional information processing in repressors: The vigilance--avoidance theory. *Cognition & Emotion*, *21*(8), 1585–1614.
Dervin, B. (1998). Sense-making theory and practice: an overview of user interests in knowledge seeking and use. *Journal of Knowledge Management*, *2*(2), 36–46.
Dimberg, U., Thunberg, M., & Elmehed, K. (2000). Unconscious Facial Reactions to Emotional Facial Expressions. *Psychological Science*, *11*(1), 86–89.
Dimoka, A. (2009). Neurois: How To Conduct a Neuroimaging Study to Inform Information Systems Research. *Proceedings of the 15th Americas Conference on Information Systems, AMCIS 2009*.
Dimoka, A., Banker, R. D., Benbasat, I., Davis, F. D., Dennis, A. R., Gefen, D., et al. (2012). On the Use of Neuropyhsiological Tools in IS Research: Developing a Research Agenda for NeuroIS. *Management Information Systems Quarterly*, *36*(3), 679–702.
Ditto, P. H., Scepansky, J. A., Munro, G. D., Apanovitch, A. M., & Lockhart, L. K. (1998). Motivated sensitivity to preference-inconsistent information. *Journal of Personality and Social Psychology*, *75*(1), 53–69.
Doherty, S., O'Brien, S., & Carl, M. (2010). Eye tracking as an MT evaluation technique. *Machine Translation*, *24*(1), 1–13.
Ehrich, K. R., & Irwin, J. R. (2005). Willful ignorance in the request for product attribute information. *Journal of Marketing Research*, *42*, 266–277.
Ehrlich, D., Guttman, I., Schönbach, P., & Mills, J. (1957). Postdecision exposure to relevant information. *Journal of abnormal and social psychology*, *54*(1), 98–102.
Ekman, P., & Oster, H. (1979). Facial expressions of emotion. *Annual review of psychology*, *30*(1), 527–554.
Endler, N. S., & Parker, J. D. (1994). Assessment of multidimensional coping: Task, emotion, and avoidance strategies. *Psychological Assessment*, *6*(1), 50–60.
Fairclough, S. H. (2008). Fundamentals of physiological computing. *Interacting with Computers*, *21*(1-2), 133–145.
Feifel, H., & Strack, S. (1989). Coping with conflict situations: Middle-aged and elderly men. *Psychology and aging*, *4*(1), 26–33.
Festinger, L. (1957). A theory of cognitive dissonance. *Evanston, Il: Row, Peterson*.
Figner, B., & Murphy, R. O. (2011). Using skin conductance in judgment and decision making research. In *A handbook of process tracing methods for decision research* (pp. 163–184). New York: A handbook of process tracing methods for decision research.
Fischer, P., & Greitemeyer, T. (2010). A New Look at Selective-Exposure Effects: An Integrative Model. *Current Directions in Psychological Science*, *19*(6), 384–389.
Fischer, P., Fischer, J., Weisweiler, S., & Frey, D. (2011c). Selective exposure to information: How different modes of decision making affect subsequent confirmatory information processing. *British Journal of Social Psychology*, *49*(4), 871–881.
Fischer, P., Greitemeyer, T., & Frey, D. (2008). Self-regulation and selective exposure: The impact of depleted self-regulation resources on confirmatory information processing. *Journal of Personality and Social Psychology*, *94*(3),

382–395.
Fischer, P., Jonas, E., Frey, D., & Schulz-Hardt, S. (2005). Selective exposure to information: The impact of information limits. *European Journal of Social Psychology*, *35*(4), 469–492.
Fischer, P., Kastenmüller, A., Greitemeyer, T., Fischer, J., Frey, D., & Crelley, D. (2011a). Threat and selective exposure: The moderating role of threat and decision context on confirmatory information search after decisions. *Journal of experimental psychology: General*, *140*(1), 51–62.
Fischer, P., Lea, S., Kastenmüller, A., Greitemeyer, T., Fischer, J., & Frey, D. (2011b). The process of selective exposure: Why confirmatory information search weakens over time. *Organizational Behavior and Human Decision Processes*, *114*(1), 37–48.
Fischer, P., Schulz-Hardt, S., & Frey, D. (2008). Selective exposure and information quantity: How different information quantities moderate decision makers' preference for consistent and inconsistent information. *Journal of Personality and Social Psychology*, *94*(2), 231–244.
Folkman, S., & Lazarus, R. S. (1980). An analysis of coping in a middle-aged community sample. *Journal of health and social behavior*, *21*, 219–239.
Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology*, *48*(1), 150–170.
Folkman, S., & Lazarus, R. S. (1990). Coping and emotion. *Psychological and biological approaches to emotion*, 313–332.
Frederick, S., Kahneman, D., & Mochon, D. (2010). Elaborating a simpler theory of anchoring. *Journal of Consumer Psychology*, *20*(1), 17–19.
Frey, D. (1981). Postdecisional preference for decision-relevant information as a function of the competence of its source and the degree of familiarity with this information. *Journal of Experimental Social Psychology*, *17*(1), 51–67.
Frey, D. (1982). Different levels of cognitive dissonance, information seeking, and information avoidance. *Journal of Personality and Social Psychology*, *43*(6), 1175–1183.
Frey, D., & Stahlberg, D. (1986). Selection of Information after Receiving more or Less Reliable Self-Threatening Information. *Personality and Social Psychology Bulletin*, *12*(4), 434–441.
Frith, C. D., & Allen, H. A. (1983). The skin conductance orienting response as an index of attention. *Biological psychology*, *17*(1), 27–39.
Fukuda, K. (1994). Analysis of eyeblink activity during discriminative tasks. *Psychological Reports*, *79*(3f), 1599–1608.
Fukuda, K. (2001). Eye blinks: new indices for the detection of deception. *International Journal of Psychophysiology*, *40*(3), 239–245.
Gallupe, R. B., DeSanctis, G., and Dickson, G. W. (1988). Computer-based support for group problem-finding: An experimental investigation. *Management Information Systems Quarterly*, 12(2), 277–296.
Gardner, R. M., Beltramo, J. S., & Krinsky, R. (1975). Pupillary changes during encoding, storage, and retrieval of information. *Perceptual and Motor Skills*, *41*(3), 951–955.
Gigerenzer, G., & Goldstein, D. G. (1999). Betting on one good reason: take the best and its relatives. *Simple Heuristics that Make Us Smart. Oxford University Press, New York*, 75–95.
Gramann, K., & Schandry, R. (2009). *Psychophysiologie: Körperliche Indikatoren psychischen Geschehens*. Beltz, PVU.
Granka, L., Feusner, M., & Lorigo, L. (2008). Eyetracking in Online Search.

Passive Eye Monitoring, 283–304.
Green, T. R. (1991). Describing information artifacts with cognitive dimensions and structure maps. *Proceedings of the ACM CHI 91 Human Factors in Computing Systems Conference*, *91*(748), 297–315.
Greenwald, A. G. (1997). Self-knowledge and self-deception: Further consideration. *The mythomanias: The nature of deception and self-deception, ed. MS Myslobodsky*, 51–72.
Gregor, S. (2006). The nature of theory in information systems. *Management Information Systems Quarterly*, *30*(3), 611–642.
Hall, A. (1945). The origin and purposes of blinking. *The British journal of ophthalmology*, *29*(9), 445–467.
Harris, P. R., & Napper, L. (2005). Self-affirmation and the biased processing of threatening health-risk information. *Personality and Social Psychology Bulletin*, *31*(9), 1250–1263.
Hart, W., Adams, J. M., Burton, K. A., Shreves, W., & Hamilton, J. C. (2012). Shaping Reality vs. Hiding from Reality: Reconsidering the Effects of Trait Need for Closure on Information Search. *Journal of Research in Personality*, *46*(5), 489–496.
Hazlett, R. L., & Benedek, J. (2007). Measuring emotional valence to understand the user's experience of software. *International Journal of Human-Computer Studies*, *65*(4), 306–314.
Hemmer, E., & Heinzl, A. (2011). Where is the “I” in “IS Research”? The Quest for a Coherent Research Stream in the Context of Human Information Behavior. In: Heinzl, A.; Buxmann, P.; Wendt, O.; Weitzel, T. (eds.). Theory-Guided Modeling and Empiricism in Information Systems Research, Springer Publishing, 223–246.
Hemmer, E., & Heinzl, A. (2012). Determinants of Information Channel Choice: The Impact of Task Complexity and Dispositional Character Traits. *Proceedings of the 45th Hawaii International Conference on System Science (HICSS)*, IEEE, 1717-1726.
Hermens, F., & Walker, R. (2010). Do you look where I look? An investigation of attention shifts and automatic response preparation following dynamic social and non-social cues. *Perception*.
Hess, E. H. (1965). Attitude and pupil size. *Scientific american*.
Hess, E. H., & Polt, J. M. (1960). Pupil size as related to interest value of visual stimuli. *Science*.
Hoffman, J. E., & Subramaniam, B. (1995). The role of visual attention in saccadic eye movements. *Perception & Psychophysics*, *57*(6), 787–795.
Holland, M. K., & Tarlow, G. (1972). Blinking and mental load. *Perceptual and Motor Skills*, *31*(1), 119–127.
Howell, J. L., & Shepperd, J. A. (2012). Reducing Information Avoidance Through Affirmation. *Psychological Science*, *23*(2), 141–145.
Huang, C.-N., Chen, C.-H., & Chung, H.-Y. (2004). The review of applications and measurements in facial electromyography. *Journal of Medical and Biological Engineering*, *25*(1), 15–20.
Hunter, A., & Konieczny, S. (2005). *Approaches to measuring inconsistent information* (Vol. 3300, pp. 191–236). Springer Publishing.
Hyönä, J., Tommola, J., & Alaja, A.-M. (1995). Pupil dilation as a measure of processing load in simultaneous interpretation and other language tasks. *The Quarterly Journal of Experimental Psychology*, *48*(3), 598–612.
Hyrskykari, A., Ovaska, S., Majaranta, P., Räihä, K.-J., & Lehtinen, M. (2008). Gaze path stimulation in retrospective think-aloud. *Journal of Eye Movement*

Research, *2*(4), 1–18.
Iqbal, S. T., Zheng, X. S., & Bailey, B. P. (2004). Task-evoked pupillary response to mental workload in human-computer interaction. *Proceedings of ACM CHI 2004 Conference on Human Factors in Computing Systems*, 1477–1480.
Jacoby, J. (1984). Perspectives on Information Overload. *Journal of Consumer Research*, *10*(4), 432–435.
Janisse, M. P. (1973). Pupil size and affect: A critical review of the literature since 1960. *Canadian Psychologist/Psychologie canadienne*, *14*(4), 311.
Jarvenpaa, S. L., Dickson, G. W., and DeSanctis, G. (1985). Methodological issues in experimental IS research: experiences and Recommendations. *Management Information Systems Quarterly*, 9(2), 141–156.
Jonas, E., Greenberg, J., & Frey, D. (2003). Connecting terror management and dissonance theory: Evidence that mortality salience increases the preference for supporting information after decisions. *Personality and Social Psychology Bulletin*, *29*(9), 1181–1189.
Jonas, E., Schulz-Hardt, S., Frey, D., & Thelen, N. (2001). Confirmation bias in sequential information search after preliminary decisions: An expansion of dissonance theoretical research on selective exposure to information. *Journal of Personality and Social Psychology*, *80*(4), 557–571.
Jones, M., & Sugden, R. (2001). Positive confirmation bias in the acquisition of information. *Theory and Decision*, *50*(1), 59–99.
Just, M. A., & Carpenter, P. A. (1993). The intensity dimension of thought: pupillometric indices of sentence processing. *Canadian Journal of Experimental Psychology*, *47*(2), 310–339.
Kahlor, L., Dunwoody, S., Griffin, R. J., & Neuwirth, K. (2006). Seeking and Processing Information about Impersonal Risk. *Science Communication*, *28*(2), 163–194.
Kahneman, D., & Beatty, J. (1966). Pupil diameter and load on memory. *Science*.
Karatekin, C., Couperus, J. W., & Marcus, D. J. (2004). Attention allocation in the dual-task paradigm as measured through behavioral and psychophysiological responses. *Psychophysiology*, *41*(2), 175–185.
Kardes, F. R., Cronley, M. L., Kellaris, J. J., & Posavac, S. S. (2004). The Role of Selective Information Processing in Price - Quality Inference. *Journal of Consumer Research*, *31*(2), 368–374.
Karson, C. N., Berman, K. F., Donnelly, E. F., Mendelson, W. B., Kleinman, J. E., & Wyatt, R. J. (1981). Speaking, thinking, and blinking. *Psychiatry research*, *5*(3), 243–246.
Kellermann, K., & Reynolds, R. (1990). When Ignorance Is Bliss The Role of Motivation to Reduce Uncertainty in Uncertainty Reduction Theory. *Human Communication Research*, *17*(1), 5–75.
Kelly, D., & Teevan, J. (2003). Implicit feedback for inferring user preference: a bibliography, In ACM SIGIR Forum, *37*(2), 18–28.
Kim, H. W., Chan, H. C., & Kankanhalli, A. (2012). What Motivates People to Purchase Digital Items on Virtual Community Websites? The Desire for Online Self-Presentation. *Information systems research*, *23*(4), 1232–1245.
Kim, J., Oard, D. W., & Romanik, K. (2000). Using implicit feedback for user modeling in internet and intranet searching. *Faculty Publications of the School of Library and Information Science, University of South Carolina*, 1–21.
Knobloch-Westerwick, S., & Meng, J. (2009). Looking the Other Way: Selective Exposure to Attitude-Consistent and Counterattitudinal Political Information. *Communication Research*, *36*(3), 426–448.

Knobloch-Westerwick, S., Carpentier, F. D., Blumhoff, A., & Nickel, N. (2005). Selective Exposure Effects for Positive and Negative News: Testing the Robustness of the Informational Utility Model. *Journalism & Mass Communication Quarterly*, *82*(1), 181–195.
Koller, M., & Walla, P. (2012). Measuring Affective Information Processing in Information Systems and Consumer Research–Introducing Startle Reflex Modulation, *Proceedings of the 33rd International Conference on Information Systems (ICIS)*.
Krohne, H. W. (2001). Stress and coping theories. *The international encyclopedia of the social and behavioral sciences*, *22*, 15163–15170.
Krohne, H. W., & Hock, M. (2011). Anxiety, coping strategies, and the processing of threatening information: Investigations with cognitive-experimental paradigms. *Personality and Individual Differences*, *50*(7), 916–925.
Kuhlmann, E. (1983). On the economic analysis of the information-seeking behaviour of consumers. *Journal of Consumer Policy*, *6*(2), 231–237.
Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science*, *42*(5), 361–371.
Kuhlthau, C. C. (1993). A principle of uncertainty for information seeking. *Journal of Documentation*, *49*(4), 339–355.
Laeng, B., Sirois, S., & Gredeback, G. (2012). Pupillometry: A Window to the Preconscious? *Perspectives on Psychological Science*, *7*(1), 18–27.
Larsen, J. T., & Norris, J. I. (2009). A facial electromyographic investigation of affective contrast. *Psychophysiology*, *46*(4), 831–842.
Lazarus, R. S. (1966). *Psychological stress and the coping process.* McGraw-Hill.
Lazarus, R. S. (1996). The role of coping in the emotions and how coping changes over the life course. *Handbook of emotion, adult development, and aging*, 289–306.
Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing.
Leal, S., & Vrij, A. (2008). Blinking During and After Lying. *Journal of Nonverbal Behavior*, *32*(4), 187–194.
Leckie, G. J., Pettigrew, K. E., & Sylvain, C. (1996). Modeling the information seeking of professionals: a general model derived from research on engineers, health care professionals, and lawyers. *The Library Quarterly*, 161–193.
Lee, B.-K., & Lee, W.-N. (2004). The effect of information overload on consumer choice quality in an on-line environment. *Psychology and Marketing*, *21*(3), 159–183.
Léger, P. M., Senecal, S., Aubé, C., & Cameron, A. F. (2013). The Influence of Group Flow on Group Performance: A Research Program. *Proceedings of the Gmunden Retreat on NeuroIS 2013*, 13.
Léger, P.-M., Young, M. J., Davis, F. D., Tiedens, L. Z., Perret, J., Jung, H., et al. (2010). Psychophysiological Measures of Cognitive Absorption. *Proceedings of the Special Interest Group on Human-Computer Interaction (SIGHCI) 2010*.
Lim, C. L., Rennie, C., Barry, R. J., Bahramali, H., Lazzaro, I., Manor, B., & Gordon, E. (1997). Decomposing skin conductance into tonic and phasic components. *International Journal of Psychophysiology*, *25*(2), 97–109.
Loboda, T. D., Brusilovsky, P., & Brunstein, J. (2009). Inferring word relevance from eye-movements of readers (pp. 175–184). Presented at the

Proceedings of ACM CHI 2009 Conference on Human Factors in Computing Systems, ACM.
Loos, P., Riedl, R., Müller-Putz, G. R., Brocke, J., Davis, F. D., Banker, R. D., & Léger, P.-M. (2010). NeuroIS: Neuroscientific Approaches in the Investigation and Development of Information Systems. *Business & Information Systems Engineering*, *2*(6), 395–401.
Lowin, A. (1967). Approach and avoidance: alternate modes of selective exposure to information. *Journal of Personality and Social Psychology*, *6*(1), 1–9.
Lowry, P., Gaskin, J., Twyman, N., Hammer, B., & Roberts, T. (2012). Proposing the Hedonic-Motivation System Adoption Model (HMSAM) to Increase Understanding of Adoption of Hedonically Motivated Systems. *Journal of the Association for Information Systems, Forthcoming*.
Machlup, F. (1993). Uses, Value, and Benefits of Knowledge. *Science Communication*, *14*(4), 448–466.
Mackie, D. M., & Worth, L. T. (1989). Processing deficits and the mediation of positive affect in persuasion. *Journal of Personality and Social Psychology*, *57*(1), 27–40.
Maier, J., & Richter, T. (2013). Text Belief Consistency Effects in the Comprehension of Multiple Texts With Conflicting Information. *Cognition and Instruction*, *31*(2), 151–175.
Malhotra, N. K. (1982). Information load and consumer decision making. *Journal of Consumer Research*, *8*, 419–430.
Malmo, R. B. (1959). Activation: A neuropsychological dimension. *Psychological Review*, *66*(6), 367–386.
Marshall, S. P. (2002). The index of cognitive activity: Measuring cognitive workload. *Proceedings of the 7th Conference on Human Factors and Power Plants, 2002*, 7–9.
Martin, L. L., Ward, D. W., Achee, J. W., & Wyer, R. S. (1993). Mood as input: People have to interpret the motivational implications of their moods. *Journal of Personality and Social Psychology*, *64*(3), 317–326.
Martinie, M.-A., Olive, T., Milland, L., Joule, R.-V., & Capa, R. L. (2013). Evidence that dissonance arousal is initially undifferentiated and only later labeled as negative. *Journal of Experimental Social Psychology*, *49*(4), 767–770.
Matthews, G., Campbell, S. E., Falconer, S., Joyner, L. A., Huggins, J., Gilliland, K., et al. (2002). Fundamental dimensions of subjective state in performance settings: task engagement, distress, and worry. *Emotion*, *2*(4), 315–340.
McGuire, W. J. (1976). Some internal psychological factors influencing consumer choice. *The Journal of Consumer Research*, *2*, 302–319.
McKinney, E. H., Jr, & Yoos, C. J., II. (2010). Information about information: A taxonomy of views. *Management Information Systems Quarterly*, *34*(2), 329–344.
Melnyk, D. (2009). *When We Do Not Want to Know: The Information Avoidance Model*. University of Florida.
Miles, A., Voorwinden, S., Chapman, S., & Wardle, J. (2008). Psychologic Predictors of Cancer Information Avoidance among Older Adults: The Role of Cancer Fear and Fatalism. *Cancer Epidemiology Biomarkers & Prevention*, *17*(8), 1872–1879.
Miller, H. (2005). Information quality and market share in electronic commerce. *Journal of Services Marketing*, *19*(2), 93–102.
Miller, S. M. (1987). Monitoring and blunting: validation of a questionnaire to

assess styles of information seeking under threat. *Journal of Personality and Social Psychology*, *52*(2), 345–353.
Mills, J. (1965). Avoidance of dissonant information. *Journal of Personality and Social Psychology*, *2*(4), 589–593.
Mills, J., & Jellison, J. M. (1968). Avoidance of discrepant information prior to commitment. *Journal of Personality and Social Psychology*, *8*(1, pt.1), 59–62.
Montag, C., Weber, B., Trautner, P., Newport, B., Markett, S., Walter, N. T., et al. (2011). Does excessive play of violent first-person-shooter-video-games dampen brain activity in response to emotional stimuli? *Biological psychology*, 1–5.
Nagai, Y., Critchley, H. D., Featherstone, E., Trimble, M. R., & Dolan, R. J. (2004). Activity in ventromedial prefrontal cortex covaries with sympathetic skin conductance level: a physiological account of a “default mode” of brain function. *Neuroimage*, *22*(1), 243–251.
Nahl, D. (2001). A Conceptual Framework for Explaining Information Behavior. *SIMILE: Studies In Media & Information Literacy Education*, *1*(2), 1–16.
Nahl, D. (2004). Measuring the Affective Information Environment of Web Searchers. *Proceedings of the American Society for Information Science and Technology*, *41*, 191–197.
Narayan, B., Case, D. O., & Edwards, S. L. (2011). The role of information avoidance in everyday-life information behaviors. *Proceedings of the American Society for Information Science and Technology*, *48*(1), 1–9.
Neta, M., Norris, C. J., & Whalen, P. J. (2009). Corrugator muscle responses are associated with individual differences in positivity-negativity bias. *Emotion*, *9*(5), 640–648.
Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, *2*(2), 175.
Nourbakhsh, N., Wang, Y., & Chen, F. (2013). GSR and Blink Features for Cognitive Load Classification. *Human-Computer Interaction-INTERACT 2013*, 159–166.
Nuthmann, A., & van der Meer, E. (2005). Time's arrow and pupillary response. *Psychophysiology*, *42*(3), 306–317.
Ohira, H. (1996). Eyeblink activity in a word-naming task as a function of semantic priming and cognitive load. *Perceptual and Motor Skills*, *82*(3), 835–842.
Orchard, L. N., & Stern, J. A. (1991). Blinks as an index of cognitive activity during reading. *Integrative Physiological & Behavioral Science*, *26*(2), 108–116.
Öhman, A., & Soares, J. J. (1994). “ Unconscious anxiety”: phobic responses to masked stimuli. *Journal of abnormal psychology*, *103*(2), 231–240.
O’Donnell, R. D., & Eggemeier, F. T. (1986). Workload assessment methodology. *Measurement Technique*, *42*, 1–49.
Palinko, O., Kun, A. L., Shyrokov, A., & Heeman, P. (2010). Estimating cognitive load using remote eye tracking in a driving simulator. *Proceedings of the 2010 Symposium on Eye-Tracking Research & Applications*, 141–144.
Peshkam, A., Mensink, M. C., Putnam, A. L., & Rapp, D. N. (2011). Contemporary Educational Psychology. *Contemporary educational psychology*, *36*(3), 219–231.
Petty, R. E., & Cacioppo, J. T. (1984). Source factors and the elaboration likelihood model of persuasion. *Advances in Consumer Research*, *11*(1), 668–672.
Petty, R. E., & Cacioppo, J. T. (1986). The elaboration likelihood model of

persuasion. *Springer Series in Social Psychology*, 1–24.
Pipino, L. L., Lee, Y. W., & Wang, R. Y. (2002). Data Quality Assessment. *Communications of the ACM*, *45*(4), 211–218.
Piquado, T., Isaacowitz, D., & Wingfield, A. (2010). Pupillometry as a measure of cognitive effort in younger and older adults. *Psychophysiology*, *47*(3), 560–569.
Poole, A., & Ball, L. J. (2006). Eye Tracking in Human-Computer Interaction and Usability Research: Current Status and Future Prospects. *Encyclopedia of human computer interaction*, 211–219.
Popper, K. R. (1973). *Objektive Erkenntnis* (pp. 277-f). I. Fleischmann (Ed.). Hoffmann und Campe.
Poulsen, A. U., & Roos, M. W. (2010). Do people make strategic commitments? Experimental evidence on strategic information avoidance. *Experimental Economics*, *13*(2), 206–225.
Pratto, F., & John, O. P. (1991). Automatic vigilance: the attention-grabbing power of negative social information. *Journal of Personality and Social Psychology*, *61*(3), 380–391.
Propp, K. M. (1997). Information Utilization in Small Group Decision Making: A Study of the Evaluative Interaction Model. *Small Group Research*, *28*(3), 424–453.
Rayner, K. (2009). Eye movements and attention in reading, scene perception, and visual search. *The Quarterly Journal of Experimental Psychology*, *62*(8), 1457–1506.
Riedl, R. (2012). On the biology of technostress: literature review and research agenda. *ACM SIGMIS Database*, *44*(1), 18–55.
Riedl, R., Banker, R. D., Benbasat, I., Davis, F. D., Dennis, A. R., Dimoka, A., et al. (2009). On the foundations of NeuroIS: reflections on the Gmunden Retreat 2009. *Communication of the Association for Information Systems*.
Riedl, R., Kindermann, H., Auinger, A., & Javor, A. (2012). Technostress aus einer neurobiologischen Perspektive. *Business & Information Systems Engineering*, *54*(2), 61–69.
Rinn, W. E. (1984). The neuropsychology of facial expression: a review of the neurological and psychological mechanisms for producing facial expressions. *Psychological Bulletin*, *95*(1), 52–77.
Roth, S., & Cohen, L. J. (1986). Approach, avoidance, and coping with stress. *American psychologist*, *41*(7), 813–819.
Salojärvi, J., Puolamäki, K., Simola, J., Kovanen, L., Kojo, I., & Kaski, S. (2005). *Inferring relevance from eye movements: Feature extraction* (pp. 1–23). Publications in Computer and Information Science.
Savolainen, R. (1993). The sense-making theory: Reviewing the interests of a user-centered approach to information seeking and use. *Information Processing & Management*, *29*(1), 13–28.
Savolainen, R. (2007). Filtering and withdrawing: strategies for coping with information overload in everyday contexts. *Journal of Information Science*, *33*(5), 611–621.
Scherer, A. M., Windschitl, P. D., & Smith, A. R. (2013). Hope to be right: Biased information seeking following arbitrary and informed predictions. *Journal of Experimental Social Psychology*, *49*(1), 106–112.
Schluroff, M. (1979). *Pupil Responses to Grammatical Complexity of Sentences*.
Schmidt, J. B., & Spreng, R. A. (1996). A proposed model of external consumer information search. *Journal of the Academy of Marketing Science*, *24*(3), 246–256.

Scholl, W. (2004). *Innovation und Information*. Hogrefe.
Schrammel, F., Pannasch, S., Graupner, S.-T., Mojzisch, A., & Velichkovsky, B. M. (2009). Virtual friend or threat? The effects of facial expression and gaze interaction on psychophysiological responses and emotional experience. *Psychophysiology*, *46*(5), 922–931.
Schulz-Hardt, S., Frey, D., Lüthgens, C., & Moscovici, S. (2000). Biased information search in group decision making. *Journal of Personality and Social Psychology*, *78*(4), 655–669.
Schwartz, B., Ward, A., Monterosso, J., Lyubomirsky, S., White, K., & Lehman, D. R. (2002). Maximizing versus satisficing: Happiness is a matter of choice. *Journal of Personality and Social Psychology*, *83*(5), 1178–1197.
Sears, D. O., & Freedman, J. L. (1967). Selective exposure to information: A critical review. *Public Opinion Quarterly*, *31*(2), 194–213.
Sequeira, H., Sequeira, H., Hot, P., Hot, P., Silvert, L., Silvert, L., et al. (2009). Electrical autonomic correlates of emotion. *International Journal of Psychophysiology*, *71*(1), 50–56.
Setz, C., Arnrich, B., Schumm, J., La Marca, R., Troster, G., & Ehlert, U. (2010). Discriminating Stress From Cognitive Load Using a Wearable EDA Device. *IEEE Transactions on Information Technology in Biomedicine*, *14*(2), 410–417.
Sheng, H., & Joginapelly, T. (2012). Effects of Web Atmospheric Cues on Users' Emotional Responses in E-Commerce, *AIS Transactions on Human-Computer Interaction* 4(1), 1–24.
Sherman, D. K., & Cohen, G. L. (2002). Accepting Threatening Information: Self-Affirmation and the Reduction of Defensive Biases. *Current Directions in Psychological Science*, *11*(4), 119–123.
Siegle, G. J., Ichikawa, N., & Steinhauer, S. (2008). Blink before and after you think: Blinks occur prior to and following cognitive load indexed by pupillary responses. *Psychophysiology*, *45*(5), 679–687.
Simon, H. A. (1972). Theories of bounded rationality. *Decision and organization*, *1*, 161–176.
Skotte, J. H., Nøjgaard, J. K., Jorgensen, L. V., Christensen, K. B., & Sjogaard, G. (2007). Eye blink frequency during different computer tasks quantified by electrooculography. *European journal of applied physiology*, *99*(2), 113–119.
Skov, R. B., & Sherman, S. J. (1986). Information-gathering processes: Diagnosticity, hypothesis-confirmatory strategies, and perceived hypothesis confirmation. *Journal of Experimental Social Psychology*, *22*(2), 93–121.
Sloan, D. M., Bradley, M. M., Dimoulas, E., & Lang, P. J. (2002). Looking at facial expressions: Dysphoria and facial EMG. *Biological psychology*, *60*(2), 79–90.
Sorrentino, R. M., Bobocel, D. R., Gitta, M. Z., Olson, J. M., & Hewitt, E. C. (1988). Uncertainty orientation and persuasion: Individual differences in the effects of personal relevance on social judgments. *Journal of Personality and Social Psychology*, *55*(3), 357–371.
Sorrentino, R. M., Holmes, J. G., Hanna, S. E., & Sharp, A. (1995). Uncertainty orientation and trust in close relationships: Individual differences in cognitive styles. *Journal of Personality and Social Psychology*, *68*(2), 314–327.
Stanners, R. F., Coulter, M., Sweet, A. W., & Murphy, P. (1979). The pupillary response as an indicator of arousal and cognition. *Motivation and Emotion*, *3*(4), 319–340.
Straub, D., Boudreau, M.-C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information*

Systems, *13*(24), 380–427.
Streufert, S., & Suefeld, P. (1965). Conceptual Structure, Information Search and Information Utilization. *Journal of Personality and Social Psychology*, *2*(5), 736–740.
Sturgeon, R. S., Cooper, L. M., & Howell, R. J. (1989). Pupil response: A psychophysiological measure of fear during analogue desensitization. *Perceptual and Motor Skills*, *69*(3f), 1351–1367.
Stvilia, B., Gasser, L., Twidale, M. B., & Smith, L. C. (2007). A framework for information quality assessment. *Journal of the American Society for Information Science and Technology*, *58*(12), 1720–1733.
Sweeny, K., Melnyk, D., Miller, W., & Shepperd, J. A. (2010). Information avoidance: Who, what, when, and why. *Review of general psychology*, *14*(4), 340–353.
Sweller, J., van Merrienbör, J. J., & Paas, F. G. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, *10*(3), 251–296.
Tanaka, Y., & Yamaoka, K. (1993). Blink activity and task difficulty. *Perceptual and Motor Skills*, *77*(1), 55–66.
Thatcher, J. B., & Perrewe, P. L. (2002). An empirical examination of individual traits as antecedents to computer anxiety and computer self-efficacy. *Management Information Systems Quarterly*, 381–396.
Todd, R. J. (1999). Back to our beginnings: Information utilization, Bertram Brookes and the fundamental equation of information science. *Information Processing & Management*, *35*(6), 851–870.
Tranel, D., & Damasio, H. (1994). Neuroanatomical correlates of electrodermal skin conductance responses. *Psychophysiology*, *31*(5), 427–438.
Tryon, W. W. (1975). Pupillometry: A survey of sources of variation. *Psychophysiology*, *12*(1), 90–93.
van Boxtel, A. (2010). Facial EMG as a tool for inferring affective states. *Proceedings of Measuring Behavior 2010*, 104–108.
Van Orden, K. F., Limbert, W., Makeig, S., & Jung, T.-P. (2001). Eye Activity Correlates of Workload during a Visuospatial Memory Task. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, *43*(1), 111–121.
Van Zuuren, F. J., & Wolfs, H. M. (1991). Styles of information seeking under threat: personal and situational aspects of monitoring and blunting. *Personality and Individual Differences*, *12*(2), 141–149.
Vandenbosch, B., & Huff, S. L. (1997). Searching and scanning: how executives obtain information from executive information systems. *Management Information Systems Quarterly*, *21*(1), 81–107.
Wand, Y., & Wang, R. Y. (1996). Anchoring data quality dimensions in ontological foundations. *Communications of the ACM*, *39*(11), 86–95.
Wang, P. (1999). Methodologies and Methods for User Behavioral Research. *Annual Review of Information Science and Technology (ARIST)*, *34*, 53–99.
Wang, Q., Wang, Q., & Ma, Q. (2011). The Application of Cognitive Neuroscience Methods in IS Research: A Retrospect of NeuroIS Research Using the fMRI Technology. *Proceedings of 2011 International Conference on Management and Service Science (MASS)*, 1–4.
Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems*, *12*, 5–34.
Weinert, C., Laumer, S., Maier, C., & Weitzel, T. (2013). The Effect of Coping Mechanisms on Technology Induced Stress: Towards a Conceptual Model. *Proceedings of the 19th Americas Conference on Information Systems (AMCIS)*.

Weyers, P., Mühlberger, A., Kund, A., Hess, U., & Pauli, P. (2009). Modulation of facial reactions to avatar emotional faces by nonconscious competition priming. *Psychophysiology*, *46*(2), 328–335.
Wiersema, D. V., van Harreveld, F., & van der Pligt, J. (2012). Shut your eyes and think of something else: Self-esteem and avoidance when dealing with counter-attitudinal information. *Social Cognition*, *30*(3), 323–334.
Wilson, P. (1995). Unused relevant information in research and development. *Journal of the American Society for Information Science*, *46*(1), 45–51.
Wilson, T. D. (1999). Models in information behaviour research. *Journal of Documentation*, *55*(3), 249–270.
Wilson, T. D. (2000). Human information behavior. *Informing science*, *3*(2), 49–56.
Wolkoff, P., Skov, P., Franck, C., & Petersen, L. N. (2003). Eye irritation and environmental factors in the office environment-hypotheses, causes and a physiological model. *Scandinavian Journal of Work, Environment & Health*, *29*(6), 411–430.
Wood, R. E. (1986). Task complexity: Definition of the construct. *Organizational Behavior and Human Decision Processes*, *37*(1), 60–82.
Xiao, B., & Benbasat, I. (2011). Product-related deception in e-commerce: a theoretical perspective. *Management Information Systems Quarterly*, *35*(1), 169–196.
Xu, Q., & Riedl, R. (2011). Understanding Online Payment Method Choice: An Eye-tracking Study, *Proceedings of the Thirty Second International Conference on Information Systems*, 1–12.
Yin, D., Bond, S., & Zhang, H. (2013). Anxious or Angry? Effects of Discrete Emotions on the Perceived Helpfulness of Online Reviews. *Management Information Systems Quarterly, Forthcoming*.
Zhang, P. (2000). The effects of animation on information seeking performance on the World Wide Web: Securing attention or interfering with primary tasks? *Journal of the Association for Information Systems*, *1*(1), 1–28.