Application of Dual-process Theory to Information Systems: Current and Future Research Directions

Stephanie Watts
Department of Information Systems,
Questrom School of Business, Boston University,
595 Commonwealth Avenue, Boston
MA 02215, USA
swatts@bu.edu

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Foundations and Trends® in Information Systems

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now Publishers Inc.
PO Box 1024
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United States
Tel. +1-781-985-4510
www.nowpublishers.com
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Outside North America:
now Publishers Inc.
PO Box 179
2600 AD Delft
The Netherlands
Tel. +31-6-51115274

The preferred citation for this publication is

S. Watts. *Application of Dual-process Theory to Information Systems: Current and Future Research Directions*. Foundations and Trends® in Information Systems, vol. 1, no. 2, pp. 69–162, 2015.

This Foundations and Trends® issue was typeset in LaTeX using a class file designed by Neal Parikh. Printed on acid-free paper.

ISBN: 978-1-68083-059-0
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Foundations and Trends® in Information Systems, 2015, Volume 1, 4 issues. ISSN paper version 2331-1231. ISSN online version 2331-124X. Also available as a combined paper and online subscription.

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Foundations and Trends® in Information Systems
Vol. 1, No. 2 (2015) 69–162
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DOI: 10.1561/2900000004

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Stephanie Watts
Department of Information Systems,
Questrom School of Business, Boston University,
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swatts@bu.edu

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Abstract

This monograph presents a research agenda for the application of dual-process theories to Information Systems (IS) research. It begins by clarifying exactly what a dual-process approach to attitude formation is, explaining how and why it can provide insights that other theoretical approaches cannot. Similarities and differences between the two dominant dual-process theories — the Elaboration Likelihood Model (ELM) and the Heuristic Systematic Model (HSM) are discussed. These concepts are illustrated in a review of 26 published dual-process-based IS studies. This body of research is categorized according to a logical schema based on the locus of attitude formation. We then distill from these studies those heuristic cues and moderating factors that are most relevant to understanding IS phenomena. Finally, we identify the following three IS phenomena as offering great potential for further applications of the dual-process approach: First, information filtering under information surplus; second, how credibility assessment interacts with system design features; and third, mediated knowledge work in situ. We hope that by so doing, we can prevent future fragmentation of this widely varied body of research, and avoid premature closure around only a subset of potential areas for dual-process-based IS research.

S. Watts. *Application of Dual-process Theory to Information Systems: Current and Future Research Directions*. Foundations and Trends® in Information Systems, vol. 1, no. 2, pp. 69–162, 2015.

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1

Introduction

This monograph addresses the dual-process approach to attitude formation as it has been applied to the domain of Information Systems (IS). It describes 26 empirical research studies published in the IS literature that have been based on the Elaboration Likelihood Model (ELM) or the Heuristic Systematic Model (HSM) — variants of the dual-process approach. Some of the IS phenomena these studies have explored include, among others, the IS training process [Bhattacherjee and Sanford, 2006, Lee and Xia, 2011, Lee, 2012]; website trust and privacy assurance [Kim and Benbasat, 2009, Lowry et al., 2012]; perceptions of online health records [Angst and Agarwal, 2009]; adoption of expert systems' advice [Mak et al., 1997, Dijkstra, 1999]; design of recommendation systems [Tam and Ho, 2005, Koh and Sundar, 2010]; computer-mediated communication [Ferran and Watts, 2008]; and knowledge management [Sussman and Siegal, 2003, Meservy et al., 2014].

Clearly the lens of dual-process theory can engender insights across a wide range of phenomena. The methods used in the studies discussed here include controlled laboratory experiments, field experiments, field quasi-experiments, field surveys of IS professionals, online surveys of

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wider populations, and big-data analyses of social media archives. The fact that one theoretical approach can shed light on so many different phenomena, and be amenable to the application of so many different methods, attests to its power and versatility. The dual-process theories seek to explain the general process of *attitude formation* in response to new information, and IS researchers are increasingly applying them to understand how individuals interact with information technologies in a wide variety of information-rich contexts.

However, there are several problems that the great flexibility afforded by this theoretical approach creates: First, the model has been applied in so many different IS contexts in so many different ways that its contributions are becoming fragmented. We need to take care that the insights it has engendered thus far do not get lost among the plethora of different phenomena studied and the methods used. Another problem is that some of these studies have been executed in ways that are inconsistent with the precepts of the approach. This creates general confusion about what the theory is and how to apply it. At the same time, we need to take what is valuable from these studies by making explicit theoretical extensions to the model where appropriate. Another issue we face is one of lost opportunity: dual-process theories explain how people process information, and because so much of the information that people process today is technology-mediated, findings from this approach can inform how these technologies can be optimally designed. This potentially allows for a deeper theoretical understanding of such phenomena as information filtering, first impressions of websites, formation of credibility perceptions, knowledge management, and interactions of these with usability and other design factors. We need to guard against premature closure on a small sub-sample of the many IS phenomena that the approach is well-suited for, particularly those that present easiest access to data. Finally, of the 26 dual-process IS studies discussed here, 10 have been published in the past three years, since 2012. Clearly this approach is gaining momentum among IS researchers, which underscores the need to address these problems. It is the objective of this paper to do so.

We begin by clarifying exactly what a dual-process approach is and how to apply it, in order to ensure that future IS researchers either

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adhere to the precepts of the approach, or make clear why they choose not to, and include the requisite theoretical extensions. We then define a logical schema for categorizing the extant dual-process IS research (see Figure 4.1), and use it to group these studies into these categories, briefly reviewing each study as we do so. This addresses the first problem — the need to understand these studies in relation to each other, with the aim of integrating them and forestalling fragmentation of this body of work. In Section 9 we begin by identifying three streams of this research that are outliers, which is not to say that they should not be pursued. We then discuss those heuristic cues and moderating factors in the studies reviewed that are clearly IS constructs, suggesting they bear further dual-process based IS research. Finally, we elucidate three particular IS phenomena that we believe present excellent opportunities for applying this approach in the future: information filtering during complex problem solving; how trust and credibility assessment interact with system design features; and organizational knowledge work. The information surplus that characterizes current organizational contexts gives rise to the need for understanding these phenomena in more depth, particularly for increasing the efficiency of organizational information processing. This is not to say that other IS phenomena should not be studied using this approach; the dual-process approach theoretically informs individual attitudinal response to new information. And when that new information is online, mediated, delivered via technology artifact, and so on, the approach can shed light on the particular phenomenon, whatever it may be. It is a valuable tool in the IS researcher's toolbox.

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2

Attitudes and Dual-process Attitude Formation

Dual-process theories explain how people form attitudes towards new information. Individuals form attitudes whenever they are exposed to information about new objects, ideas, events, or people. Such information is called an informational stimulus, since it stimulates the formation of an attitude [Ajzen and Fishbein, 2005]. Spencer [1862] first employed the term attitude in the psychological literature in 1862. Attitudes can vary in strength, accessibility, and ambivalence. Because they are formed contextually and reside in people's heads, they are empirically difficult to study. Attitudinal responses to new information occur *between* a person and an informational stimulus, and as such the attitude construct does not reside either within the person or within the stimulus, but emerges from the interaction of the two [Zhang, 2013].

Attitude formation is the process by which people integrate new information into their mental models and schemas so that they may act on it in the future. When encountering new information about an object, idea, event, or person(s), in any form, individuals assess this new information for validity and form an attitude toward it, often with a positive or negative valence. It is important to understand that the attitude formation process is not something that people consciously

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turn on and off; rather, it is the way that individuals process new information as they interact with it during work and in everyday life [Eagly and Chaiken, 1998]. Attitude formation is an almost instantaneous response to exposure to new information, and according to dual-process theories, it is partially sub-conscious. It is this partially sub-conscious aspect from which the dual-process model takes its name: when we are exposed to new information, we engage in two different mental processes, one of which is the conscious application of logical, rational analysis to understanding and assessing the new information in a process which takes some time and effort. But *at the same time*, and primarily sub-consciously, we apply a host of short-cuts and rules toward assessing this new information. We apply these rules, called heuristics or cues, because if we processed every piece of new information analytically, it would take too long, require too much effort, and we would never get anything done. It takes more *cognitive effort* to undertake the rational analysis of weighing the pros and cons of logical arguments than it does to react to simple cues. It is generally agreed upon that attitudes formed on the basis of heuristic processing alone will be less stable, less resistant to counterarguments, and less predictive of subsequent behavior than attitudes formed as a result of systematic processing [Chaiken, 1980]. However, it is important to note that the two extremes of using only cues or only logical analysis are simplistic and rarely occur in practice. Most people are continuously informed by both rational arguments and heuristic cues, and these two types of processing play off each other in complex ways [Chaiken, 1980, Chaiken et al., 1989].

Since it explains how humans process new information, the dual-process approach to attitude formation is widely applicable to any phenomenon that exposes individuals to new information. It is a cognitive model, one of several that are clearly relevant to IS-related phenomena [Davern et al., 2012]. To utilize this approach, the phenomenon to be investigated must be some type of individual-level attitude formation process, such that the dependent variable is an attitude formed by an individual in response to being exposed to new information — the informational stimulus. To model the phenomenon, the researcher must

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split apart attributes of the informational stimulus from attributes of the person receiving that information, together with any aspects of the context that might affect the cognitive effort or capacity of the person receiving it. The next step is to describe the informational stimulus in terms of two sets of characteristics, one set of which is the basket of things embodied in the stimulus that can be consciously analyzed — logics the recipient may consider as she actively and consciously assesses the validity of the new information in the context of the task at hand. The other set is comprised of the heuristics and cues evident from the stimulus, most often based on pre-existing beliefs, frames of reference, social norms, and so on.

Figure 2.1 illustrates these two categories of information attributes on the left side as the independent constructs that they are. Thus the informational stimulus is modelled in terms of one or more heuristics that enable short-cuts to validity assessment of it, and *also* one or more factors that the recipient can use to systematically analyze it, such as a strong clear argument. In interpersonal interactions (computer-mediated or not), in which one person is providing new information to another, attributes of the information *source* often serve as heuristics. For example, the extent that a person seems to be likable or credible often serves as a short-cut for analyzing the new information that he or

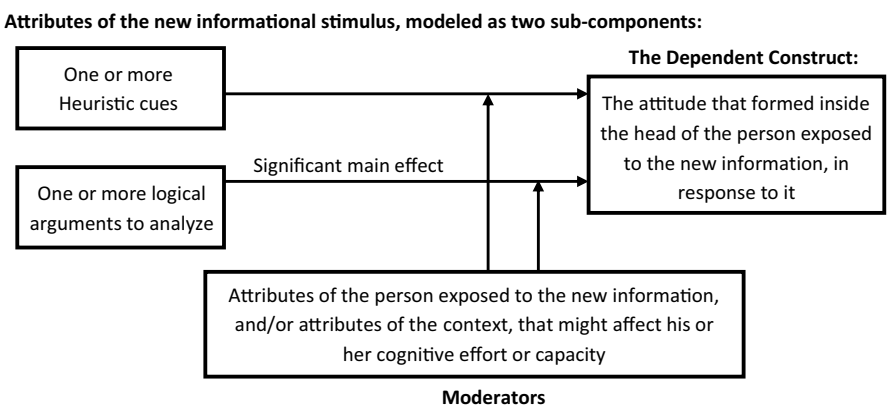


Figure 2.1: Basic components of all dual-process models.

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she delivers to us. In addition to source cues, there are many heuristics that characterize the new information itself — assurance symbols, data quality indicators, and so on. Dual-process theory works by separating these two buckets of information attributes, because doing so allows the researcher to see their differential effects in response to various levels of cognitive effort and capacity on the part of the person receiving the information. Importantly, the dual-process approach requires that each of these two "baskets of processing effects" have significant main effects on the dependent variable. The next task of the researcher is the addition of moderators to the model that enable him to explore tradeoffs and interdependencies between these two types of cognitive processes.

Because heuristics function quickly and often sub-consciously, and systematic processing of the argument is effortful and takes time, anything that alters the cognitive capacity or effort of the person receiving the information will alter the balance of the two processing modes and so is a candidate for moderator, but there must be a logical explanation for this mechanism; an explanation that implicates the moderator as increasing either cognitive capacity or effort. Typical moderators are internal to the person receiving the new information — motivation, expertise, personality — or external aspects of the particular context, such as incentives, time pressure, task complexity, involvement in the topic, and so on. Note that for models that are to be tested in the laboratory, the relative strength of the two types of main effects are usually manipulated to make the different processing modes individually salient. In such cases additional moderators are not required although they are usually included for manipulation checks. But moderation effects are a necessary component of the dual-process approach and so must be included in the research model. By affecting the individual's motivation and/or effort to process systematically, moderators reveal how the two processing modes — heuristic or systematic — interact to engender the resultant attitude. Moderators enable the researcher to identify which processing mode the information recipient is using and why, and this is important since heuristic processing is much faster than systematic processing, but attitudes formed as a result of systematic

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processing can be more stable and longer lasting [Petty and Cacioppo, 1986a,b].

Four key premises of the dual-process are often misunderstood: First, it models an intra-psychic phenomenon — how individuals form attitudes to new information. Thus it does not apply, without an explicit theoretical extension, to any phenomenon above the individual level of analysis. Considering the extent that modern individuals are exposed to new information online, there is no shortage of IS applications at this level of analysis. Second, the approach originated in psychology, where it is clearly distinguished from research on judgment and decision-making [Wegener et al., 2010]. While the results of attitude formation processes certainly inform individual decision-making, which in turn often inform behavioral outcomes, the approach distinct from theories that seek to explain decision-making and behavioral outcomes. Third, it models the interplay between individuals' heuristic processing and analytical processing. Thus research that focuses entirely on one of these two types of processing to the exclusion of the other is not consistent with the purpose of the approach. Fourth, the approach is designed to investigate how people form attitudes, and people form attitudes very quickly; most people form a first impression of another in about 40 milliseconds [Bar et al., 2006]. Therefore, research that applies a dual-process approach over the course of days, weeks, or months needs explicit theoretical extension.

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3

The ELM and the HSM

An issue that has created some confusion regarding dual-processing is that there are multiple flavors of it. The two that are most dominant in management research are the Elaboration Likelihood Model (ELM) by Petty and Cacioppo [1986a,b], and the Heuristic Systematic Model (HSM), [Chaiken, 1980, Eagly and Chaiken, 1993], each with its own nuances and vocabulary. Briefly, the history of these theories is as follows: The ELM was first published in 1983 in the *Journal of Personality Social Psychology* [Cacioppo et al., 1983], and continued to be published primarily in psychology journals such as *Cognitive Therapy and Research* (1988) and the *Journal of Social and Clinical Psychology* (1989). By the mid-1990s it was being applied to such varied phenomena as assessing the impact of Supreme Court decisions on the public [Hoekstra and Segal, 1996, — *Journal of Politics*], and changing men's gender-role attitudes [BrooksHarris et al., 1996, — *Sex Roles*]. It was the basis of five IS research studies during the next decade (1996–2006), but was primarily applied to non-IS phenomena in psychology, social psychology, advertising, and marketing, and was published in journals in these fields. Since 2007, the ELM has been applied to an increasingly wide range of domains, for example, criminology,

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sports, environmentalism, nonprofits, entrepreneurship, food, tourism, and social media, all the while continuing to be widely applied to psychology and social psychology, marketing, and advertising. Of the 388 ELM-based articles published since the theory originated in 1983, more than half of them have been published since 2007.

Very similar to the ELM, the Heuristic-Systematic Model [Chaiken, 1980] was first published in 1980. Because of its emphasis on validity-seeking rather than persuasion, the HSM was more widely adopted by researchers in psychology and communications departments than by those in business schools. Until recently, marketing scholars published works based on the ELM rather than the HSM. Of the 100 articles based on the HSM that have been published since 1991, 25 have come out of business schools, with 12 of those having been published in IS journals. Historically, when the dual-process approach was used by management scholars, it was by those in marketing departments interested in the problem of how consumers form attitudes towards products and services in response to advertising and marketing materials, and a large body of research has accumulated in this stream. Very recently, a significant proportion of both ELM and HSM studies that are coming out of business schools are being published in IS journals. IS-related phenomena are increasingly becoming a primary focus of dual-process research.

The explanation of dual-process attitude formation earlier generalizes the two main variants of this body of theory — the Elaboration Likelihood Model (ELM) [Petty and Cacioppo, 1986a,b] and the Heuristic Systematic Model (HSM) [Chaiken, 1980, Chaiken et al., 1989]. These two theories vary from each other somewhat and use different language to explain dual-process attitude formation. The differences between the two are subtle: The ELM identifies itself as a theory of persuasion, and as such has been utilized extensively in the field of marketing research. The emphasis there has been on what can be done *by those creating the new informational stimulus* — marketers in this case — to affect how people process new information in ways that will result in the formation of a desired attitude; usually intent to purchase. In this sense the ELM comes from a *prescriptive* orientation. In contrast, the HSM comes out of the field of social psychology and

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emphasizes the process of how *recipients of a new informational stimulus* make sense of that new information in validity seeking contexts. The HSM thus has more of a *descriptive* emphasis. Both the ELM and the HSM seek to explain the same phenomenon — attitude formation — but approach it from different perspectives.

The ELM was developed in the early 1980s by [Petty and Cacioppo, 1986a,b] in order to account for reported differences in influence results across individuals and contexts. According to the ELM, different message recipients will vary in the extent to which they cognitively elaborate on a particular message, and these variations in elaboration likelihood affect the success of an influence attempt, along with other factors. Elaboration involves attending to the content of the message, scrutinizing and assessing its content, and reflecting on issues relevant to the message. Because of the cognitive effort involved, receivers do not elaborate on every message they receive, and some receivers elaborate on fewer messages than others do. Persuasion can occur at any degree of receiver elaboration, but as the result of very different influence processes; high levels of elaboration represent a central route to influence, while low levels result in a peripheral route.

According to the ELM, when an individual is able and willing to cognitively elaborate on a persuasive communication, the *quality* of the arguments contained within the communication will determine the degree of informational influence [Petty and Cacioppo, 1986a]. Thus the ELM identifies argument quality as the critical determinant of informational influence under conditions of high elaboration likelihood. When an individual is either unable or unwilling to process the arguments presented in a message, peripheral cues will play a more critical role in the influence process. Peripheral cues are informational indicators that people use to assess content other than the content itself [Petty and Cacioppo, 1986a]. As elaboration likelihood decreases, peripheral cues have increasingly important effects on recipient attitude, belief and consequent influence [Petty and Cacioppo, 1986a]. The central and peripheral routes are viewed as the extremes of a single underlying elaboration dimension — a person engaging heavily in elaboration would not make use of peripheral cues, and vice versa. This

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tenet is now viewed as somewhat simplistic; attitude formation is generally understood to be a complex interplay between the two processing modes. The HSM acknowledges this complexity, identifying the biasing effect, in which peripheral processing affects central route processing [Chaiken and Maheswaran, 1994], along with other interactions between the two processing modes.

According to the ELM, attitudes formed via central route processing are stronger than those formed under low elaboration, which makes them more persuasive and less susceptible to counter-persuasion than attitudes formed under low elaboration [Petty and Cacioppo, 1986b]. It has been widely utilized by marketing researchers to understand how consumers *can be persuaded*, investigating "inducements to process" — factors that drive recipients of informational stimuli (primarily advertisements in this case) to process that information centrally rather than peripherally.

At about the same time as Petty and Cacioppo were developing the ELM, Shelly Chaiken and her colleagues were developing the HSM and publishing empirical research based on it. The HSM seeks to model generalized validity-seeking contexts rather than the persuasion process. Validity-seeking settings are those in which people are primarily motivated to attain accurate views of new information as consonant with relevant facts [Chaiken, 1980]. For this reason, the HSM has been applied to a wide variety of phenomena, from auditor performance [Brazel et al., 2004], to risk perception [Trumbo, 2002], to the media effects of vividness and communicator salience [Chaiken and Eagly, 1983].

According to the HSM, people apply the least amount of cognitive capacity necessary for ascertaining the validity of received information. At this point, they reach a sufficiency threshold beyond which additional cognitive processing is unnecessary. And because heuristics are simple rules that conserve cognitive capacity, they are utilized early in the information assessment process. If they are not sufficient to support validity assessment, the more resource intensive process of systematic processing is invoked [Chaiken and Eagly, 1983, Chaiken et al., 1989]. As with the ELM, the relative emphasis on the two types of processing varies with the available cognitive capacity of the individual and the

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effort they expend. The greater the cognitive capacity and/or effort, the greater the likelihood that systematic processing will be undertaken if a sufficiency threshold has not been reached using heuristics. People that are highly motivated are more likely to undertake the effort of systematic processing than those that are less motivated to do so [Chaiken et al., 1989, Petty and Cacioppo, 1986a], but it is cognitive capacity that both enables and constrains systematic processing. A number of factors have been identified that affect cognitive workload and hence the likelihood of heuristic processing, for example: Communication medium, personal relevance, task importance, accountability, fit of content to functional disposition, unexpectedness of content, repetition, time pressure, knowledge and expertise, direct experience with attitude objects, positive mood, anxiety, background noise, interruptions, and visual distractions have all been shown to affect cognitive workload and thus the likelihood of heuristic processing [Eagly and Chaiken, 1993, p. 314]. In addition, people vary in their need-for-cognition, which is a personality factor. People with high need-for-cognition enjoy more effortful cognitive tasks than those with low need-for- cognition [Cacioppo et al., 1983]. Such people tend to do more rational analysis and rely less on simple cues as they form attitudes.

The HSM models a greater level of complexity than the ELM regarding the interplay of heuristic and systematic processing. According to the ELM, with the exception of biasing effects, as systematic processing goes up, peripheral processing goes down. But in the HSM, heuristic and systematic processing modes can and do occur concurrently. Potential interactions include *additivity*, which occurs when heuristic and systematic processing both occur and the results reinforce each other, leading to higher confidence than with either processing mode by itself; *bias* — as with the ELM, this occurs when heuristic processing results in inferences that bias subsequent systematic processing; and *attenuation*, which occurs when systematic processing generates results that overturn those of heuristic processing.

In these ways the HSM is more nuanced than the ELM, and emphasizes the important role that heuristics play in the very early stages of the near-instantaneous attitude formation process. It can expose

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complex interaction effects between the two types of cognitive processes, which themselves are not always clearly demarcated. It does not privilege systematic processing over heuristic processing in the way that the ELM does. This is important for understanding information systems-related phenomena, in which cues and heuristics are particularly important for two reasons. First, because information surplus is rampant and here to stay; people are inundated with information as they work and play, and the capability to quickly filter many different information stimuli is fast becoming an important skill. Unless the task

Table 3.1: Comparison of the ELM with the HSM.

Elaboration likelihood model (ELM)	Heuristic systematic model (HSM)
Petty and Cacioppo [1986a,b]	Chaiken [1980]; Chaiken et al. [1989]
Theory of persuasion	Theory of attitude formation in validity-seeking contexts
Central route processing	Systematic processing
Peripheral processing	Heuristic processing
Peripheral cues	Heuristic cues
Involvement and expertise increase elaboration likelihood and decrease reliance on peripheral cues	Principle of least effort: Systematic processing is initiated if the sufficiency threshold has not been reached via heuristic processing
The two processing routes are inversely related, except that cues can serve as inducement to elaborate	The two types of processing are interdependent
Persuasion via central route more persistent, more resistant to counter arguments	Interdependency types: additivity, bias, attenuation

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is very important, individuals tend to filter new information quickly, primarily on the basis of heuristics and cues, and the HSM is an apt lens for understanding how they do this [Meservy et al., 2014]. Second, the functionality and user interfaces of IT artifacts incorporate cues that afford various functions. Effective functionality can engender different cognitive processing than less effective functionality, and good IT designs produce unambiguous affordance cues that guide people to effective use without the need for systematic analysis. Other cues on websites can indicate levels of security (for example, the broken padlock), privacy (for example, cookies), ethical production (for example, Fair Trade), and other attributes of the content and the company producing it. For these reasons then, the study of heuristics and cues are central to the field of information systems, and a dual-process approach enables researchers to understand their use in context. Table 3.1 lists the constructs and assumptions of each of the two dual-process models in parallel, using the vocabulary of each.

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4

Dual-process Research In Information Systems

With an understanding of the dual-process approach in general, and of the ELM and the HSM in particular, we shall now review much of the dual-process studies published by information systems researchers. Historically, IS researchers have investigated people's attitudes towards computers in the workplace. The TAM and its derivatives were widely applied for understanding how workers adopt a particular system or software application [Davis, 1989], and why or why not they continue to use the system/application. However, this approach is limited for understanding several aspects of information systems use that emerged beginning in the 1990s. First, much computer work, particularly that of knowledge workers, moved to the Internet and was conducted using Web browsers. Many such users are not resistant to using the Web, especially younger ones, so getting them to adopt the technology itself was no longer such an obstacle (although certainly technology acceptance is still important in many contexts). Hence, in addition to investigating workers' utilization of computer applications, IS researchers became interested in how workers used the *information* made available to them by these systems, and the role of system design in this process. For online knowledge work, the emphasis expanded from system

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adoption to *information adoption* [Sussman and Siegal, 2003] — the incorporation of new *mediated* information into existing mental models and schemata. Thus the study of the interaction between system design and information adoption was born, for which the dual-process theoretical approach was clearly a good fit.

The second emergent phenomenon that increased interest in the dual-process approach was that of Web 2.0. Because Web 2.0 enabled almost anyone with computer access to easily post content to the web, there was soon a lot more content available for users to peruse, content whose validity was not necessarily clear. Prior to Web 2.0, online content was primarily of two forms, either journalism or marketing. Generally, individuals could identify marketing information, understand it as having a persuasive agenda, and interpret it on that basis. On the other end of the scale, reputable news outlets published articles that adhered to norms of journalistic integrity, and readers could generally trust that the content had not been falsified. But with the advent of Web 2.0, the volume of content on the web exploded, as did the various genres of it, particularly blogs, social media and reviews. Much of this online content was neither advertising nor journalism but something in between the two, and the task of validity assessment became substantially more difficult for Web users. For this space too, the dual-process approach to understanding information adoption was a natural fit.

As a wide variety of information assessment tasks moved online, IS researchers became increasingly interested in the *information* component of these systems, using a dual-process approach to investigate how people form attitudes towards mediated content in a wide variety of domains and contexts. Figure 4.1 categorizes these different domains, divided on the basis of the dependent variable as the locus of attitude change — either attitudes formed about the artifact itself (2), or about the information delivered by the technology, further divided on the basis of whether this content was generated by the system itself (1), as is the case with Expert Systems and Recommendation Agents, or was generated by other users of the same platform, such as online reviews and online community archives (3).

Next, using this logical schema, we categorize the extant dual-process IS research and discuss each published article in some detail.

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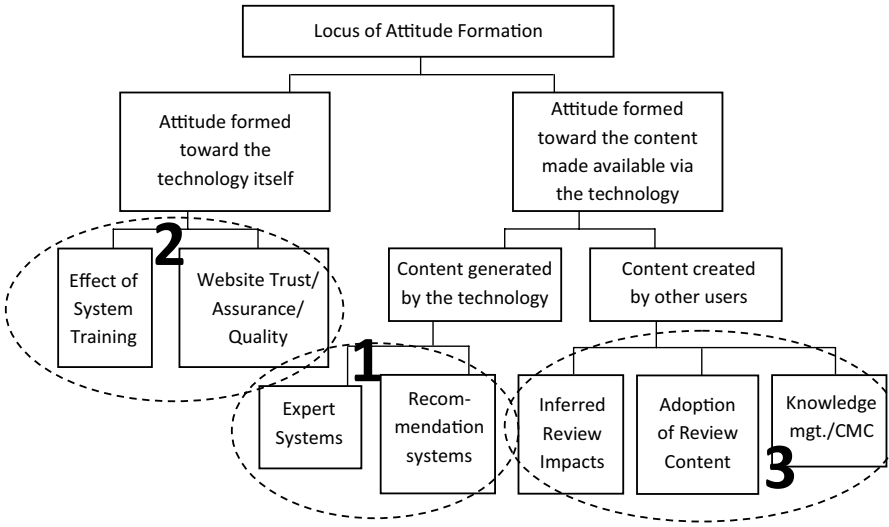


Figure 4.1: Logic underlying the organization of articles reviewed.

Table 4.1 lists each of these studies in three columns that correspond to the three categories in Figure 4.1, with the relevant section in this text indicated in the bottom row. The selection criteria for these articles was that they explicitly identify either the ELM or the HSM as the basis for their theoretical model, and that they are published in an IS journal. Most of them adhere strictly to the generalized dual-process model in Figure 2.1, while several of them veer from this ideal form but are included for their interesting methods or findings. Other articles have been excluded because they omitted basic features of the model or were published since this article was written. The following discussion begins with category one — attitudes formed toward content generated by expert systems and recommendations systems, because the application of the dual-process approach to IS began here with the work of Mak et al. [1997], and Dijkstra [1999]. Following this we describe studies in the second category — those investigating attitudes formed toward an IT artifact itself — first due to training on a system, and second, to exposure to websites. We then discuss the research in the third category; adoption of online content that has been created

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Table 4.1: Organization of articles reviewed.

Attitude toward content generated by technology		Attitude toward the technology itself			Attitude toward content produced by other platform users	
Expert systems	Recommendation systems	Effect of system training	Website trust/ Assurance/ Quality	Inferred review impacts	Adoption of review Content	Knowledge management/ CMC
Mak et al. [1997]	Tam and Ho [2005]	Bhattacherjee and Sanford [2006]	Castaneda et al. [2007]	Baek et al. [2012]	Cheung et al. [2008]	Sussman and Siegal [2003]
Dijkstra [1999]	Koh and Sundar [2010]	Lee and Xia [2011]	Kim and Benbasat [2009]	Ma et al. [2013]	Luo et al. [2013a]	Robert and Dennis [2005]
		Lee [2012]	Zhou [2012]		Kayhan and Bhattacherjee [2013]	Ferran and Watts [2008]
			Lowry et al. [2012]		Zhang and Watts [2008]	Meservy et al. [2014]
			Angst and Agarwal [2009]		Chen and Ku [2013]	Majchrzak and Jarvenpaa [2010]
			Luo et al. [2013b]			Watts et al. [2009]
Section 5		Section 6		Section 7		Section 8

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by other users, primarily in the form of online reviews and archives of knowledge networks. The next four sections present these dual-process IS studies in some detail. Readers interested in a general assessment of this body of work apart from the specifics of each study may choose to skip to Section 9 at this point, noting Table 8.1 which summarizes the most interesting issues raised by each paper.

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5

Dual-process Approaches to Understanding Attitude Change in Response to Content Generated by Expert Systems and Recommendation Agents

During the 1990s, expert systems emerged as important means for extending individuals' memory and analytical capabilities. Such systems are only valuable when the content they deliver in the form of recommendations and advice is utilized by individual users, which does not always happen. In order to understand which factors might improve the adoption of expert system output, researchers turned to the ELM.

5.1 Adoption of expert system advice — revising one's prior judgment

In the first application of the dual-process approach to an IT context, authors Mak et al. [1997] operationalized the ELM constructs as follows: the moderator of involvement was measured as users' perceived participation in updating the knowledge of the expert system, since involvement leads to motivation to elaborate, and we know that participation in system development motivates system use, or use of system output in this case. The *ambiguity of the decision* served as a proxy for the argument strength of the message, since presumably more ambiguous problems require more elaboration to solve. The *perceived*

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credibility of the experts building the system served as the peripheral cue in this context. For this laboratory experiment, the authors created two levels of each of three hypothesized effects. The dependent measure was the behavioral change that occurred if a user decided to accept the system's recommendation to revise her original judgment. The results of this study ($N = 36$ MBA students) were consistent with dual-process theory: Two different ways of processing ES recommendations were apparent, one a central-route cognitive and the other a peripheral route. Demonstrating the central route, those who thought that they had participated in updating the system's knowledge base were influenced by the ambiguity of the case. By contrast, the users who believed they had *not* participated in the knowledge update were influenced by the credibility of the experts that had built the system.

This study was the first to apply the ELM to an IS context. It characterized participation in system development as a moderator serving to heighten involvement and hence increase elaboration likelihood — an important contribution to the participatory development literature. And it posited the transfer of credibility attributions from the system developers to the content delivered by the system. Findings imply that, since the users that did not participate in loading the knowledge base were more likely to rely on peripheral cues in deciding whether to follow the system's advice, such cues should be designed into the system to specifically support these users. It also suggests a task-dependency: for routine unambiguous decisions, people that did not participate in developing the system will follow the system's advice, as long as its developers are credible and cues are present that indicate this. But for complex, ambiguous problems, users that participated in developing the system are best-suited to the task. Systems can be designed to support both types of users, depending on the nature of the decision task.

5.2 Adoption of expert system advice — disagreeing with it

In an elegant design, Dijkstra [1999] also applied the ELM to understanding how people adopt advice generated by an expert system, in

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