

An Analysis of Previous Information Systems Research on Emotions

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Abstract. In the past decade, the study of emotions in information systems research has gained prominence and has allowed the field itself to expand its horizon while delving into other disciplines. The idea behind decoding the human behavior promotes the need to understand the complex nature of human emotions and makes it especially relevant as an element for information systems research. In addition, the use of technologies to persuade and motivate individuals for health behavior change through web and advanced technologies takes the basis from such research. The purpose of this literature review was to extract and analyze studies on emotions published in “the basket of eight” journals in information systems research to gain a better understanding of previous research over the topic.

Keywords: emotions, information systems, literature review.

1 Introduction

The domain of human-computer interaction has always been keen on monitoring the technological advancements, but its ever-growing need has specifically focused on the study of human behavior. On the other hand, the rapid advancement in mobile technology and increasing use of ubiquitous devices means more opportunity and need for humans to interact with technology [40]. This new technology industry of opportunities that relies on more user mobility and more interaction provides huge motivation to go more in depth of human behavior, while similar interaction opportunities can be used to persuade and motivate individuals for health behavior change. Persuasion has always been an important part of human behavior and makes use of it to influence other's attitude and behavior [17]. However, since emotions tend to flirt with human behavior in a complex way, they play a vital role with the phenomenon of persuasion as well.

Emotions in persuasive technologies do exist but only as observation elements, irrespective of “what they are?” “Why causes them?” Or “why do we have them.” According to Fogg [18], the persuasion process works smoothly in humans when

emotional cues are used. The systematic application of psychological principles has a well-documented history in information systems development. On this matter, various disciplines such as affective computing, information systems, human computer interaction and psychology overlap, hence creating the need for multi-disciplinary approaches in research. The study of human behaviors to better understand their mental processes and cognitive psychology goes hand in hand with the creation of cognitive models for the development of persuasive technologies. Thus, in one way or the other, research on emotions may play a critical part in further enhancing the field of persuasive technologies, specifically behavior change ones that lead to positive health outcomes. The purpose of the current review was to extract the literature of the Information Systems Research (ISR) on emotions research to gain a better understanding of previous research over the topic.

2 Background

2.1 Emotions

The nature of emotions described by Plutchik [49] states that human emotions are extremely complex and evolutionary. It is their complexity that compels us to study them more and a theoretical approach is a must. It is because emotions are an essential part of who we are and how we survive. Further research by Ekkekakis [17] tries to eliminate the confusion and explains the differences in affect, emotion, and the mood. It states that one distinguishing feature of moods is that they typically last longer than emotions, while affect is a neurophysiological state consciously accessible as a simple primitive non-reflective feeling most evident in both mood and emotion. It emphasizes that a more meaningful differentiation feature of moods might be that they are diffuse and global as opposed to being specific to an object. Additionally, the work elaborates on the self-reporting measures assessing the three terms. As an example Plutchik [49] emphasizes that it is the emotional distress that impels people to look for help. Thinking on the same pattern, emotions should not be considered outside the scientific boundary of research on human behavior. Emotions in information systems are normally associated with human communication such as the work by Willis et al. [64] of supporting emotions in communication through “Emotishare” icons, but they never got the position of important elements of research in science. The role of emotions in computer-mediated communication is important as concluded by Derks et al. [14]. The review of the empirical evidence found that emotions are abundant and it is not difficult to communicate emotions online. Further, there was no indication that computer-mediated communication is less emotional than face-to-face communication. Mauss [39] suggested that there is no benchmark measure of emotional response, and all experiential, physiological, and behavioral measures are relevant in understanding them.

There has been some research such as Picard’s work [47] on the ability of computers to sense, recognize, process, and respond to human communication.

Emotional states such as frustration, interest, joy, anger, distress, anxiety and surprise are affective states, studied thoroughly in theory of emotions as human emotions. However, Picard stresses not only on cognitive emotions but also considers various physical aspects of emotions such as facial expressions (which is apparent) and heart rate (which is not apparent). For this purpose, an intellectual framework called 'affective computing' was defined to understand ideas, its applications, and key concerns. On a general level, humans are prone to get persuaded if their emotional senses are stirred, since we become emotional beings in issues of influence. One could argue that if an entity can sense, recognize, and respond to human communication, which has embedded emotional cues, then persuasion holds a much better chance. The ability of persuasive systems employing emotions in its design hence increases its spectrum to persuade.

Emotions can be studied in various forms as well. The information systems use itself brings new psychological and behavioral challenges and these arise from human interactions with technology leading to notable stress perceptions in users. In the study of information systems, these stress perceptions related to technology are usually referred to as technostress, a term defined by psychologist Craig Brod [7]. Since then, the term has been widely used in Information Systems research in various directions such as Rene Riedl's work on it from neurobiological perspective [52, 53]. Riedl along with others [52, 53, 54] has performed an extensive research on neuro information systems especially focusing on the concept of technostress. Though the use and ubiquity of technology has greatly benefited human race, it can also be a source of stress. The importance of using psychometric methods along with the physiological data, while understanding 'technostress' from a biological perspective, has also been echoed by Tams et al. [58]. Hence to better design information systems, it is essential to study the cognitive traits of humans, their perception, and as well as their emotions. Therefore, it is essential to focus on how ISR incorporates emotions, in what way are they represented and is there any concrete method to measure them.

2.2 Persuasive Technology and Behavior Change

Fogg introduced the concept of Captology as the study of computers as persuasive technologies [19]. Persuasive technology focuses more on psychological cues for influencing while making use of Information Technology. Fogg [19] believes that humans have always been influenced by different mode of communication, which has in result changed their attitudes or behaviors whether willingly or otherwise. The term Captology is used as the area of research for the theory, design, and analysis of computers as persuasive technologies. A persuasive technology is a device or an application produced to change the attitude or behavior in a pre-decided way. The Captology concept only focuses on the planned persuasive affects expected, but of course side effects of technologies also exist. More contributions were made to the persuasive technology area by various researchers. King et al. [28] described the landscape of persuasive technologies in terms of commercial applications, persuasion strategies such as motivational positive feedback and exploring important target

domains such as health. Berdichevsky et al. [6] worked on the ethical and moral issues regarding persuading through technologies, while Tseng et al. [60] pointed out the credibility of computers in the ultimate goal of persuasion. Persuasive systems unlike other systems try to infuse cognitive or emotional change in order to transform user's mental state into a planned one. Whalen [63] stated that the goal of a persuasive system designer is less of designing a system and more of changing the user's behavior. Tarning et al. [59] further analyzed literature that was the part of the persuasive technology conferences and concluded that there is a continuous need for research on predictable persuasive methods, measurement of successful designs, and empirically proven models.

The emerging and relevant use of physiological data of individuals gathered through sensors has already got a strong basis for identifying ones emotional state. Further, sensors have become a common tool for observations in daily lifestyle [33] taking physiological measures such as heart rate, stress level, geographical location etc. People tend to attach their emotions with pictures [23], places [38], and activities etc. And these can be easily analyzed through their online and technological activities. Kahneman et al. [26] presented a Day Reconstruction Method to assess how people spend their time and experience the various activities using time-budget measurement and experience sampling. Adding to these studies, why not reinforce persuasive techniques for motivating people by taking into consideration their emotions and physiological state to influence effectively. The Persuasive Systems Design model or in short PSD model [43] provides an extensive conceptualization of technology-mediated persuasion techniques.

3 Methods

3.1 Identification of Literature

We conducted electronic literature searches for “the basket of eight” journals namely *European Journal of Information Systems (EJIS)*, *Information Systems Journal (ISJ)*, *Information Systems Research (ISR)*, *Journal of Association for Information Systems (JAIS)*, *Journal of Information Technology (JIT)*, *Journal of Management of Information Systems (JMIS)*, *Journal of Strategic Information Systems (JSIS)* and *MIS Quarterly (MISQ)*. The authors chose to limit the search to Information Systems as it is their primary study domain and these journals are considered to be the top journals in the field of Information Systems Research by Association for Information Systems [1]. The search for literature in these electronic journals was conducted in three databases (ProQuest, EBSCOHost Web, and Elsevier SD) through the National Electronic Library Interface (NELLI) [42] as the search tool, to which the access was provided by the University of Oulu library. This is a sample query utilized in the search process:

JN("MIS Quarterly") AND (TI (emoti OR Mood OR feeling*) OR AB (emoti* OR Mood OR feeling*) OR KW (emoti* OR Mood OR feeling*))*

The following terms were used in the database searches: (1) emotion*, mood, feeling* and (2) emoti*, mood, feel* while screening the titles, abstracts, keywords and tags (anywhere in the source). The authors initially made a test run to combine synonyms of emotion with 'human behaviour' and 'behaviour change' terms, but it did not reveal any substantial results. Therefore, the decision was made to restrict the terms to the earlier mentioned. The emphasis was also given to screening the bibliographies of the relevant articles, including literature reviews and meta-analyses, however the results were not fruitful. The literature research was made on 6th, 7th and 8th January 2015 at the University of Oulu premises by the first author. The publications available for each of the journal varied across the group, for example MISQ sources were available from 1977 as it was established then, while JSIS sources were available from 1995 although it was established in 1991. However, full source access was available to all journals published January 01, 1995, to December 31, 2014, in English.

Table 1. Number of articles found according to publication year.

<i>Publication Year</i>	<=79	80-84	85-89	90-94	95-99	00-04	05-09	10-14
<i>Number of articles (73)</i>	2	1	1	4	7	9	22	27

The Table 1 categorizes the findings according to publication year. The rising numbers in Table 1 depicts quite clearly the rapid rise in publication after 2005. On a general note, one could base this on the evolvement of ISR via advancement in technology. There has been a growing trend for emotions in ISR and MISQ has been at the forefront from it with 21 out of 73 identified.

2.2 Inclusion Criteria and Data Abstraction

All 73 records were included initially which were found on the basis of keywords. A literature identification process followed it. Since not all publications were available before 1994, it was essential to restrict the timeline between 1995-2014 to give an equal setting to all journals. Therefore 15 records were excluded in the first identification process. In the second step, the abstract of the remaining 58 records were screened to assess the nature of the articles whether emotions were used as part of the research or was an aspect of English language vocabulary. This step allowed the exclusion of further 17 records and rest 41 full articles were obtained for examination. After through examination in the third step, it was a critical decision to exclude all articles before 2004 and restrict the timeline from 2005 to 2014. The decision was made on the basis that articles focused on research that was (1) non-web

related (2) in non-internet era (3) had no relation with mobile technology. All articles were included which (1) had emotions as part of research either as a direct or non-direct variable (2) accepted either presence or influence of advancement in technology. This led to the exclusion of 6 more articles and the remaining 35 were included in the review. Overall, the information presented in the articles was thoroughly examined and evaluated. The quality of the articles was high as was expected from top journals in the ISR field. The data was abstracted to reveal various study characteristics as shown in further tables.

3 Results

3.1 Study Characteristics and Analysis

The characteristics of the included studies are presented in Table 2 to 9 with *author detail, the relevant problem domain, the significance of emotions in the study, and the empirical strategy*. The studies varied in terms of their problem domains and hence the objective of the studies as well. However, the 35 studies were categorized into similar or broader domains in eight separate tables for better analysis. The studies related to broader domain of e-commerce were found to be seven as listed in Table 2.

Table 2. Studies related to E-commerce (7).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Dezhi et al [15]	Effects of online Reviews	Discrete emotions in a review online	The seller reviews from Yahoo! Shopping web sites were collected to examine the relationship between emotional review content and helpfulness ratings. (7322) Reviews
Komiak et al [31]	Web based product brokering Recommendation Agent (RA)	Emotional trust	An experiment using two commercial RAs (23)
Kuan et al [32]	Group-buying sites	Positive and negative emotions to a deal	A controlled experiment with 30 group-buying deals along with EEG
Liqiong et al [35]	E-commerce/ Design of webpages	Emotional reactions towards design of webpages	5 pilot studies and a laboratory experiment to test the model and

			associated hypothesis (467)
Nah et al [41]	Virtual Worlds	Theory of positive emotions	An experimental design used to compare 2D versus 3D simulation of a virtual hospital tour (445)
Parboteeah et al [45]	E-commerce/ Design of webpages	Emotion as mood-relevant cue for impulse buying (cognitive reaction)	Two studies 1- an experimental interface design of a website 2- a controlled laboratory experiment (264/216) undergraduate students
Pelet et al [46]	E-commerce/ Design of Websites	Emotional responses as conveyed by mood	A laboratory experiment with 8 different website versions (21)

Dezhi et al [15] tried to explore the effects of emotion anxiety in a seller review on its helpfulness to readers and found that reviews indicative of anxiety were more helpful than those indicative of anger. Komiak et al [31] emphasized that emotional trust exceeds cognitive trust in determining customers intention to adopt, while Kuan et al [32] found that positive and negative “buy” information has an asymmetric influence on attitude and intention, whereas “like” information has a positive influence on intention. Liqiong et al [35] summarized findings that a web user’s initial response of pleasantness and arousal evoked by visual complexity and the order design features carry-over subsequent approach behavior toward the website. While Nah et al [41] compared 2D and 3D virtual world for telepresence, enjoyment, brand equity, and behavioral intention, Parboteeah et al [45] found that the likelihood and magnitude of impulse buying behavior is directly influenced by the quality of the task relevant characteristics of the website such as navigability and mood-relevant characteristics such as visual appeal. Pelet et al [46] cited hue and brightness with chromatic colors for websites effecting memorization and buying intention of the user.

Table 3. Studies contributing to areas of limited research in IS and its theories (5).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Ciborra et al [8]	Situatedness in IS research	Emotions as a part of comprehensive understanding of ‘whole’ person in a situation	Review of situatedness literature and the outcomes of two situational case studies
Davern et al	Cognition in IS	Interplay between	Review of cognitive

[9]	research	cognition, emotion and attitude explaining behavior in IS	research in three streams, synthesizing and illustrating evolution
Liang et al [34]	IT security research	Emotion focused coping against an IT threat	IS literature research but mainly drawing from cybernetic and coping theory
Ping [48]	Affective concepts in IS research	Emotions as a core affect attributed to stimuli	Literature research and argumentation
Resca [50]	Knowledge in IS research	Emotional as everyday knowledge in organizational life	Literature research and argumentation to Ciborra's work

The studies which contributed to areas limited research in IS and its theories are listed in Table 3. Ciborra et al [8] emphasized that to capture the inner life of the actor, mind and heart the researcher have to believe in the original meaning of the term 'situatedness' while Resca [50] tried to summarize the common theme in Caludio Ciborra's work on knowledge. Davern et al [9] made a detail review on four cognitive qualities of information technology: interactivity, fit, cooperativity, and affordances. Liang et al [34] introduced Technology Threat Avoidance Theory (TTAT) citing lack of research in the field and Ping et al [48] gave affective response model (ARM), a conceptual framework that provides a systematic and holistic reference map for any ICT study that considers affect. Moving on, the studies, which are related to IT Acceptance, Use and Adoption, are listed in Table 4. Bagozzi [4] tried to deepen the theory of Technology Acceptance Model's decision-making core by specifying psychological processes and Beaudry et al [5] studied the direct and indirect relationships between four emotions, namely excitement, happiness, anger, and anxiety. De Guinea et al made two studies [11, 12], firstly demonstrating two IS use patterns, automatic and adjusting and the second on automatic behavior and the influences of emotions on behavior. Malhotra et al [37] suggested that human behavior might result from combinations of perceived external influences and personal volition.

Table 4. Studies IT Acceptance, Use and Adoption (5).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Bagozzi [4]	Technology Acceptance Model (TAM)	The treatment of emotions has not been grounded in	Theoretical research and commentary

		theories	
Beaudry et al [5]	Information Technology Use	Role of emotions with IT use	Survey of (249) Bank managers
De Guinea et al [11]	IS Use Patterns	Emotions have different values as a construct of IS Use pattern	Two studies with different methods to study the influence of expected and discrepant events. Study 1: (58) employees from 13 organizations
De Guinea et al [12]	Information Technology Use	Influence of emotions on behavior such as they contribute to intentions to Continue Using IT	Literature reading of research on Continuing IT Use
Malhotra et al [37]	IT adoption	Emotion as psychological feeling affecting intention	Field study of a web based educational platform in a large university (211)

The studies that are related to social networks, collaboration and relationship management are listed in Table 5. De et al [13] experimented with a digital game based on how competition impact player's behavior and emotional responses, while García-crespo et al [20] tried to integrate influence of social networks in customer relationship management and presented a platform SEMO, which extracted features from social networks and relates them to consumer emotions. Hsien-Tung et al [24] conceptualizes contributions to virtual communities by small friendship group shared we-intentions and their consequences. Kelly et al [27] found that different mechanisms develop trust at different stages of a relationship. Initial stages involved care and attentiveness, however it further required a stable collaborative order. Koch et al [30] investigated that social networks sites within an organization blur the boundary between social life and work life, which creates positive emotions for employees that use the system. On the other hand, Shen at al [56] studies social networks for the purpose of collaboration.

Table 5. Studies related to Social Networks, Collaboration and Relationship Management (6).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
De et al [13]	Digital Games	Emotions as a response such as enjoyment or arousal	An experimental study to understand player behaviors and emotional responses under different competition conditions

			such as competing with similar/high/low level skills. (80)
García-crespo et al [20]	Customer Relationship Management	Emotions as part of customer behavior	A use case scenario was developed to explain the concept in a functional environment. The evaluation was performed through a questionnaire (52)
Hsien-Tung et al [24]	Virtual Communities	Role of Emotional Influence Processes in Contribution Behavior	Longitudinal quasi-experimental field study of a virtual community platform by two surveys with (972) respondents belonging to 187 different communities
Kelly et al [27]	Offshoring relationships	Trust as an 'emotional commitment'	A longitudinal and interpretive study of an Ireland-India information systems offshoring relationship over an 18 month period
Koch et al [30]	Social Networking Sites (SNS) within organizations	Theory of positive emotions	Interpretive case research methodology
Shen et al [56]	Social Network facilitated Collaboration	Emotions facilitating we-intentions	University students using QQ IM for group communication and collaboration, (482) survey respondents

The studies that are related to NeuroScience are listed in Table 6. NeuroScience research has been gaining more interest especially in the last few years. Astor et al [3] tried to improve financial decision-making by integrating physiological data into information technology artefacts through an auction game. The effort was successful in inducing arousal and rewarding in down-regulation of arousal to perform well in the game. It was concluded that the effective use of Emotion Regulation strategies could be used for rewarding. De Guinea et al [10] attempted to theorize that implicit neuropsychological states (memory load and distraction) and explicit (engagement and

frustration) antecedents interact in the formation of perceived usefulness (PU) and perceived ease of use (PEOU). The findings indicated that both constructs interact together and have a nonlinear effect on behavioral beliefs. When engagement is high, distraction does not significantly affect PU, while on low distraction has a negative significant effect on PU. When frustration is high, memory load has a negative effect on PEOU, whereas when it is low, memory load has a positive effect on PEOU.

Table 6. Studies related to NeuroScience in IS (4).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Astor et al [3]	Financial decision making	Emotion awareness and regulation to improve financial decision making	An auction game based on arousal inducing Neuro IS tool with biofeedback. (104) Participants in two evaluation studies.
De Guinea et al [10]	Information Systems Research on Behavioral beliefs	Influence of emotions on behavioral beliefs	An experiment that measured neurophysiological states while individuals worked on instrumental and hedonic tasks using technology. (24) Undergraduate students.
Dimoka et al [16]	Cognitive neuroscience in IS research	Emotions as hidden mental processes impossible to measure with current methods or tools	A neuroIS study on Technology Adoption and Use by experimenting with two manipulated websites before, during, and after an fMRI session (6)
Gregor et al [21]	Neuroscience in IS research	Assessing and understanding human emotions as constructs in IS	Two laboratory experiments conducted with 6 online travel service webpages. The first study included self-report measures and qualitative comments (42) while the second included self-reports and electroencephalography (EEG) (21)

Dimoka et al [16] reviewed the emerging cognitive neuroscience literature and proposed a framework for exploring the potential of cognitive neuroscience for IS

research. It was concluded that IS theories can be enhanced and IT systems/tools can be better designed using cognitive assessments. Gregor et al (2014) developed a nomological network with a view of relationships between emotions and other IS constructs namely physiology, language, and behavior. The study found empirical support for the 3-emotion system's nomological network and different emotion systems though inter-related; they differed in the understanding offered into emotion phenomena. The studies that are related to computer-mediated communication are listed in Table 7. Johnson et al [25] studied the hostile expressions of emotion used termed 'flaming' in negotiations on agreement, both parties involved, and the context. The study demonstrated that flames directed at the negotiation opponent slightly decrease the likelihood of reaching an agreement and if reached, it significantly favours the flame recipient. While flames directed at negotiation context significantly increases the likelihood of agreement but still favours the flame recipient. While Weiquan et al [62] examined the effectiveness of emoticons and found that using liking emoticons increases perceived good intention of the feedback provider and decreases perceived feedback negativity when the feedback is specific; however, it has no significant effect for unspecific feedback.

Table 7. Studies related to Computer-mediated communication (2).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Johnson et al [25]	Computer-mediated communication	Emotions as part of hostile expressions during negotiation	A laboratory experiment of nine rounds of negotiations was conducted using computer-mediated communication with (148) students having buyer and seller roles
Weiquan et al [62]	Computer-mediated communication	Emotions in communication as Emoticons for visual expression	A laboratory experiment with 8 emoticons varying in liking and disliking, (198) undergraduate students

The studies that are related to Information Disclosure, Sharing, and Privacy are listed in Table 8. Anderson et al [2] tested a model whether the type of information, the purpose, and the requesting stakeholder play a role in an individual's willingness to disclose information. The results suggested that requesting stakeholder's trust and the purpose for which information is required, plays an important role in willingness to provide personal health information. Further investigation revealed that the individuals with negative emotions involving their current health status are more willing to disclose that information. Stieglitz et al [57] examined whether sentiment occurring in social media content is associated with a user's information sharing

behavior. The study based on Twitter application suggested that emotionally charged Twitter messages tend to be re-tweeted more often and more quickly compared to neutral ones. Further, an advertisement design has the potential to trigger emotions. Wakefield [61] explored the roles of positive and negative affect on users' trust and privacy beliefs that relate to the online disclosure of personal information. The research found that positive affect has a significant effect on users' website trust and privacy beliefs that motivate online information disclosure and this effect is more pronounced for users with high Internet security concerns. Zahedi et al [65] investigated the evolution of trust using the case of health infomediaries and found that the structure of trust changes over time and information quality becomes the single most important antecedent in infomediary trust building in the later stages of use. Meanwhile, satisfaction plays an important role in changing Web customers' trust beliefs.

Table 8. Studies related to Information Disclosure, Sharing, and Privacy (4).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Anderson et al [2]	Healthcare Information privacy	Role of emotions in decision to disclose personal health information (PHI)	(1089) Respondents providing self-reported data to a hypothetical scenario-based electronic survey
Stieglitz et al [57]	Information Sharing behavior on Social Media	Emotions in communication	Two datasets of 165,000 tweets from twitter platform messages
Wakefield [61]	Information Privacy	Emotions related to Information disclosure	Two commercial websites for testing a model, (301) internet users
Zahedi et al [65]	Trust in Information Disclosure online	Emotions as trust	A controlled laboratory experiment in 3 phases, (209) participants

Table 9. Studies related to IT professionals, job or workplace (2).

<i>Article</i>	<i>Problem Domain</i>	<i>Significance of Emotions</i>	<i>Empirical Strategy (Participants)</i>
Lounsbury et al [36]	Personality Traits of IT professionals	Emotional resilience as a trait	Analysis on archival source of responses from personality assessment and career planning

			service of a human resource company (1058)
Rutner et al [55]	IT workplace	Emotional labour theory	A questionnaire administered to IT employees of a Fortune 100 company, (225) IT employees

The studies that are related to IT professionals, job or workplace are listed in Table 9. Lounsbury et al [36] examined the personality traits of IT professionals in relation to job satisfaction and career satisfaction through a human resource company. The findings indicated that personality traits are linked to both job and career satisfaction with emotional resilience highly correlated. Meanwhile, independent introverts are found to be better suited for IT work. Rutner et al [55] examined an IT professional's emotional dissonance, the conflict between norms of emotional display and an employee's felt emotion through a questionnaire to IT employees of fortune 100 companies. The study suggests that emotional dissonance predicts work exhaustion better than do perceived workload, role conflict, or role ambiguity, constructs, which have long been associated with work exhaustion. Job satisfaction is influenced directly by role ambiguity and work exhaustion. In turn, job satisfaction influences employee turnover intention. The next section briefly discusses the overall nature of the included studies and what impressions they collectively provide.

3.2 Discussion

There are many theories of emotions and many conflicting views. The multiple studies perceive emotions in a variety of ways. Bagozzi [4] was critical that the treatment of emotions is not grounded in IS theories, while Dimoka et al [16] considered them as hidden mental processes impossible to measure. About one-third of the studies either directly or indirectly referred to the theory of positive emotions as a basic theory in their study and only a couple of them tried to distinct between mood and emotions, namely Parboteeah [45] and Pelet [46]. Komiak [31] and Zahedi [65] took emotions from perspective of trust development in their studies.

Of the 35 studies included in the review, 28 based their work on some empirical investigation. The rest of the studies either focused on literature research either for their proposed arguments or proposed theory. The use of physiological data as a way to identify the neurophysiological state in the studies was the focus for Astor et al [3], De Guinea et al [10], Dimoka et al [16], Gregor et al [21] and Kuan et al [32]. The authors used fMRI sessions and electroencephalography (EEG) based data to support their empirical investigations. Such empirical strategies might have a lot of potential in the field of persuasive technologies.

Table 10. Studies involving IT artifacts in empirical study inclined towards Persuasion.

<i>Article</i>	<i>IT Artifact</i>
Astor et al [3]	An auction game based on design guidelines for NeuroIS tools with Bio-feedback
De et al [13]	A framework for game playing research under different competitive conditions
Dimoka et al [16]	Two manipulated websites differing in functionality (usefulness) and user friendliness (ease of use)
Komiak et al [31]	Two Recommendation Agents with high and low level of personalization.
Kuan et al [32]	Group buying sample deals manipulated to persuade consumer to purchase
Liqiong et al [35]	Manipulated webpages with stimuli to induce emotional response

The 28 studies that had an empirical strategy, only a handful (6 in number) were found to be using some kind of IT artifact which was potentially persuasive in nature, those studies are listed in Table 10 with a brief description of the IT artifact. Almost all the articles echoed the need to improve the IS theories in order to decode the human behavior. The renowned researchers such as Ciborra et al [8], Davern et al [9], De Guinea et al [11], Dimoka et al [16] and Gregor et al [21] raise these concerns. According to Dimoka et al [16], the present IS literature is lacking in cognitive, emotional, and social processes because of the complex interplay between IT and information processing, decision making, especially behavior among individuals. The cognitive NeuroIS literature informing IS research usually now termed as NeuroIS has been gaining ground as researchers try to employ neurophysiological measurements to support their work. The studies try to triangulate the neurophysiological data with the subjective data in their study to facilitate and show the emotional effect on social behavior.

The multiple studies vary from the perspective of how the emotions are being studied from the pivotal position of an Information System. Whether the Information System is being used as emotion communication vehicle or Information System design is actually inducing emotions in the user. For instance, all the studies related to e-commerce or the games experimented by Astor et al [3] and De et al [13] point to the latter purpose. This means that the systems are being designed with purpose of inducing emotions in users to achieve a completely different goal. On the other hand, studies those come under computer-mediated communication are trying to assess the effects of emotions when transmitted through Information Systems. This gives way to the third kind of studies, which focus on the relation between the emotions and 'use' of Information Systems for a specific purpose. For instance, studies related to privacy and security in Information Systems. In the case, where the topic under research is the

decision to disclose personal health information based on individual's emotion, Information System in some way takes a neutral position. In addition to this view, the review indicates that when emotions are studied as constructs there is no standard as to what measure of emotions meets or surpasses conventional criteria for evaluating reliability and validity.

There is a growing trend seen in the study of emotions as mentioned earlier in the paper and this literature trend review was performed in January 2015. There is a high probability that in the mean time more work important research has been done concerning this topic. For example, Tams et al [58] work on illustrating the 'Holistic Effects of Neuroscience and Self-Reported Data in the Context of Technostress' was only available after the literature research period. Therefore, searching literature in the last year or so might reveal additional articles related to the study of emotions and is a potential future research step. Furthermore, searching the used terms in databases like Scopus and Google might significantly increase the number of hits as well. This certainly provides an opportunity for scholars to grab by expanding research 1) to more databases such as Scopus, 2) more domains such as Human Computer Interaction, and 3) by adapting a robust systematic literature review process from various sources such as Okoli [44], Hammersley [22], and Kitchenham [29].

4 Limitations and Conclusion

Analyzing emotions in a literature review is a challenging task considering the complexity of understanding emotions itself. While conducting such a review with articles diving into multiple problem domains, potential bias always lies in the interpretation of the articles. The authors only concentrated on the top "basket of eight" journals for there cannot be any doubt about the quality of resources, however the authors cannot claim that all relevant research in the IS field has been overviewed. But any non-recurring research topics would still give consent to more work needed in the research area to reach the top journals.

In this review we analyzed the previous information systems research on emotions. The authors think that a further robust systematic literature research is recommended to recognize and analyse the previous work on emotions as an aspect of human behavior. By only understanding the extent to which emotions have been studied in detail, we can use the knowledge to improve information system design.

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