iConference 2015 Workshop Proceedings

On the Role of Engagement in Human Information Interaction: From Research to Implementation

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# Table of Contents

## Workshop Proposal

1-3

## Short Papers

**Affective Search: How Does Affect Impact Web Search Performance?** Niloufar Sarraf, Queensland University of Technology  
4-6

**Do People ‘Like’ Me? Assessing Social Media’s ‘Like’ Button and its Impact on Self-Esteem,** Sarah-Rose Marcus, Rutgers University  
7-11

**Theoretical Considerations on Emotions and Engagement for Systems Design,** Miriam Matteson, Kent State University  
12-14

**Text-Based Methods for Measuring Dynamic Affect in Learning Games,** Daniel Perry and Cecilia Aragon, University of Washington  
15-17

**Encouraging and Maintaining Engagement in Online Communities: The Importance of Translation and Coherence,** Adam Worrall, Florida State University  
18-20

**GIS RTM User Engagement via Social Media,** Anthony J. Corso, Claremont Graduate University, Claremont  
21-23

**A Proposal of Applying Page-centric Collaborating E-learning System to Communication and Seeking,** Yuhki Shiraiishi, Yukiko Kawai, Jianwei Zhang and Toyokazu Akiyama, Tsukuba University of Technology and Kyoto Sangyo University, Japan  
24-26
Workshop Proposal - On the Role of Engagement in Human Information Interaction: From Research to Implementation

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Abstract
This workshop will provide a forum for researchers, practitioners and developers interested in user engagement and emotion in the context of human information interaction. Specifically, the workshop aims to address the following questions: “How do we ensure that the measurement of subjective information experience is robust and scalable?”, “How do we design interfaces for engaging and emotionally compelling experiences?”, and “How do we prevent disengagement?” The ability to answer these questions relies upon: a solid conceptual understanding of subjective experiences; robust, scalable approaches to measuring engagement; and the ability to utilize this knowledge in information systems and interface design. This three-part half-day workshop will include: talks by the organizers to ground the workshop’s themes; position paper presentations and design exemplars from attendees, and an interactive session focused on design scenarios and prototyping. The intersection of emotion and engagement with measurement and design in information interaction contexts is a timely issue for the iSchool community.

Keywords: user engagement; emotion; measurement; design; human information interaction

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1 Introduction
Everyday we spend a significant amount of time online, connecting with other people, accessing information and sharing knowledge. In parallel, we use a broad array of information resources (e.g., Q&A forums, databases) and modes (e.g., smart phones, social networking applications) to interact with information. This abundance of digital content is problematic for many users, but also information purveyors, such as libraries and other cultural heritage organizations, as well as online search companies, e-commerce firms, educational institutions, governments, etc.: How can information environments be designed to satisfy functional user and organizational needs, yet still be compelling?

For the user, access to relevant content has become a non-trivial task. Despite the abundance of work in information retrieval, human-computer interaction, and design, many information systems may be considered inadequate due, in part, to the failure to understand the inter-relation between the physiological, cognitive and affective needs of users. The time is right to develop a coherent framework that accounts for the unique personalities, emotions, motivations and information needs that inform, constrain, and influence people’s interactions with information in manifold ways. Development of scalable and accurate methods for quantifying user engagement in information interaction contexts, including but not limited to online search and digital libraries, could mitigate the factors that lead to abandoning and disengaging from information systems.

In recent years, there has been much emphasis on emotion and engagement in digital information interactions [9]. Self-report measures [12] and physiological methods, such as facial recognition [1,10], have been used in small-scale user studies, while large-scale web analytics have sought to identify behavioral patterns of engagement [2,3]. Yet, we are still challenged by the measurement of highly subjective information experiences. Traditional metrics of engagement are typically optimized to capture the whole spectrum of the user experience in a single way, resulting in inaccurate assessments. Numerous studies have emphasized the need to move towards a broader understanding of engagement for a number of diverse domains.
[6,11]. What is more, we do not yet know what makes one website or digital library interface more or less engaging than another.

2 Workshop Themes
This workshop aims to provide a forum for researchers, developers, and students interested in user engagement and emotion. The workshop will focus on subjective experiences with information systems broadly defined, including digital libraries and repositories, mobile apps, or museum, web search, social media, or online learning interfaces. Specific questions for exploration include:

- What is the value of developing engaging information systems? What do they contribute to the user experience and/or user outcomes?
- What methods and measures are appropriate for evaluating subjective user experiences? How do we know if they are robust?
- How do we design for user engagement with information-rich systems and applications? What ethical, cultural, usability, and aesthetic concerns must be considered?
- How do we prevent disengagement?
- How do we “scale up” small-scale techniques for measuring engagement and emotion and connect them with large-scale techniques, such as web analytics?

3 Format
Session One: Foundational talks by the organizers related to the workshop’s purpose and themes (60 minutes):

- Current state of user engagement research in various online information settings (O’Brien);
- Emotion research in information retrieval and museum communities (Lopatovska);
- Scalability issues, web analytics, and engagement in web search (Arapakis).

Session Two: Lightning talks based on position papers by attendees. Examples of applications that illustrate engaging/emotional design, as well as innovative research studies, are encouraged (50 minutes).

Session Three: An interactive session, centered on design scenarios, where we will explore innovate ways to create engaging and affectively compelling information systems (80 minutes). Participants will develop engaging and emotional interface prototypes for specific information environments based on provided scenarios, and present these to the larger group.

Workshop wrap up: Plans for future engagement and community building (10-15 minutes). The organizers invite potential attendees to submit brief position papers to the organizers addressing one or more workshop themes or illustrating systems that exemplify engaging design. Workshop proceedings will be published in the University of British Columbia’s Institutional Repository.

4 Conclusion
A central question being posed by researchers, practitioners and designers in a variety of information settings is, “Are we engaging users?” The ability to answer this question relies upon: a solid conceptual understanding of subjective experiences; robust, scalable approaches to measurement; and the ability to utilize this knowledge in information system design. Thus the intersection of emotion and engagement with measurement and design in information interaction contexts is a timely issue for the iSchool community. The format of the workshop offers opportunities for attendees to engage with the theoretical (session 1) and
applied (session 3) nature of emotion and engagement, and to bring their own examples, experiences, and challenges into the session (session 2).

References
Affective Search: How Does Affect Impact Web Search Performance?

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Abstract

Information retrieval processes entail complicated cognitive processes, which are also composed human emotion responses (Picard, 2001). These entail physiological and neurological reactions. In order to understand the role of affective responses in information retrieval, more specifically within search process, researchers need to investigate these interactions from multiple perspectives (Scherer, 2005). However, our understanding of how emotions affect information retrieval, as revealed in search performance, is limited (Nahl & Bilal, 2007). There is a gap in the body of knowledge on the effects of physiological and neurological responses on information retrieval, more specifically on web search performance. My doctoral research aims to examine cognitive relationships between dimensions of human emotions and information retrieval, as in search performance. My aim is to increase our understanding in regards to affective search, improving information systems design practices, and investigating ways to design ‘smart’ information systems that learn and improve search results based on neuro feedback. This pilot study examined the neurological relationship between dimensions of emotions and web search performance by applying emerging and cutting edge research technologies, such as electroencephalography (EEG), thereby increasing our understanding of affective search and improving information systems design practices.

Keywords: affective information retrieval, affective search, neuro-information science, brain computer interaction, information systems design


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1 Introduction

The affective component of information retrieval system design is becoming increasingly essential within the field of information retrieval, as it encompasses complicated human cognitive processes. Cognitive processes include not only mental processes but also emotion (or affective) processes and responses (Picard, 2001). Therefore, it is important to move toward understanding the affective dimension of information retrieval. The goal of this study is to explore and examine the neurological affective components of information retrieval systems, more specifically in web search processes and search performance.

Over the past decade, information retrieval research studies have evolved and become increasingly sophisticated. System-oriented approach was one of the first types of studies where information retrieval systems were the focal point of attention. However, researchers began to realize that not only do we need to examine machines but we also need to study user interaction with the systems. This, in turn, led to user-oriented approach. Shortly thereafter, researchers began to detect sophisticated cognitive processes when dealing with information retrieval systems. As a result, studies began to turn to cognitive-oriented approaches.

Most recently, research communities are detecting how human emotions may play a significant role in human computer- interaction. Expressions such as “pleasurable engineering” or “emotional design” have become the driving factors in system design, and these expressions have also been extended to information retrieval system design (Nahl & Bilal, 2007). These emerging factors and expressions indicate the important role of emotions in human-computer interaction, highlighting the importance of including the affective dimensions when designing information retrieval systems. However, our understanding of how emotions affect search processes, as revealed in search performance— search effectiveness and search efficiency—is limited (Nahl & Bilal, 2007).
As a result, the emotion-oriented approach has risen to the surface, making researchers realize the potential effects of affective dimensions on user information retrieval processes. More specifically, researchers are increasingly exploring the neurological aspects of cognitive and emotion responses. This research intends to contribute to the emotion-oriented approach studies, aiming to add value to the evolution of information retrieval research approaches by further exploring neuro-information science.

2 Problem statement and Research Questions
There is a gap in the current body of knowledge on the effects of physiological and neurological emotion responses in information retrieval, more specifically on web search. This pilot study aimed to examine the effect of different dimensions of emotions on web search performance, as revealed in search efficiency and search effectiveness.

- Q1: How do dimensions of emotions affect search effectiveness?
- Q2: How do dimensions of emotions affect search efficiency?
- Q3: Are there any interactional effects between dimensions of emotions and search performance?

The hypothesis is that positive emotional states have positive effects on information retrieval and negative emotional states affect users’ web search performance negatively.

3 Industry implications
In an era when humans are creating brain controlled airplanes, neuro-gaming, and robots that learn behavior by reading human emotions, there appear to be no limits in having search engines read human emotions in order to improve search results based on the neurological feedback they receive from brain waves. Thanks to technologies such as Interaxon and Emotiv, EEG devices have readily been made available to researchers interested in neurorelated studies that otherwise would have not had access to expensive fMRI machines. Although the two devices measure different aspects of the brain, nonetheless, EEG devices help researchers conduct neuro-related studies. I envision my dissertation adding to the body of knowledge of Neuro Information Science in developing search engines that, through wearable computing devices that are able to read brain waves and dimensions of emotions in order to improve search results based on the neurological feedback that the search engines receive from brain waves.

In other words, search engines become an extension of the human brain by receiving brain waves that constantly provide neurological feedback in terms of the search results that they provide. All the while, the search engine reads brain waves by receiving the brain signals through wearable computing devices. Gradually, the search engine may ‘learn to improve’ its results based on, for example, alpha (calm) brain waves received.

4 Conclusion
This research topic will be a beneficial addition to the current body of knowledge in the field of Neuro Information Science. We need to increase our body of knowledge and strive to understand how human affective responses impact human-computer-interaction. This, in turn, will help us design smarter information retrieval systems. Most recently, Artificial Neural Networks, the complex adaptive deep learning systems (a step beyond machine learning) that use statistical learning algorithms, increasingly strive to model the human brain’s biological neuron networks and architecture. These computations, although artificial, strive to model human decision-making processes and aim to estimate a wide range of computational functions based on large sets of data inputs. It is worth noting that artificial neural networks, while quite sophisticated in computing and recognizing patterns, at the moment, primarily receive their input from data types, such as pixel, binary, digital, etc. These artificial neural networks are codes that aim to simulate the way in which the human brain learns, more specifically in recognizing patterns or creating memories. The codes are organized in layers in order for the systems to learn to understand various data inputs.

While the artificial neural networks are still in their infancy, it is essential to recognize that, to this day and to my knowledge, they are based solely on digital data input. System programmers and architectures fail to approach these efforts based on a holistic view of the human brain. In other words, the main component of emotion is missing from this equation. I propose that adding one additional data input of human emotion may improve these artificial neural networks. One of the main contributions of this research paper is my proposal to the scholars of Artificial Intelligence to include human emotions readings via wearable computing devices as an additional data put for their statistical learning algorithms when creating these artificial neural networks.
References


Do People ‘Like’ Me? Assessing Social Media’s ‘Like’ Button and its Impact on Self-Esteem

Sarah-Rose Marcus, Rutgers University, School of Communication and Information

Abstract
This proposal investigates the causal relationship between the “like” function on social media and changes in state self-esteem. Drawing on social comparison theory, I hypothesize that users’ levels of self-esteem will increase based on the amount of “likes” that they receive, the degree that one’s “like count” surpasses their aspiration level and the degree that one’s “like count” exceeds the “like count” of their peers. I propose a mixed methods approach that includes both a qualitative observation and an experimental design. The qualitative observation will closely monitor changes in self-esteem in relation to social media posts, while the experiment will manipulate the amount of “likes” that users receive. Observations will be recorded using specimen records, observation logs and beeper responses of a self-reported self-esteem measure. Experiments will include three conditions based on the number of “likes” distributed to participants (low “likes,” medium “likes” and high “likes”) and will measure self-esteem using the State Self-Esteem Scale. This paper argues that these methods are most efficient for testing the causal relationship of “likes” and self-esteem by providing both a controlled manipulation and an observation in the field.

Keywords: self-esteem, social media, social comparison, ecological psychology


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Research Data: In case you want to publish research data please contact the editor.

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1 Introduction
It goes without saying that social media has become pervasive for most adult Internet users in the United States. Sites such as Facebook and Instagram are currently a part of our habitual communication patterns in which users check in on a daily basis (Duggan & Smith, 2013). Individuals take advantage of social media’s features in order to enhance their interpersonal communication and strengthen their relationships.

A more recent feature that has emerged in popularity over the past several years is the “like” button. This button was first launched by Facebook as a simple way for individuals to let others know that they enjoyed a post “without having to leave a comment” (Facebook, 2014). Individuals began to use the “like” button as a passive way of showing interest without having to engage in conversation. This button helped users connect with their weak ties (Granovetter, 1973) without seeming inappropriate. Individuals also engaged with the feature to show close friends and loved ones their unconditional support. “Liking” content has become so commonplace that it is now considered an everyday Facebook activity. As of May 2013, there have been 4.5 billion “likes” generated daily, which was a 67% increase from August 2012. Sites such as Instagram have also adopted the feature and see 1.6 billion “likes” each day (Instagram, 2014). As the behavior of “liking” becomes part of daily life, it becomes important to understand the consequences it might have.

Public discourse depicts exaggerated claims about the impact that the “like” button has on social media users’ self-esteem. For example, a 2014 Ford consumer report claimed that 62 percent of adults worldwide reported having higher self-esteem after receiving positive social media feedback (Connelly, 2014). The Thailand Department of Mental Health also recently issued a statement that not receiving enough “likes” on a “selfie” could potentially cause young adults to have “a negative attitude toward themselves” (Campbell, 2014).

These arguments within the popular press are not grounded in reliable data. This calls for the academic community to test the validity of these assumptions through more meticulous research. The proposed project will be the first academic study to examine whether social media’s “like” feature directly impacts users’ levels of self-esteem. This gap is quite surprising given the amount of literature on social media
and self-esteem (Gonzales & Hancock, 2011; Krämer & Winter, 2008; Valkenburg, Peter, & Schouten, 2006) as well as psychological well-being (Burke, et al., 2010; Ellison et al., 2008).

2 Method
This study contributes to the findings mentioned above and provides insight across the disciplines of psychology, communication studies and technology studies. Using observational methods and experiments, I plan to explore whether the number of “likes” received on the site of Instagram can directly lead to changes in self-evaluations. Drawing on the theoretical framework of social comparison theory (Festinger, 1954), this study tests the following hypotheses:

H1: A higher amount of “likes” will lead to a higher level of state self-esteem.

H2: The higher a person’s “like count” exceeds their aspired number of “likes,” the higher their level of state self-esteem will be as a result.

H3: The higher a person’s “like count” exceeds the “like count” of their peers, the higher their level of state self-esteem will be as a result.

First, I participate in an in-depth observation of active Instagram users and monitor how they feel about themselves before, during and after their Instagram posts. I plan to follow each member of my sample for a one-week period (Sunday-to-Sunday; 11 AM to 11 PM). I will monitor each social media post through an observation log that records the number of “likes” that participants receive. Observational data will be recorded through specimen records, which record behaviors and situations using a “detailed, sequential narrative” (Barker & Wright, 1954, p. 15). I plan to also have the participants record their own self-esteem levels. Each participant will carry with them a beeper, which will randomly alert them throughout the day (approximately twice per hour). The beeper will ask, “On scale of 1-5, with 5 being feeling extremely good about yourself, how do you feel about yourself during this particular moment?” Users will simply answer the question by punching in their answer number (1 to 5) into the beeper.

Part II of the study involves an experimental manipulation. Each participant will be provided a smartphone with a ready-made Instagram account and will be told that they can change the name, picture, and personal bio. Participants in each condition will be given 92 pre-determined followers and 5 pre-determined users who they will be following. Each participant will also be provided a minifeed that displays 5 phony posts of college-age students with an average of approximately 53 “likes.” Participants will be instructed that they have 30 minutes to post a picture of an object distributed by the staff member. Over the course of 20 minutes, participants will be told to remain on their Instagram accounts until they receive their final results. During this time, the number of “likes” that they receive will be manipulated by an application used by the experimenter in a nearby room. There will be three conditions: A “low like” condition (23 “likes”), a “medium like” condition (53 “likes”), and a “high like” condition (83 “likes”). State self-esteem will then be measured using the State Self-Esteem Scale (SSES), with 20 items measuring self-esteem (alpha= .92).

3 Conclusion
The present study is of high value because it is the first to provide evidence on the relationship between social media “likes” and self-esteem. Previous methods have yet to indicate a clear direction of association between social media use and changes in self-esteem. The time-order of this effect cannot be tested through a cross-sectional survey in which data is collected at one moment in time. A longitudinal measure would also be inappropriate for assessing the fluctuations of self-esteem. The most useful way to measure this short-term effect is to manipulate a variable in a true experiment. The proposed observation will also provide a fruitful way of discerning how this process occurs “in the field.” Using this method in addition to experiments will help to identify the interpersonal, community and contextual factors that might impact self-esteem. These findings could then direct scholars to develop further measures for testing the causal connection between “likes” and self-esteem.
References


### Appendix A: Observation Log

<table>
<thead>
<tr>
<th>Hour 1</th>
<th>Time (per 10 minutes)</th>
<th># Of “likes”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours 2 and 3</td>
<td>Time (per 20 minutes)</td>
<td># Of “likes”</td>
</tr>
<tr>
<td>Hours 4-10</td>
<td>Time (per half hour)</td>
<td># Of “likes”</td>
</tr>
</tbody>
</table>

### Appendix B: Beeper Directions

Please punch in your answer to the following question into buttons 1, 2, 3, 4 or 5.

On scale of 1-5, with 5 being feeling extremely good about yourself, how do you feel about yourself during this particular moment?

### Appendix C: Coding Sheet of Self-Esteem Monitor

<table>
<thead>
<tr>
<th>Time of beep</th>
<th>Self-esteem level (1-5)</th>
<th>Number of hours/minutes before post</th>
<th>Number of hours/minutes after post</th>
<th>Current number of “likes”</th>
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Appendix D: Hypotheses Measures

Directions: Please answer the following questions in an open-ended response.

1. Approximately how many "likes" do you hope to achieve on your post?
2. Approximately how many "likes" did the users in your mini-feed receive on their posts?

(After distribution of "likes")
3. How many "likes" did your post receive?

Appendix E: State Self-Esteem Scale (Heatherton & Polivy, 1991)

Current Thoughts

This is a questionnaire designed to measure what you are thinking at this moment. There is, of course, no right answer for any statement. The best answer is what you feel is true of yourself at this moment. Be sure to answer all of the items, even if you are not certain of the best answer. Again, answer these questions as they are true for you RIGHT NOW.

1=not at all 2=a little bit 3=somewhat 4=very much 5=extremely

1. I feel confident about my abilities.
2. I am worried about whether I am regarded as a success or failure. (R)
3. I feel satisfied with the way my body looks right now.
4. I feel frustrated or rattled about my performance. (R)
5. I feel that I am having trouble understanding things that I read. (R)
6. I feel that others respect and admire me.
7. I am dissatisfied with my weight. (R)
8. I feel self-conscious. (R)
9. I feel as smart as others.
10. I feel displeased with myself. (R)
11. I feel good about myself.
12. I am pleased with my appearance right now.
13. I am worried about what other people think of me. (R)
15. I feel inferior to others at this moment. (R)
16. I feel unattractive. (R)
17. I feel concerned about the impression I am making. (R)
18. I feel that I have less scholastic ability right now than others. (R)
19. I feel like I'm not doing well. (R)
20. I am worried about looking foolish. (R)

Theoretical Considerations on Emotions and Engagement for Systems Design

Miriam Matteson, Kent State University

Abstract

Borrowing theories from psychology on emotions and engagement provides information science researchers alternative lenses through which to study and develop information systems that facilitate positive emotional user engagement. Several constructs with potential value to information science are introduced with brief commentary on how they might support information systems design and research. While these theories do not tell us how information systems should be designed, they do provide a basis for understanding users’ emotional responses to information systems, and suggest ways to uncover factors and conditions that influence users’ engagement with information systems.

Keywords: Emotions; Broaden-and-Build Theory; Work Engagement; Job Demands-Resources Model; User Engagement: Information Systems Design

Introduction

In this position paper, I introduce several theories from psychology related to emotion and engagement, relate them to user engagement, and suggest ways in which they may contribute to information systems design.

Emotions are brief responses to stimuli: individuals perceive a stimulus, which triggers an appraisal process, resulting in the experience of an emotion. Stimuli can be events, interactions, experiences, or routine elements of a given environment, and the appraisal process is a cognitive interpretation of the stimulus according to a schema that considers attributes such as certainty, agency, expectedness, probability, or control potential (Roseman, 1984). Frederickson’s (1998) Broaden-and-Build theory of positive psychology provides a basis for predicting how information systems influence users’ emotions positively or negatively and offers a justification for information systems that facilitate positive emotions in users. As articulated in the Broaden-and-Build theory, positive and negative emotions have different effects on people. Researchers have shown that discrete negative emotions are linked to tendencies toward a specific set of actions: fear is linked with escape, anger is linked with the desire to attack, disgust is linked with the desire to expel (Fredrickson, 2001). In contrast, responses to positive emotions, such as joy, interest, pride, contentment, or love, lead to a less constrained set of responses (Fredrickson, 2004). For example, joy is linked with the urge to play and be creative; interest is associated with the desire to take in more information and stay engaged; contentment creates the desire to appreciate life experiences and recreate those experiences. This is not to say that people always follow specific action repertoires, but that our responses tend to come from a narrow set of options when we experience negative emotions, and that positive emotions evoke modes of thinking and behavior with less constrained possible outcomes – that is, they broaden experience. Further, positive emotions have a longer-term effect by building up a personal reserve of positive emotional resources that can be tapped during times of difficulty. Research has shown that positive emotions broaden the range of individual behaviors (Fredrickson & Branigan, 2005)undo the narrowing effects of negative emotions (Fredrickson, Mancuso, Branigan, & Tugade, 2000)increase psychological resiliency (Tugade & Fredrickson, 2004)and add to reserves of personal emotional resources (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008).

The Broaden-and-Build theory provides an underlying explanatory mechanism for the emotional responses observed (such as motivation, enjoyment, fun, along with the frustration, guilt, and boredom) when users interact with information systems as reported in O’Brien and Toms’ (2008) research on user engagement. Interacting with an information system provides a stimulus to users. How they perceive that stimuli may result in negative or positive emotions. Negative emotions are more likely to result in a reduced range of available actions, most of which point to discontinued use of the system. In contrast, when users experience positive emotions, they are more likely to demonstrate a desire to play, interact, explore, or savor the experience (Fredrickson, 2001). Thus the emotion process and the Broaden-and-
Build theory together explain the connection between users’ interactions with information systems and subsequent action repertoires, which have been broadly described in the O’Brien and Toms (2008) model of engagement, reengagement, and disengagement.

User engagement can also be considered in conjunction with the construct of work engagement, a “positive, fulfilling, affective-motivational state of work-related wellbeing…” (Leiter & Bakker, 2010, p. 1) Work engagement includes a sense of activation or energy towards and identification with one’s work, and has been operationalized through the Utrecht Work Engagement Scale (UWES) with 3 subscales: vigor, dedication and absorption (Schaufeli & Bakker, 2010) Work engagement seems to fit reasonably well into the notion of user engagement, as reflected in the User Engagement Scale (UES) (O’Brien & Toms, 2013). Absorption, a cognitive sense of losing oneself in work, seems to map well to the UES subscale of “focus attention”. Dedication speaks to an emotional aspect of work engagement including feeling proud and inspired by work and maps to the combined subscales of “felt involvement”, “endurability”, and “novelty”. Vigor, the idea of energetic behavior, seems of the three the least related to the UES, although there may be some connection to elements of the UES subscale “perceived usability”, perhaps reversed scored. One possible point of exploration between work engagement and user engagement would be to test for overlaps among the factors of each construct, and to consider whether either engagement construct may be meaningfully expanded by the other.

Research could also explore factors or conditions that are antecedents to either kind of engagement. The work engagement construct is most often linked with the Jobs Demands–Resources (JD-R) model, a descriptive framework which says that in every occupation there are factors that are job-demands, or stressors, and there are job-resources, or motivators (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). Job demands and job resources may be physical, psychological, social, or organizational (Schaufeli, 2012). Job demands tax mental and physical resources, resulting in burnout or mental weariness (Schaufeli & Bakker, 2004) while job resources have a motivational effect on employees leading to work engagement. From an organizational perspective, one obvious connection between user and work engagement is to explore how information systems use may be either perceived as a job stressor or a job resource. (See Derks and Bakker (2010) for an example.) Information systems that users view as a job resource (something that facilitates work accomplishment), not a job demand (something that causes strain) should result in 1) a positive relationship to work engagement, 2) a negative relationship to burnout, and 3) a buffer to the negative effects of other job demands. Testing information systems use as a demand or a resource could apply to engagement in work environments as well as with hobby or personal arenas.

Systems researchers could also apply the JD-R model as a possible explanatory mechanism for user engagement, where burnout is replaced by disengagement or non-use and work engagement becomes user engagement. Research could examine the factors—individual, system, or organizational—that function as either demands (stressors) or resources (motivators) toward engagement or disengagement with an information system. The constructs of demands and resources from the JD-R model, though similar to idea of contextual measures in information retrieval measurement (O’Brien & Toms, 2013), may offer a unique path through which to elicit other demands and resources that would usefully inform information systems design.

2 Conclusion
In short, Broaden and Build, Work Engagement, and JD-R model provide information systems designers and researchers alternative frameworks to apply to user engagement and systems design.

References


Text-Based Methods for Measuring Dynamic Affect in Learning Games

Daniel Perry, University of Washington
Cecilia Aragon, University of Washington

Abstract
Positive affect has been shown to increase learning performance and retention. While a growing number of serious and educational games are being designed and researched, few are designed with an acute understanding of affective processes in gameplay. In this position paper, we discuss several commonly used techniques for measuring emotion and engagement in games, and recommend a methodology that accounts for affect as a dynamic system in educational games. We further discuss the preliminary analysis of text-based chat logs from a bioinformatics learning game to support our recommendations. This work has implications for the design of affective experiences in educational games and other learning environments.

Keywords: Game-based learning; serious games; affect; emotion; text analysis.


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1 Introduction
Emotion and affect have been shown to be important indicators of interest, engagement, and creativity in tasks (Fabri, 2004). Additionally, social technologies that support collaboration and peer connection can play an important role in fostering a positive youth identity (Bers, 2007). There is therefore much value in understanding the role of affective states within the framework of learning games. While the terms are frequently used interchangeably by scholars, we draw on Russ’s (1993) understanding of affect as feeling states that are more inclusive and pervasive than the interrupting experience of emotions. Aragon and Williams (2011) developed a theory of collaborative creativity accounting for affect as a dynamic and complex system. We suggest that a dynamic systems model is similarly useful for understanding areas of affect-laden content measured in chat logs of educational games, and can complement existing methods of categorizing by valence (positive and negative affect states).

2 Background
Several methods of determining affect, emotion, and engagement in gameplay are commonly used. These include the measurement of physiological signals, the use of self-reported survey data, researcher observations during gameplay, and a text-based analysis of chat logs. Studies that collect physiological measures, such as electroskin conductance (e.g., Ivory, 2007) or electrocardiogram signals (e.g., Ravaja, 2006), often combine and compare these measurements with self-reported assessments of emotional state. Conati (2002) presents an approach using a Dynamic Decision Network and physiological measures to estimate players’ emotional state while playing educational games. A growing body of research has also worked to automatically adapt game difficulty and state based on players’ physiologically measured emotional state (e.g., Chanel, 2011; Liu, 2009). Lazzaro (2004) observed gameplay sessions to determine four areas of fun and to gain insights into associated emotions. A challenge with many of these measures is the dependence on an experimental setting for collecting this data.

There have also been several notable studies that use a text-based analysis of game chat logs to understand the affect and experience of players. Ducheneaut et al. (2006) conducted an analysis of text-based communication in World of Warcraft (WoW), noting that WoW’s players utilized chat as a form of performance and for diffuse information access. In research on text chat in BZFlag, an open source capture the flag game, Herring et al. (2009) found that that messaging between players occurred at seemingly regular intervals of the same length, and that the majority of messages were related to reactions to gameplay. There have additionally been several strategies for categorizing affect in communication in games. Peña and Hancock (2006) categorized participant text messages into socio-
emotional and task-based messages, finding the majority of the messages to be socioemotional and positively valenced. While categorization by valence and task is useful, our analysis suggests there are benefits to augmenting these techniques with a more dynamic understanding of affect in learning games.

3 Methodology & Discussion

We discuss the preliminary analysis of chat logs from the bioinformatics game MAX5, where youth (ages 14 – 19) played the PC game within the context of a high school science class (Perry, 2013). Players were automatically and randomly paired, communicating through an in-game chat interface to complete game missions to stop the spread of a deadly flu virus. Two independent coders analyzed 171 chat messages that were sent and received in the in-game chat tool. Task-based messages contained procedural content related to accomplishing game tasks and did not contain affect. We found 53 instances of affect-laden messages either negatively or positively valenced (the joint-probability of agreement between coders was 78%). We found 69 instances of task-based messages (the joint-probability of agreement between coders was 86%). Codes in disagreement were not included in the sample. Overall there were a greater number of messages expressing negative affect than positive affect (36 negative as opposed to 19 positive messages). While the small sample size prevents us from making generalizable results, it does allow us to compare coded categories with a more qualitative content analysis. We further posit that binning by positive and negative affect and task-based messages, while helpful, does not adequately reflect the dynamic interactions we observed in the logs over time.

![Image of a coded chat log collected from the bioinformatics game MAX5.](image)

In the example above (Figure 1), a player asks for task-based information related to the game mission and an affective exchange follows this. While there are more negatively coded messages in this example than positive, the overall tone is actually quite playful and supportive in nature. This exchange mirrors a process that Aragon and Williams (2011) refer to in their collaborative creativity model as the frame stage, in which a sense of trust is formed and group members work “to absorb external information, data, ideas, and intellectual nourishment, and at the same time to filter out potentially harmful environment pressures.” In this particular case, we observe a damping of negative affect with banter that is supportive in tone.

In this preliminary work, we suggest a dynamic model of affect applied to in-game chat logs provides a useful understanding of how and why valence is operating within a learning game. In further work, we are additionally interested in ways we can extend this analysis of dynamic states using an automated approach that is scalable to larger data sets.

References


Table of Figures

Figure 1. A coded chat log collected from the bioinformatics game MAX5. ......................... 16
Encouraging and Maintaining Engagement in Online Communities: The Importance of Translation and Coherence

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Abstract
This brief position paper argues that an important element of encouraging and maintaining engagement with an information-centric, information and communication technology (ICT)-supported online community is to support and facilitate the processes of translation and coherence. Based on the literature and a recently completed study of the roles that LibraryThing and Goodreads play as boundary objects in the existing and emergent communities of their users, leaders of online communities should focus their engagement on the processes that create resources for translation and coherence to facilitate further knowledge sharing and creation, the development of common ground, and enhance the role of the online community and its technology as a key site for engagement in information behavior and activities. Consideration of translation and coherence are vital for users’ continued engagement with an online community and the technology that supports it.

Keywords: online communities, translation, coherence, engagement, information and communication technologies


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1 Introduction and Background
This position paper puts forth the argument that an important element of encouraging and maintaining engagement with an information-centric online community supported by information and communication technologies (ICTs) is to support and facilitate the processes of translation and coherence. In a recently completed research study, I examined the roles that two digital libraries and online communities, LibraryThing (librarything.com) and Goodreads (goodreads.com), play as boundary objects in the existing and emergent communities of their users. The focus was on the roles that LibraryThing and Goodreads—and the ICTs they provide—play in the translation between and coherence of existing communities and in the potential convergence of new communities. Using data from content analysis of, a survey of, and interviews with users of nine existing LibraryThing and Goodreads groups, and informed by social informatics and sociotechnical systems theory and research, this study helps improve our understanding of how users translate and negotiate shared characteristics such as information value, social norms, and information behavior and activities.

A theoretical framework was used to conceive of LibraryThing and Goodreads as boundary objects (Star, 1989; Star & Griesemer, 1989), with conceptualizations of translation and coherence taken from Star’s boundary object theory. Translation is “the task of reconciling [the] meanings” and understandings of objects, methods, and concepts across communities (p. 388) so people can “work together” and remain engaged with systems and communities (p. 389); coherence is the degree of consistency between different translations and social worlds. Boundary objects play a critical role in translation and “in developing and maintaining coherence” between and across communities (p. 393). Social worlds (Strauss, 1978) and information worlds (Burnett & Jaeger, 2008; Jaeger & Burnett, 2010) were selected as the most appropriate lenses on community for the study. Further details of the study, its background, and the data collection and analysis process are available (Worrall, 2014, 2015), with further publications to come on key findings and implications. This position paper focuses on those most germane to encouraging and maintaining engagement in an online, information-centric, ICT-supported community.

2 Becoming and Staying Engaged
Relevant to the findings of the study vis-à-vis engagement is the work of Preece and Maloney-Krichmar (2003, p. 609), who developed a list of nine questions that users may ask as part of becoming an engaged member of or maintaining engagement in an online community, with implications for the
community and its social context (or “sociability”) and usability. These questions speak to the coherence of common and shared social norms and rules, valuing of information, and information behavior and activities. Having such coherence will allow meanings and understandings to be reconciled between different users and user communities. Preece and Maloney-Krichmar suggested providing structure for supporting translation and coherence, such as stating the purpose of an online community in clear terms, explaining membership and rules, developing help pages and a list of frequently asked questions that explain how the community works, providing direct help when and where needed, facilitating the information seeking and searching process, and encouraging leaders to stimulate continued interaction.

3 Relevant Study Findings

In my study, many of these were present in one LibraryThing group where pages and threads had been created to introduce the group, its rules, and its members. Having these resources present for those new to the community or needing a refresher appeared to serve well in helping facilitate translation between members and the overall coherence and engagement of the group as a community around LibraryThing and its technology as a boundary object. Across most of the groups studied, technology was important to the coherence of existing communities and to continued engagement by users in them. The technology implemented by LibraryThing and Goodreads allowed users to discuss and interact, organize and catalog, and engage in information behavior and activities. Many behaviors and activities focused on the creation or maintenance of both organizational and community structure. This included social norms and rules that were established to guide threads and groups; and social annotations, lists, ratings, and reviews that served to organize books, series, and authors. LibraryThing and Goodreads, as ICTs, were found to play a strong role as technological boundary objects in maintaining this structural coherence and furthering engagement.

The translation and coherence of information values also played a vital role in encouraging continued engagement. These findings will be covered in greater depth elsewhere at the iConference (Worrall, 2015), but it is the often-invisible process of translation of values and its potential to lead to cohered information values that is most important in a values-based role for LibraryThing and Goodreads and in maintaining users’ engagement. Better understanding of where divergences and disagreements exist allows coherence to continue over time without major conflict, ensuring users continue to engage in the community despite those differences. LibraryThing and Goodreads were found to serve an implicit and often key role in facilitating this process for users from the groups studied.

4 Conclusions and Implications

While limitations in the study design and data collection limit the generalizability of these findings, their transferability to other online community contexts is believed to be quite high when combined with the literature, and leads to implications for the design and development of and practices within online communities and the ICTs that support them. Leaders of online, information-centric, ICT-supported communities—including moderators, boundary spanners, and others with high visibility—should focus their engagement on the processes that create resources for translation and coherence, such as but not limited to the help pages recommended by Preece and Maloney-Krichmar (2003) and seen in one LibraryThing group in this study. Boundary spanners should play a significant part in these processes. The coherence of the resources to the community as it changes should be maintained in order to maintain engagement, with further translation of meanings and understandings for existing and new members taking place when necessary. This sharing of existing knowledge will facilitate further knowledge sharing and creation (Ardichvili, 2008; Haythornthwaite, 2006); encourage the development of common ground (Davenport & Prusak, 2000); and enhance the role of the online community and its technology, as a boundary object, as a key site for engagement in information behavior and activities. Sharing of values, bridging of values and norms, and translating knowledge between contexts also encourages greater levels of knowledge sharing and engagement (Ardichvili, 2008; Bechky, 2003).

Those designing and maintaining online communities and related ICTs should ensure that clear expressions of site-wide social norms and rules, understanding of what types of information are valued, and expectations for normative information behavior and activities are made explicit, following Preece and Maloney-Krichmar’s (2003) suggestions. At the same time, community managers and technology developers must be willing to be engaged in a translation and negotiation process with users and the other existing communities they are part of about the meanings and understandings behind these expressions. This will help maintain the coherence and engagement of the broader community.
Highlighting translation processes and resources for users and encouraging leaders within the online community and its sub-communities to do so will facilitate the negotiation and reconciliation of users’ intended meanings and understandings of information and knowledge, and thus their continued engagement with the online community and the ICTs that support it.

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GIS RTM User Engagement via Social Media

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Abstract
Within geographic information system artifacts risk terrain modeling and retrospective mapping are common crime-based development approaches. Mapping is predictive, accurate, and precise yet these techniques use risk layers rooted in environmental criminology. Opportunity exists to improve status quo by introducing risk terrain and retrospective hot spot crime analysis outcomes via implementation of social media risk factor layers. As a result, user engagement and emotion in the purview of GIS RTM artifact implementation can be observed.

Keywords: Social Media; Crime; Predictive Analysis; GIS Engagement


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1 Overview

Over the last decade risk terrain modeling has materialized as an alternative to retrospective hot spot crime analysis. Within geographic information system artifact development risk terrain modeling (RTM) is a common point data crime-based risk assessment approach. This mapping is predictive, accurate, and precise and compares to traditional hot spot mapping techniques like Spatial and Temporal Analysis of Crime (STAC), Nearest Neighbor Hierarchical Clustering (Nnh), and Kernel Density Estimation (KDE) (Drawve, 2014). These various techniques have been accounted for many times by Drawve (2014), Joel M. Caplan, Kennedy, and Miller (2011), and Kennedy, Caplan, and Piza (2011), as a consequence, crime mapping evaluation techniques are of great interest. Substantive analysis and evaluation indicates risk terrains support the context of a solution whereas retrospective hot spot maps, being less complex based on their univariate approach, provide greater accuracy but subpar reliability (Dugato, 2013); both operationalize the same risk factor layers (Kennedy et al., 2011). Literature identifies a strong set of traditional risk factor layers yet state-of-the-art artifact development has not operationalized social media as one of them. Although the potential of such an artifact to produce optimal risk terrains and retrospective hot spot maps is significant, geographical information system (GIS) RTM social media risk layer implementation is infrequently considered by an RTM operator. These deficiencies expose the need for observing the relationship between an artifact's intended environment value and its impact on user experience. The relationship is supported via integration of artifact theory development, predictive outcomes, and social media design considerations and leads to the conclusion that user engagement and emotion in the purview of GIS RTM artifact development are indeed little understood.

GIS RTM artifact value and user experience rests on risk layer selection as achieved with the adoption of an assessment variable set. Crime theory’s retrospective layer variables include space, time, or crime type (Santos, 2012) (Johnson et al., 2007); risk terrains use the same theoretical approach but incorporate specific variables to signify presence, absence, or intensity of the variable (Kennedy et al., 2011). For example, Ratcliffe (2012), Drawve (2014), and Joel M. Caplan et al. (2011) signify traditional retrospective risk layers primarily from existing literature, e.g., bars, nightclubs, and restaurants are common; other layers such as gang activity, land use, and housing facilities are also prevalent (Taniguchi, Ratcliffe, & Taylor, 2011). Prior observation has defined many crime variables and their measurable factors and provides documented process tailoring and tool support to achieve a crime-based density map or a risk map layer (J.M. Caplan & Kennedy, 2010) (Ratcliffe, 2004). With little variation, a social media corpus possesses the same set of risk layer variables that are applicable for use in a density map or risk terrain artifact; however, social media linguistic measurements are significantly more complex. The corpus can reveal event-based utterances or communication themes that support context-based input layers, which, definitively identifies the presence, absence, or intensity of crime. On one hand, like traditional risk layers social media adds to intended artifact value, i.e., events are identified in terms of frequency or metadata. Nevertheless, user experience would remain neutral. On the other hand, social media is very much dissimilar because it requires natural language processing (NLP) to operationalize variables, which, exploit sentiment or context and produce outcomes that auspiciously influence user engagement. For example, the task of realizing the context of a tweet is complex and consists of many preprocessing procedures; however, if properly implemented it provides both a conceptual framework to
underpin the artifact and the RTM operator direct access to one’s social media self-revelation. The RTM operator becomes privy to otherwise latent user exchanges.

The quantifiable factors of layer selection when consumed by the risk model significantly influence artifact performance; however, their impact on user experience is debatable. Environmental criminology (Brantingham & Brantingham, 1981) promotes crime understanding in terms of time, place, and crime risk factor layers, and although these are customary variables (Santos, 2012) for retrospective analysis, they are not necessarily the best when implementing a risk terrain model trying to expose predictive outcomes. Moreover, a retrospective artifact based simply on understanding a crime’s setting is hard to compare with a predictive model. Current techniques to address this issue are being managed via predictive accuracy and recapture rate indices (Drawve, 2014). Drawve (2014) tested performance comparison models and processes using, STAC, Nnh, KDE, and RTM artifacts. The predictive accuracy index (PAI) was used as a measure of accuracy with assessment being component-based variables consistent with the environmental criminology variables previously noted. In addition, the recapture rate index (RRI) suggests measurement for short-term and long-term crime prediction. Since it is thought that social media, in a similar way to traditional layers, can be operationalized and subsequently compared via the same performance priorities of traditional layers, investigation and analysis to determine its scope of use is relevant. Such comparative approaches are akin to a predefined gold standard where artifact outcomes are quantifiably evaluated. While a social media corpus might be generated via real-time stream capture and its content be metaphorically driven (e.g., a sparse tweet such as LoL), collection variations and content irregularities can be mitigated with preprocessing rules designed for a specific mapping environment. Li, Chen, Ji, Muresan, and Zheng (2012) conduct social media-based experiments combining social cognitive theories and natural language procedure; thus, ascertaining the utterance a particular Twitter user makes about a real-world event. For this reason, RTM operator evaluation involving user emotion can be considered. These very difficult, yet practical measurement considerations entice further inquiry as clearly one can either measure artifact environment value or user experience outcomes—each are project dependent however latent relationships may exist between them.

Opportunity exists to improve risk terrain modeling and retrospective hot spot crime analysis mapping outcomes by implementing social media risk factor layers. Each mapping technique is systematically distinct with subtle differences with respect to layer selection. Defining a layer selection theory—for example, environmental criminology’s time, place, and crime—is a critical component of the process and must be done in parallel with social media risk layer development. It is plausible that the construction of a social media engagement model be considered at the same time. Since artifact measurements of current techniques, PAI and RRI, are well defined, alterations should be realized in order to support the tangible and intangible value of social media and its impact on user engagement. Sufficient evidence from multiple sources presents a conclusion that supports adequate social media layer selection and performance measurement values when properly implemented will both improve predictive crime-based mapping artifacts and support a robust engagement framework.

References


A Proposal of Applying Page-centric Collaborating E-learning System to Communication and Seeking

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Abstract
We have developed a page-centric collaborating system based on user’s behavior; a user can see and chat with others browsing similar pages through avatars on the browser, much like face to face communication in the real world. This system makes it possible to share information and convey emotion effectively through any and all Web pages. Moreover, the system also enables users to search not only Web pages but also appropriate users. Especially, the system supports groups to communicate with each other seamlessly in information seeking and organizing, e.g., students can share search tasks using the system, experienced students can teach novice students effective searching methods, etc. In this paper, we propose that teachers or leaders utilize the system to enhance interaction among and with students in class. This promises to enlarge the learning effects of students and improve user engagement.

Keywords: communication; cooperative work; search; ranking; education
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1 Introduction
The importance of Web experience has been increasing more and more not only in daily use but also in educational contexts, e.g., seeking information, e-learning, collaborative tasks, etc. Especially, Massive Open Online Courses (MOOCs), which enable a lot of students to participate in the course via the Web, are rapidly expanding. In the real world, people in the same place can efficiently share opinions, questions, impressions, etc., while viewing the same view or contents, because they communicate face to face with mutual contents, documents, or views. This leads to the construction of a loose relationship, which is natural and important but lacking in distributed Web experience.

Therefore, we have developed a page-centric collaborating system\(^1\) (Shiraishi, Kawai, Zhang, & Akiyama, 2014); in this paper, we propose use cases that illustrate how the system can enhance the interaction among and with students in e-learning courses for group work that requires information seeking and organizing. In the system, the user can perceive other users browsing the same contents or Web pages pointed by URI as avatars on the browser, similar to when people can see the faces of others who are physically in the same place (Figure 1). Moreover, since the collaborating system is developed as an extension of the existing browser, the system has hardly any influence on the daily Web browsing experience.

2 Page-centric Collaborating System Based on User’s Behavior
As shown in Figure 1(a), if the user has a question about the contents on the page, s/he can immediately ask avatars browsing the same or related pages using chat sidebar. Furthermore, a user can jump to the desired page by clicking a transparent avatar or chat log. The system optimizes the displayed and communicable users by highlighting the relationship among them based on their information searching and

\(^1\) Available at http://klab.kyoto-su.ac.jp/~mito/index.html
sharing activities. Then, the system also enables users to search not only Web pages but appropriate users (Figure 1(b)): we constructed a new ranking model (Shiraishi et al., 2014) by combining the real space information (the user activities) with the Web space information (the hyperlinks). The communication function is achieved by the collaboration between the server side and the client side.

3 Page-centric Collaborating System Based on User’s Behavior

As shown in Figure 1(a), if the user has a question about the contents on the page, s/he can immediately ask avatars browsing the same or related pages using chat sidebar. Furthermore, a user can jump to the desired page by clicking a transparent avatar or chat log. The system optimizes the displayed and communicable users by highlighting the relationship among them based on their information searching and sharing activities. Then, the system also enables users to search not only Web pages but appropriate users (Figure 1(b)): we constructed a new ranking model (Shiraishi et al., 2014) by combining the real space information (the user activities) with the Web space information (the hyperlinks). The communication function is achieved by the collaboration between the server side and the client side.

![Figure 1: Page-centric Collaborating System Based on User’s Behavior through Avatars](image)

4 Use Cases of Utilizing Page-centric Collaborating System in E-learning Courses

3.1 Information seeking individually

For an individual work assignment accomplished by searching the Web, there are three interesting use cases.

a. Novice students can watch others’ behavior for reference.

b. Highly motivated students can search something that others cannot search yet.

c. Students are motivated by others’ searching behavior since they recognize they are not alone.

3.2 Information seeking collaboratively

For a group work assignment accomplished by searching the Web, there are three interesting use cases.

a. Students can share the searching tasks smoothly and seamlessly through page-centered communication.

b. Experienced students can teach novice students the effective searching method by just doing it actually.

c. Hearing impaired students can chat with each other easily without using other communicating tools.

5 Discussion and Conclusion

In related works, ComMentor (Röscheisen, Winograd, & Paepcke, 1995) provides an annotation function to Web contents. Wakurawa (Akatuka, 2006) notifies acquaintances accessing the same page. In these systems, users must use a communication tool such as Skype to communicate with each other.

We propose that teachers utilize the page-centric collaborating system to enhance the interaction among
and with students in e-learning courses. We also stated some use cases, especially for group work in information seeking and organizing. These promise to enlarge the learning effects of students and improve the user engagement.

References


Table of Figures

Figure 1. Page-centric Collaborating System Based on User’s Behavior through Avatars ... 24