An Immediacy-Based Model of Source Orientation

ABSTRACT

When we interact with a computer, we are actually interacting with many different entities: the computer, the software on the computer, the programmers who wrote the software, the company that paid the programmers, and often other users that appear through the software. We normally only focus on one of these entities at a time, and consider ourselves to be interacting with that entity. How do people figure out which entity to focus on?

We review a variety of literature to identify key concepts related to this problem of *source orientation*. We then use those concepts to build a model of how people orient to different sources, and what influences which source a person will be oriented towards, and when that person will choose to reorient to another source. People naturally orient toward sources that are "close" to them, but some factors like a negative event can cause them to reorient to more distant sources. Our model helps predict how and why people behave in complex HCI interactions (such as troubleshooting problems on their computer) and can help designers build systems that intentionally orient their users toward (or away from) specific sources.

Categories and Subject Descriptors

H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces—*Theory and Models*

General Terms

HUMAN FACTORS

Keywords

source orientation, CASA, agency, attribution

1. INTRODUCTION

When people interact with computers, they actually are potentially interacting with a large number of entities, or sources of behavior. Even a basic interactive event which may appear to involve only one person can actually involve several other people or autonomous entities.

When conducting a web search, for example, there are several distinct entities with which the user is interacting in some form or another. On one level, the user is interacting with a computer by viewing information on a monitor and typing the characters of the query onto a keyboard. On another level, the user is focusing the interaction on a specific aspect of the computer, a web browser. On yet another level, the user is interacting with another computer, or several other computers, which are acting as servers and which execute the actual search. The user is also interacting with the company, i.e. Google or Yahoo, which runs the servers to which the web search has been requested. Programmers and designers have also carefully crafted the user experience for the website, the web browser, the operating system, and other software which is involved in the act of making a web search. When the user makes a query, he or she is interacting with those people as well. The user is also interacting with millions of others on the Internet who have created content or websites which will be retrieved in the search.

Any entity that influences an interaction with a computer is a *source*. Sometimes, it is not apparent which source (or sources) caused the behavior or provided the information at any given time. This makes human-computer interaction an interesting context in which people at any given moment may be only partially aware or cognizant of all the sources with which they interact, meaning that there are varying levels of immediacy between users and these sources. For this reason, human-computer interaction has at times been viewed as a form of parasocial interaction [31].

It may be overwhelming for a user to simultaneously consider everyone with which he or she is interacting, even if the user were completely aware of all of them. If a user were to carefully consider each of those sources, the simple act of making a web search could become quite complicated and inefficient. It is therefore natural that when performing a search, or performing other actions using a computer or similarly complex system, a user is usually oriented toward only one source. Source orientation, then, is *the psychological locus of a user's interaction [31] in a mediated environment at a given time.*

Source orientation can influence how people think about and use computers. In the web search example above, the way

people make credibility judgements is strongly influenced by source orientation. Users who are oriented toward Google as an organization are likely to judge search results based on their opinion of Google. Users oriented toward the programmers at Google will likely judge search results based on the perceived quality of the search algorithms. Users who are oriented toward the creators of the resulting webpages will likely judge search results based by the credibility of the website containing the search result.

Additionally, source orientation holds a particular importance in developing the theory of Computers as Social Actors (CASA). Computers are only treated as social actors when the user of the computer is oriented toward the computer as a source. Therefore, understanding when this happens is essential to understand when computers are treated as social actors, and how to design systems that are intended to be interacted with socially.

Source orientation is becoming particularly important as we move toward more social and group-based computing technologies. When interacting with Facebook, how does a person understand who they are interacting with? Are they interacting with their local computer? Facebook the technology? Facebook the company? Their friend who posted a status message? Other friends who can see the status message but haven't posted it? To design social computing technologies, it is valuable to understand who the user thinks they are interacting with, and to design the system so that the user is oriented toward the appropriate source.

Source orientation can influence users' behavior when using computers in various ways.For example, source orientation can affect the way users troubleshoot computer problems. If oriented towards the computer, a user may try to solve the problem by searching through the "Help" section of the interface. If oriented to the company that makes the computer, the user may call customer service.

Source orientation may influence security behaviors. A user whose computer crashes may be oriented to a computer virus as a the source of the computer's problems, and may seek to solve them by eliminating the virus. However, if that user were instead oriented towards a hacker who infected the computer with the virus, the user may seek to eliminate access to the computer, such as a firewall or stronger password.

Source orientation has relevance to online behaviors as well. Social media, and the web in general, are full of advertising and attempts to persuade users towards opinions or behaviors. Source orientation can affect how users respond to such attempts. A user who is oriented to the Amazon.com website may appreciate the recommendations that the site provides because they make it easier achieve the goal of the interaction with the site. On the other hand, a user who is oriented towards Amazon the company may have a different reaction to these recommendations. This user may consider the company's motives behind the specific recommendations ("Are these the things that will best fit my need or will they make Amazon the most money?") and become less trusting of the recommendations.

1.1 Previous Work

Source orientation has been suggested as an explanation for CASA [21]. CASA is a series of experiments which show that computer users treat computers as social entities, behaving towards them as they would towards other people in analogous contexts.

One explanation which has been proposed for this finding is that when using a computer, users are oriented towards the programmer of a computer and not the computer itself, therefore making a social response an expected outcome [21]. This explanation has been refuted for several reasons. First, in most CASA studies, users report that they do not think about the programmer at all [21]. Second, Sundar and Nass [31] explicitly tested this explanation and found that when induced to think about a computer's programmer, rather than the computer itself, users did not show the expected social response to flattery. Hoffman et al. [14] measured users' source orientation towards the programmer, and found that users who were thinking about the programmer did not show an expected social facilitation effect. In a study of social responses to computerized survey methods [33], researchers induced users to think about the researchers (using images of the researchers) rather than the computer and did not find expected social responses. Some studies [9, 28] have manipulated source orientation to test whether users show social responses to computers that are connected to the computer which the user is directly using. These studies found that users generally do not respond socially to these "distal" computers even if they are oriented towards them as the source of behavior or information.

While these studies are focused on the effect of source orientation on explicit social responses to computers, there are some important findings which can be extracted from these studies which are of more general relevance to HCI and computer-mediated communication. These studies demonstrate that users can be oriented to a variety of sources, either through experimental manipulation or simply through natural variation in users (as found in [14]). And more importantly, these studies demonstrate that orientation to different sources leads to different behavior by users. However, to date, source orientation has received little attention outside of CASA.

We develop a model which offers a more precise and generalizable understanding of source orientation than is provided in the literature above. This model is intended to offer a framework for future research on source orientation. It is also intended to be a reference for designers which can be used to evaluate system designs with respect to their influence on source orientation.

2. METHODS

We began the process of creating our model by closely examining and scrutinizing the small body of existing literature on source orientation. From this small body of literature, we decided to search for places where source orientation has been applied to other research or designs by following citations to the source orientation literature. This process led to an important insight. While source orientation is a concept which is specific to HCI and closely related research, we noticed that it has considerable similarity to many other

concepts which are studied outside of HCI. Furthermore, many of these concepts have rich histories and have received considerable attention from their respective fields. Thus, we decided that our strategy for understanding source orientation would involve extensive study of these related concepts from other fields.

We decided to explore the literature on these concepts and extract theories and findings which would be applicable to source orientation in HCI. There were two steps in this process. The first step was identifying the concepts from other fields which appeared similar or relevant to source orientation. The second step was conducting a literature review of the concept and evaluating the findings and theories of that concept to source orientation. Our initial set of related concepts were identified as we explored work which cited the existing source orientation literature. As we explored these initial concepts, we had insights which led to an expansion of this list of related concepts.

For each concept, we looked at textbooks, foundational papers and review papers in order to see an overview of important findings and theories related to the concept. For each finding or theory, we considered what prediction about source orientation the finding or theory would make. We noted those findings which made plausible predictions about source orientation which seemed consistent either with existing HCI literature or with our intuitions. Some concepts, findings or theories did not appear to have relevance after closer examination of the literature, and so these items were eventually disregarded. However, as we found interesting connections to source orientation among the literature we reviewed, we simultaneously began to hypothesize about the relationships between these concepts. More specifically, we considered how elements in typical human-computer environments might act as triggers for the various cognitive process we were studying, and how those process would affect behavior in HCI.

We began to form a model which would explain how source orientation could work in HCI in light of the findings of our exploration. We iteratively compared our model's predictions to empirical source orientation and HCI findings, refining the model so as to make it consistent with what is already known about source orientation and HCI, but also to give it power to make predictions about things that are not known. The model we present here is the output of this iterative process. It is at a stage in this process where we believe it accounts for existing HCI findings and can make strong theoretical predictions for future empirical and theoretical work.

3. KEY CONCEPTS

We begin by describing the key related concepts that emerged from our review of the literature and briefly discuss their relevance to source orientation.

Attention. The process of allocating attention has been one of the primary topics of cognitive psychology for decades. Two principal processes have been identified which govern the allocation of attention [1]. Exogenous or bottom-up processing allocates attention to sensory stimuli in the environment. This process can be automatic, and is influenced by the salience of the stimuli. Endogenous or top-down processing allocates attention according to an individual's motivations, experiences, or other intrinsic qualities.

These processes often compete for limited attentional resources, as evidenced by a classic attention experiment in which 50% of subjects fail to notice a gorilla standing in the middle of a screen because they are intensely focused on completing a goal of counting the number of times a basketball is passed between people on the screen [5].The competition for attention can be complex, with numerous environmental stimuli potentially seeking attention through exogenous processing, as well as individual motivations, task demands, goals, or habits seeking to foster attention through endogenous processes.

Both types of attention processing are likely involved in HCI with regard to source orientation. Users have prior experience, expectations, motivations, and goals they are seeking to accomplish when using a computer, which would draw on top-down or endogenous processing to allocate attention. But they are also subject to stimuli presented in the interface or other contextual stimuli, which would draw upon exogenous, bottom-up processing. This is similar to the competition for attentional resources shown in the gorilla experiment between the two types of processing. The outcome of this competition will influence source orientation.

Attribution Theory. Attribution theory comes from a line of research primarily in psychology (and most concentrated in social psychology) which seeks to explain how people determine causes and effects of events. Research on attribution theory has identified numerous mechanisms and explanations for people's attributions of causality in given circumstances. Factors of motivation, cognition, context, arousal, and intentionality all contribute to the process of attributing causality (see Kelley and Michela [17] for a review).

Kelley and Michela [17] argue that certain characteristics of information (such as its distinctiveness and consensus with the views and understandings of others), as well motivational factors, strongly influence the ways that people make attributions. To illustrate their framework, we can look at an example of receiving spam forwarded from a friend. If receiving spam from this friend is a salient and distinctive behavior (other friends don't send spam) and no motivation is apparent, an attribution to the environment is likely ("he got a virus that is sending me spam"). In other circumstances, such as an apparent motivation (the spam indicates a reward for forwarding it) and other people show consensus in forwarding spam, an attribution to the person may be more likely ("my friend is purposely sending me spam").

Attribution theory has identified biases and asymetric patterns in the way people make attributions, such as correspondence bias or the fundamental attribution error (overstating the influence of personality and understating the influence of situational factors in others' behavior) [12] and a negativity bias (a tendency to attribute negative outcomes to external causes and positive outcomes to internal causes) [20]. These biases suggest, as argued by Kelly and Michela,

that another critical factor in attributions is the concept of locus of control. This concept is particularly important in the context of HCI, as it has an apparent connection to the concept of agency.

Agents have been widely deployed in interfaces as a means for simulating human interaction within completely automated environments. Agents seek to simulate a human-like control over the virtual environment in which they interact, and users must willfully go along with this strategy. Complicating things in virtual environments is the fact that in some contexts, it may not be clear if an agent is internally controlled by an artificial intelligence, or externally controlled by a real human. Much research and endeavors into artificial intelligence have in fact demonstrated that distinguishing between the two can be at times quite difficult [7]. Therefore, making attributions of causality can be quite complicated in human-computer interaction simply because the nature and identities of possible causal entities may be unclear. Making attributions of causality may depend on detection of agency.

Source orientation may provide a strategy for managing this difficulty, as refocusing attention and engagement towards another source (where agency can be more easily detected) may make it possible to make attributions.

Social Presence. Social presence refers to "a sense of being with another person", [3]. Typical conceptual definitions of social presence in mediated environments have treated it as the degree to which an interaction is comparable to a real, face to face interaction [30]. This conceptual definition has been modified to include various motivational and psychological factors related to attention and involvement [3, 27]. Social presence is determined both by the technological affordances of a medium [30] (i.e. its media richness, the extent to which multiple cues are available for communication), and by individuals' motivation to treat an interaction as a social interaction, which may be the result of the context or simply of personality. Social presence is ultimately a measure of engagement towards social information. When a person is highly involved in a conversation or some other interaction, there is a high degree of social presence (even if the conversation is over IM). However, the salience of available information about others in a mediated environment can be antecedents to the level of engagement, making the relationship reciprocal in nature.

The concept of social presence is similar to source orientation. They are both levels of engagement towards a source of behavior or information. The primary difference is that one can be oriented towards a source that is not human, or not even resembling human. Although theories of anthropomorphism, as well as CASA, would argue that people will treat even the non-human entities as if they were human, there are boundaries to those effects. People do not anthropomorphize everything all the time. As such, social presence cannot be used interchangeably with source orientation. Social presence may, however, be classified as a specific type of source orientation in which a person is oriented towards a source which they treat as a human.

Credibility and Persuasion. Credibility of information, and studies of how people make credibility assessments, provide another useful pool of literature for understanding source orientation. Credibility assessments are a context in which a person must make an explicit evaluation of a source of information, as well as consider other influential but possibly not apparent sources. This is similar to the context of source orientation in HCI in that there are many sources involved in a computer's behavior, and source orientation involves an evaluation of at least some of these sources.

Rieh and Danielson [26] summarize the literature on credibility, and have argued that an important heuristic for the design of credible websites is emphasizing the real person or organization behind the website. This suggestion is effectively an argument for inducing source orientation away from the computer or website and towards the real person or people behind it. One of the bases for their suggestion is the credibility research that finds people give more credibility to information which seems to have been generated by people rather than automatically.

A related concept is persuasion knowledge. Persuasion knowledge is the extent to which a person believes a communication to have the goal of persuading (i.e. how aware one is that another person is trying to persuade them). Friestad and Wright [10] in their persuasion knowledge model argue that when a person recognizes that a communication is a persuasion attempt, and the person is experienced with such persuasion attempts, they are likely to look past the immediate source of the attempt (i.e. the salesman) towards the underlying source of the persuasion attempt (i.e. the company the salesman works for). This model effectively argues that persuasion knowledge can induce source orientation. It can be inferred that the process of establishing credibility may be similar to the process determining source orientation. A person evaluates a source, and under certain conditions may determine that a closer examination of hidden or unapparent sources may be necessary.

Rieh [25] found that motivation is an important component of credibility, and that a person will assign more credibility to a site which they purposely visited than a site to which they were redirected unexpectedly. Regarding source orientation, a similar effect seems plausible in that a person's motivation to interact or be engaged with a source may determine the extent to which they subsequently become engaged with that source or instead seek out engagement with other sources.

4. SOURCE ORIENTATION MODEL

Building on the key concepts above, we developed a model of how we believe source orientation to work.

4.1 The Three Processes of Orientation

We have identified three conditions which must be met for a user to be oriented to a source. First, the user must be aware of the source. A user, for example, who is not aware that he or she is connected to a server cannot be oriented towards that server. Second, the user must be attentive to the source. In the example, even if the user is aware of the server, he or she cannot be oriented to the server unless there is some attention allocated to the server when

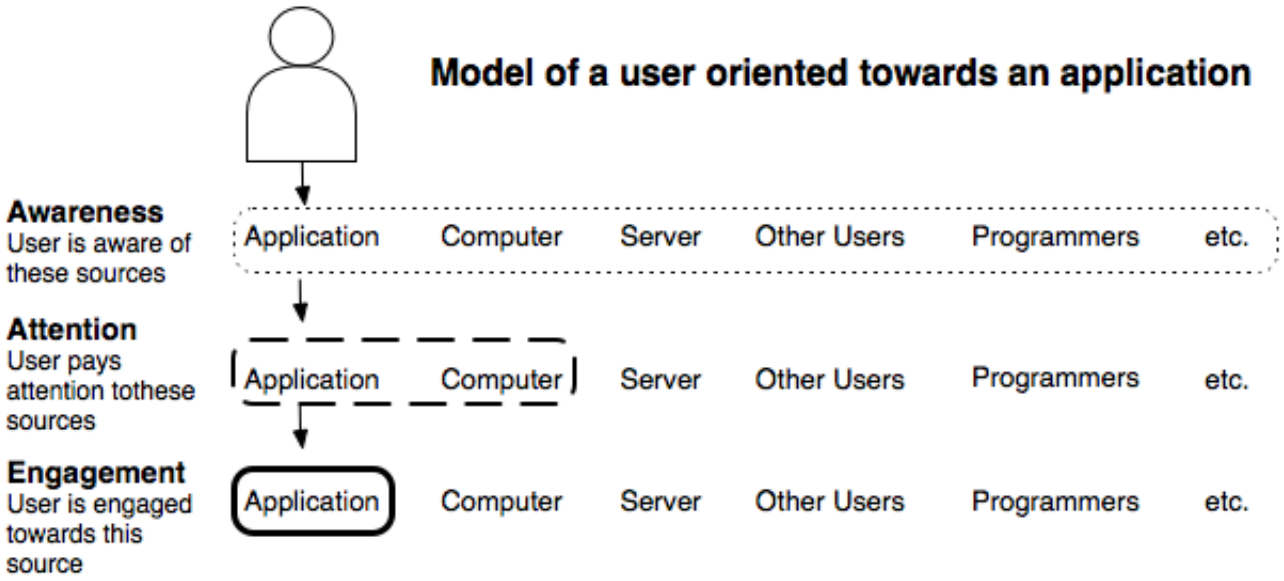

Figure 1: Source orientation

interacting with the computer. The third condition is that the user must be engaged towards the source. This means that users actively consider their behavior as being either responsive to the source or targeted towards a source. For example, computer users seeking to hack into a system may be engaged towards the programmers of that system if they view the interaction as a game of cat-and-mouse between themselves and the programmers, thinking about "what the programmers were thinking" as they look for vulnerabilities.

Figure 1 illustrates this definition. Under this definition, we propose that while users may be aware of many of the sources with which they interact, they are likely to only allocate attention to a small set of those sources at any given moment, and are likely to only be engaged towards a single source at a single point in time. The source to which a user is engaged is the user's source orientation.

This definition suggests three important processes are at work in human-computer interaction. The first is a process by which users become aware of the various sources involved in their interaction. We assume that this process is largely synonymous with the process of constructing schema or mental models about how computer systems work. This may come about through formal or informal education, or through personal exploration and experience.

The second process suggested by this definition of source orientation is that of all the sources of which a user is aware, there is a process which determines how attention is allocated among those sources, which we have discussed in the above section on attention.

The third process implied in our definition of source orientation is the process by which users become engaged towards a single source from among the sources to which they allocate attention. How do users determine which source they will treat as their "psychological locus?" This concept of engagement means that users *intend* a source to be the recipient of some behavior, or that users explicitly consider their behavior to be in response to the behavior of a target source.

It is important to note that this definition does not imply that users will necessarily be attentive to multiple sources. If a user is only attentive to one source, they can only be engaged towards that source. This third process may simply be a matter of default. We also do not claim that these two process are necessarily independent of each other, and we certainly allow for the possibility that some factors will influence both the process of attention and engagement simultaneously. But we distinguish these processes because they *can* be independent of each other (as in the Google privacy example previously mentioned), and so our definition and model need to allow for that possibility.

4.2 Source Distance

How do users develop engagement towards a source? First, environmental stimuli such as the interface of the system or explicit markers of sources (such as handles, avatars, logos etc.) can attract user attention through exogenous, bottom-up processing of sensory information. When users see, hear, or feel other sources (or representations of sources), they are likely to allocate attention to those sources provided they have available resources (which may already be occupied by top-down, endogenous processing for other activities). Once a user has allocated attention to a source, engagement must develop towards the source whereby the user treats it as the subject of the interaction.

One important consideration is that not all sources are equal in terms of their accessibility to the user. Some sources, like the computer itself, an application, or a chat-partner, offer synchronous, real-time interaction and require little mediation for interaction. Such sources are in a sense much closer

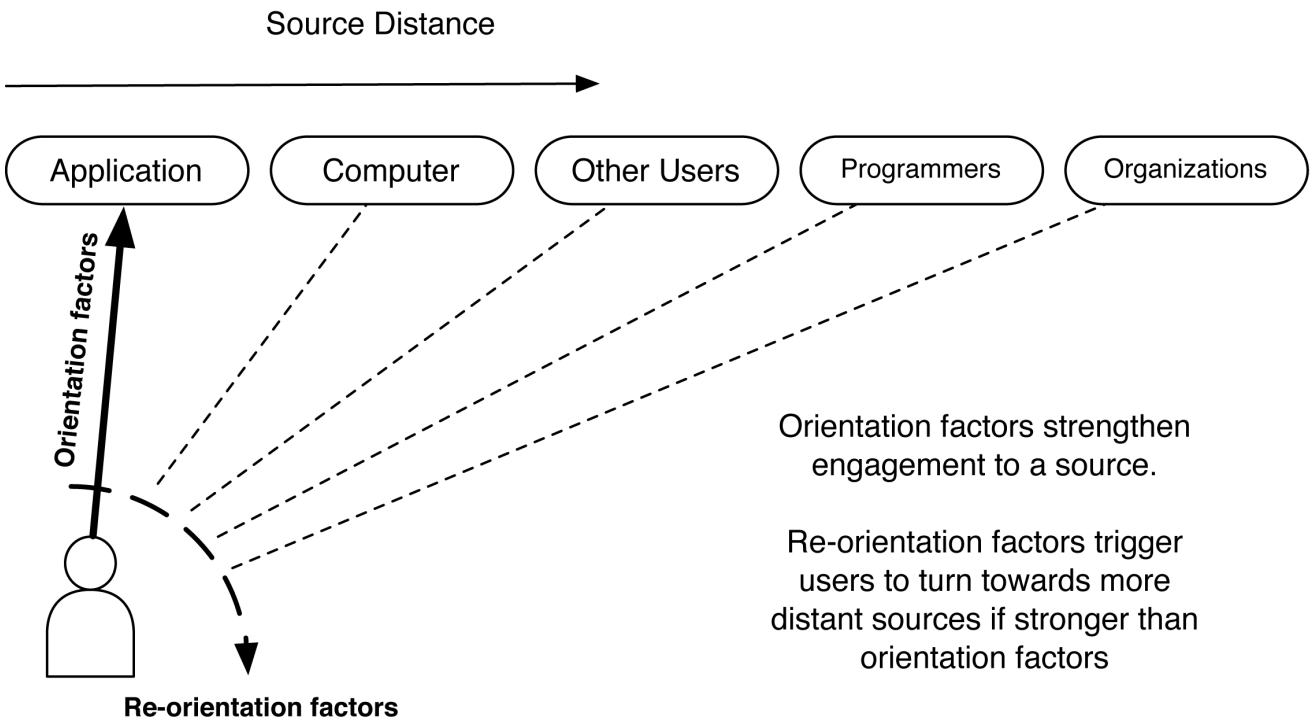

Figure 2: Source Distance

to a user than sources such as programmers, companies, or web-servers. There are fewer degrees of mediation between a user and a web browser than between a user and a blogger. The web browser is visible and immediately interactive, whereas the blogger does not have the same degree of interactivity and has a less visible identity. We use the term *source distance* to refer to the degree of immediacy between the user and a source.

We propose that some factors (called *orientation factors*) will tend to favor orientation towards "proximal" sources like the computer or software, and that other factors (*re-orientation factors*) will tend to favor "distal" sources like programmers, organizations, or other users. Proximal sources require fewer resources for interaction than distal sources, and are therefore easier to engage in interaction and to maintain engagement. But re-orientation factors can trigger users to become engaged towards other sources, and that when the user re-orients it will typically be towards a more distant source. Figure 2 illustrates this concept.

In the sections below, we describe these orientation and re-orientation factors in more depth, and in the process offer evidence for the assertions of this model.

4.3 Orientation and Re-orientation Factors

There are a number of actors that may influence how people choose to orient toward different sources. Here, we identify a number of these factors. Also, different factors may cause people to re-orient to a different source than the one they are currently oriented towards.

Orientation Factors. Considerable work in computer-mediated communication has concluded that, despite technological advances, "distance matters" [23]. The mediation of communication degrades the quality of interactivity and accessibility between communicators. In HCI, far more layers of mediation separate users from the programmers, organizations, content creators, policy makers etc. than from user interfaces and those with whom direct, two-way interaction is afforded. These less mediated sources can more easily attract users' exogenous attentional processing (since the user can see or them), and the greater interactivity afforded by more proximal sources can enhance engagement. For these reasons, our model suggests that users have an initial bias towards becoming oriented towards proximal sources such as the computer or application. The CASA paradigm offers evidence of this.

The social responses to computers observed in CASA studies are evidence of orientation to the computer. And this appears to be the default state for users. Since users do not show social responses to computers when there is reason to believe that users were not oriented towards the computer [9, 14, 31, 33], but in most general circumstances they do show these social response, we conclude that social responses are a default state for users (which has been argued by others as well, see [4]). We propose that one important reason for this default source orientation to the computer is simply its proximity.

Among the strongest antecedents to social responses to computers is the use of anthropomorphic cues in the design of an interface [29]. Human-like appearance of a computer or

a robot [8] can elicit social behavior towards the machine. One explanation for this behavior is that in any interactive situation, treating something as human is the default state unless there is a clear reason that this is inappropriate [4]. Human-like form or images simply prime users to treat the computer as a human, and as long as there is no apparent reason not to do this, users will automatically or mindlessly interact using normal social scripts.

Given this default state of human-human interactive behavior, we can suppose that any cues from a source which suggests that interaction using standard social behavioral scripts is likely to keep a user engaged and attentive to that source. Human-like images are one obvious type of cue. Another may be signals of agency or intentionality. If a source demonstrates agency, that is to say, it suggests that it determines its own behavior and is not directly under the control of some other source, users are likely to maintain orientation to that entity. In one study [22], subjects treated an avatar in a 3-D environment the same when they were told it was controlled by a computer as when they were told it was controlled by a person, suggesting that the computer was able to demonstrate enough agency to maintain subject's orientation (a difference in behavior would have suggested that subjects re-oriented towards a more distant source like the programmer or the researchers).

Effective presentation of agency may work like other anthropomorphic cues to signal that social responses are appropriate, thus strengthening engagement and orientation towards the agent. Bandura [2] cites intentionality as a fundamental aspect of agency. That is to say, we can suppose that if an intention is apparent in the behavior of some entity, we are likely to perceive it is having agency and thus may become more involved or oriented towards it. Heider and Simmel's [13] classic experiment demonstrates this. In their experiment, people anthropomorphized animated shapes (circles, squares and triangles) if they moved around the screen with some apparent intention (such as chasing one another). It follows that if the intentions of the source to which a user is oriented are apparent, they are likely to maintain their involvement based on a perception of agency.

When a source has human-like appearance and agency, users are primed to treat it as human regardless of its true nature. The concept of social presence similarly suggests that people can become engaged towards entities in a virtual or mediated environment in a social manner as a result of the properties of the communication channel and their own personalities and motivations to have social interaction [27]. Since some personality factors such as affiliative tendencies [19] can enhance social presence, it is reasonable to assume that similar factors can strengthen orientation towards a source that is truly social in nature.

While interfaces using human-like appearance and behavior may prime user behavior through bottom-up processing of stimulus information, users still have goals and motivations to complete or fulfill when using computers. Therefore, the context in which a computer is used, or the task which is being performed, will undoubtedly have an influence on user engagement towards any source in the interaction. People generally follow the principle of least effort in accomplishing tasks or goals, which means that users are unlikely to change course in an interaction if their goals are being accomplished. Therefore, it is logical that goal satisfaction is an important engagement factor. As long as users are finding success in completing tasks or fulfilling motivations, it is unlikely that they will seek engagement with other sources.

Re-orientation Factors. Any source of which users are aware has opportunities to capture user attention and cultivate engagement. If engagement factors originate from sources other than a user's source orientation, there is naturally a possibility that the user will reorient towards the new source.

Consider the following example. A user playing a game on a console such as a Nintendo Wii is highly oriented towards the game as the source of information and actions with which he or she interacts. As many games are now incorporating advertising or product placements, the user may come across advertisements from Nintendo while playing the game. These advertisements use the player's name, show a picture of a Nintendo game designer, and change over time according to the player's behavior. These attributes may elicit social presence, or feelings of anthropomorphism towards Nintendo as a company, or simply be clear indicators of agency and intentions on the part of Nintendo. Some users may then become oriented towards Nintendo rather than the more proximal source of the game itself, if these orientation factors are stronger for Nintendo than for the game. However, in addition to orientation factors associated with other sources, our exploration of research suggested some other circumstances where reorientation may be likely.

Attribution theory discusses a number of biases that exist in the way humans attribute causes of behavior or outcomes. The negativity bias reported by [20] shows that when users experience negative outcomes, they are likely to attribute it to the agency of another person than to chance (even the chance of randomization by a computer program). In other words, when a user experiences a negative event, he or she may seek some agent to which they can lay blame. If their current source has not demonstrated enough agency to appropriately warrant blame, users may reorient to a more distant source whose agency is worthy of blame. For example, if the power goes out while a computer user is working on some task, the user will likely find it inappropriate to blame the computer for its failure. Instead, they may seek a more distant source whose agency can more appropriately be blamed, such as the power company. This context of negative events suggests that disruption of user goals can trigger reorientation.

In addition to negative events, unpredictable or inconsistent events and behaviors might also be able to trigger reorientations. One study [32] found that when interacting with a robot, users prefer that the robots be agreeable with the user and that its voice come from its body. However, if the robot is not agreeable, people prefer that its voice be separated from its body. This is similar to many other studies of avatars and robots which find that consistency between behavioral and visual realism is more important than great fidelity in either dimension in terms of social responses

Table 1: Summary of orientation and re-orientation factors

Orientation Factors	Re-Orientation Factors
Anthropomorphic cues	Anthropomorphic cues, social presence, agency, or intentions of a distant source
Perception of agency	Explicit orientation cues
Perception of intentions	Perception of intentions
User goal satisfaction	Unpredictable or inconsistent source behavior
Social presence	Extended time with a particular source orientation

as well as general affective responses [11, 16, 22]. This suggests that when there is inconsistency or unpredictability in the behavior of a source, a burden is placed on the user to reconcile that inconsistency. Since social responses to computers are limited when this inconsistency is present, it is plausible that users may have re-oriented. This would be a logical strategy in many cases. If a computer's behavior is unpredictable, a strategy of "reverse engineering" is often useful. This strategy is a form of source orientation, as users try to get inside the minds of the system's designers rather than into the mind of the system itself.

Another possible re-orientation factor is time. Some CASA research has shown that the duration of social responses to computers is limited [9, 24, 33]. Over time, the strong social responses people demonstrate in an initial computer interaction seem to fade. This is not the result of greater experience and expertise however, which actually strengthen social responses to computers [15]. A source reorientation is another possible explanation, and validation of the source distance model should verify this.

The most clear re-orientation factor, in that is has been empirically demonstrated in CASA research, is that explicit orientation cues can cause users to orient towards more distant sources. This is the basis of Sundar and Nass's [31] experiment which successfully manipulated source orientation simply by telling participants to think about the programmer. Computer interfaces are full of explicit cues, such as the name of the sender of an email, company and software logos, or profile pictures on social network sites. The research on computer-mediated communication and HCI make it clear that humans do orient towards distant sources in many contexts of computer use, and these explicit cues are likely the primary reason that this is possible.

5. APPLICATIONS OF THE SOURCE ORIENTATION MODEL

Below we provide three examples where the source orientation model can make predictions about user behavior which can be informative to the design of systems.

Troubleshooting. A user creates a document with a typical word processor and tries to save it. The program gives the user an error message that "the document cannot be saved at this time." The source distance model suggests that most likely, the user's orientation had been towards the computer as she was working on the document (as most CASA studies suggest). However, this error message is a negative event which disrupts the user's goals, and the logo of the company that makes the word processor attracts the user's attention. These factors trigger a re-orientation to the company that makes the word processor. This re-orientation means that the user now considers herself to be interacting with the company, rather than the application. As such, she seeks a solution to the problem by contacting the company.

Now consider a user who is creating a similar document using a different word processor. This word processor uses a different interface design which incorporates a "personal assistant" metaphor in which the user dictates the contents of the document to an embodied conversational assistant. This assistant is highly anthropomorphized, uses natural language, and makes suggestions to the user as he creates the document. The user tells the application to "Save the document", and the agent replies that "I can't save the document right now, sorry." The source distance model, like in the previous example, suggest that the user is highly likely to be oriented towards this interface when the problem occurs. However, in this case there are more orientation factors than were present in the previous example, such as an anthropomorphic representation and agency of the application (since it makes suggestions). In this case, these orientation factors may outweigh the negative event and disruption of user goals, and the user may not re-orient towards a different source. Consequently, the user may seek to solve the problem by asking embodied agent how to solve the problem.

Security. A user gets a phone call from a friend telling him that she is suddenly receiving a lot of spam from his email account, and that he should check to see what the problem is. He logs on to his computer to look for evidence. The source distance model predicts that the default orientation will be to a proximal source such as the computer or application, so this user is likely treating the computer as the locus of the interaction. As such, he uses the computer's security tools to run a virus scan, which discovers a virus running on his machine. He follows the steps suggested by the antivirus software's interface to remove the virus, and resolves the problem. In this case, the the user's goals for the interaction have been satisfied, he remains oriented to the computer, and he may consider the interaction to be completed because his problem has been resolved.

In another instance, a user may receive the same phone call about the spam. She may log on to her computer to investigate, but this user does not have antivirus software. This user may look through her email settings, change her password or sort through the processes running on the computer in order to determine why the spam is being sent from her computer. If she is unsuccessful in finding the problem, the source distance model predicts that she will consider other sources of such behavior from among those of which she is aware. She notices icons representing the presence of other users on her network, and realizes that another person on her network or through the web may have accessed her com-

puter. She focuses her attention on this hacker, considers the hacker's intentions or motives, and decides to take action to protect her computer from hackers by installing a firewall. In this case, the disruption of her goals and the social presence of other users triggered a re-orientation towards a more distant source, and ultimately led to a different security behavior than the user in the first example. In the first example, the agency of the antivirus software to autonomously search for problems and the step-by-step dialogue driven interface keep the user engaged as his goals for the interaction are satisfied, which maintain his orientation towards the computer and lead to a different behavioral outcome.

Persuasion. A user is reading product reviews for lawmowers on a retailer's website. The reviews are user generated, cannot be anonymous, and are are accompanied by avatars for the author. This user becomes oriented to the authors of the reviews because the explicit use of names and avatars provide anthropomorphic cues and afford social a strong degree of social presence. This user finds one review particularly helpful and clicks the author's name to read other reviews written by the author. He quickly notices that this author has reviewed dozens of different lawmowers, which strikes him as an unusual and unexpected behavior because few people own dozens of different types of lawmowers. The source distance model might predict in this circumstance that a reorientation could be triggered by this unexpected behavior of the source. In this case, the user might consider the agency of some lawnmower manufacturers to write reviews on the site, or the intentions of the site to present influential reviews. In this case, the user's persuasion knowledge may be activated and he may treat the reviews as advertisements rather than useful information from a like-minded consumer. However, a user who has little in interacting with others through reviews on the site may not become oriented to these authors and instead treat the site as a salesperson, orienting to the site and using other other features such as the site's recommendation system to make decisions.

6. DISCUSSION

These examples illustrate how the source orientation model can be used by designers to evaluate designs. The premise of the model suggests that in the early stages of any design process, designers should determine the intended source orientation of users on the system, as their behavior may vary according to source orientation. The model also provides a set of factors for which the design can be evaluated in order to estimate whether the design will manage user source orientation in order to provide a usable and secure experience.

Similarly, user experience researchers can benefit from the model, who run the risk of creating demand effects in their research if users are oriented to the researchers rather than to the interface that is being evaluated. The source orientation model suggests that social media and CSCW researchers who study social behavior in mediated environments need to consider whether users and subjects in their research are oriented to other users, or if they are oriented to other sources such as the interfaces they are using or the organizations which run social media sites. Fortunately, the model also provides a set of factors which researchers can use to make such determinations and to enhance research designs by controlling for source orientation.

Limitations. The source orientation model we have presented has been constructed by synthesizing a broad set of literature, and not by generating new data. This approach has several limitations. Firstly, much of the data used to build the model was generated in classical experimental psychology or communications and not in an applied setting such as HCI research. So we do not know how the context of using a computer might change people's cognitions in relation so some of the concepts we studied such as attribution theory or persuasion knowledge.

Second, the data which we have synthesized are highly diverse. They measure not only many different aspects of cognition, but also many aspects of behavioral outcomes. And these concepts were tested independently of each other, meaning that we don't know how they may interact with each other. We do not know, for instance, how anthropomorphic representations in interfaces influence persuasion knowledge, or how negative outcomes influence social presence.

Similarly, we do not know the relative strengths of these factors to each other. This is a critical limitation because our model explicitly states that re-orientation factors must be stronger than orientation factors in order to trigger a re-orientation.

For these reasons, we present this model as an exploratory model. It is informative in that it is highly inclusive, considering a broad range of factors which data suggest are influential to some degree. However, the model at this stage in its development lacks precision. Further empirical testing in HCI contexts is required to certify the specific strength and interactions of these factors.

Conclusion. The source orientation model is a framework for informing future design of systems and research. It provides a structured way to think about how and why users interact with sources of varying distance in human-computer interaction.

7. REFERENCES

[1] M. H. Ashcraft. *Cognition*. Pearson Prentice Hall, Upper Saddle River, NJ, 4 edition, 2006.

[2] A. Bandura. Toward a psychology of human agency. *Perspectives on Psychological Science*, 1(2):164–180, June 2006.

[3] F. Biocca, C. Harms, and J. K. Burgoon. Toward a more robust theory and measure of social presence: review and suggested criteria. *Presence: Teleoperators and Virtual Environments*, 12(5):456–480, Oct. 2003.

[4] L. Caporael. Anthropomorphism and mechanomorphism: Two faces of the human machine. *Computers in Human Behavior*, 2(3):215–234, 1986.

[5] C. Chabris. *The invisible gorilla : and other ways our intuitions deceive us*. Broadway Paperbacks, New York, 1st paperb edition, 2009.

[6] T. Chaminade, J. Hodgins, and M. Kawato.

Anthropomorphism influences perception of computer-animated characters' actions. *Social cognitive and affective neuroscience*, 2(3):206–16, Sept. 2007.

[7] B. Christian. *The most human human : What talking with computers teaches us about what it means to be alive*. Doubleday, New York, 2011.

[8] B. R. Duffy. Anthropomorphism and the social robot. *Robotics and Autonomous Systems*, 42(3-4):177–190, Mar. 2003.

[9] D. Eckles, D. Wightman, C. Carlson, A. Thamrongrattanarit, M. Bastea-Forte, and B. J. Fogg. Social responses in mobile messaging. In *Proceedings of the 27th international conference on Human factors in computing systems - CHI '09*, page 1651, New York, New York, USA, Apr. 2009. ACM Press.

[10] M. Friestad and P. Wright. The Persuasion Knowledge Model: How People Cope with Persuasion Attempts. *Journal of Consumer Research*, 21(1):1–31, Nov. 2007.

[11] M. Garau, M. Slater, V. Vinayagamoorthy, A. Brogni, A. Steed, and M. A. Sasse. The impact of avatar realism and eye gaze control on perceived quality of communication in a shared immersive virtual environment. In *Proceedings of the conference on Human factors in computing systems - CHI '03*, page 529, New York, New York, USA, Apr. 2003. ACM Press.

[12] D. T. Gilbert and P. S. Malone. The correspondence bias. *Psychological Bulletin*, 117(1):21–38, 1995.

[13] F. Heider and M. Simmel. An experimental study of apparent behavior. *The American Journal of Psychology*, 57(2):243–259, Apr. 1944.

[14] L. Hoffmann, N. C. Krämer, A. Lam-chi, and S. Kopp. Media Equation Revisited: Do Users Show Polite Reactions towards an Embodied Agent? In Z. Ruttkay, M. Kipp, A. Nijholt, and H. Vilhjálmsson, editors, *Intelligent Virtual Agents*, pages 159–165. Springer, Berlin, Heidelberg, 5773 edition, 2009.

[15] D. Johnson. Experience as a moderator of the media equation: the impact of flattery and praise. *International Journal of Human-Computer Studies*, 61(3):237–258, 2004.

[16] K. Keeling, D. Keeling, A. de Angeli, and P. McGoldrick. Social interaction with social beings. In N. T. Wood and M. R. Solomon, editors, *Virtual Social Identity and Consumer Behavior*, pages 73–92. M.E. Sharpe Inc., Armonk, NY, 2009.

[17] H. H. Kelley and J. L. Michela. Attribution theory and research. *Annual review of psychology*, 31:457–501, Jan. 1980.

[18] E.-J. Lee. What Triggers Social Responses to Flattering Computers? Experimental Tests of Anthropomorphism and Mindlessness Explanations. *Communication Research*, 37(2):191 –214, Apr. 2010.

[19] E.-J. Lee and J.-w. Jang. Not so imaginary interpersonal contact with public figures on social network sites: How affiliative tendency moderates its effects. *Communication Research*, 2011.

[20] C. K. Morewedge. Negativity bias in attribution of external agency. *Journal of Exp*, 138(4):535–545, 2009.

[21] C. Nass and Y. Moon. Machines and mindlessness: Social responses to computers. *Journal of Social Issues*, 56(1):81–103, 2000.

[22] K. L. Nowak and F. Biocca. The effect of the agency and anthropomorphism on users' sense of telepresence, copresence, and social presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, 12(5):481–494, Oct. 2003.

[23] G. M. Olson and J. S. Olson. Distance matters. *Human-Computer Interaction*, 15(2):139–178, 2000.

[24] L. M. Pfeifer and T. Bickmore. Is the media equation a flash in the pan? In *Proceedings of the 2011 annual conference on Human factors in computing systems - CHI '11*, page 777, New York, New York, USA, May 2011. ACM Press.

[25] S. Y. Rieh. Judgment of information quality and cognitive authority in the Web. *Journal of the American Society for Information Science and Technology*, 53(2):145–161, 2002.

[26] S. Y. Rieh and D. R. Danielson. Credibility: A multidisciplinary framework. *Annual Review of Information Science and Technology*, 41(1):307–364, Oct. 2008.

[27] G. Riva. Is presence a technology issue? Some insights from cognitive sciences. *Virtual Reality*, 13(3):159–169, May 2009.

[28] N. Shechtman and L. M. Horowitz. Media inequality in conversation: how people behave differently when interacting with computers and people. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, CHI '03, pages 281–288, New York, NY, USA, 2003. ACM.

[29] L. Sproull, M. Subramani, S. Kiesler, J. Walker, and K. Waters. When the Interface Is a Face. *Human-Computer Interaction*, 11(2):97–124, June 1996.

[30] J. Steuer. Defining virtual reality: Dimensions determining telepresence. *Journal of Communication*, 42(4):73–93, Dec. 1992.

[31] S. S. Sundar and C. Nass. Source Orientation in Human-Computer Interaction. *Communication Research*, 27(6):683 –703, Dec. 2000.

[32] L. Takayama, V. Groom, and C. Nass. I'm sorry, Dave. In *Proceedings of the 27th international conference on Human factors in computing systems - CHI '09*, page 2099, New York, New York, USA, Apr. 2009. ACM Press.

[33] R. Tourangeau, M. Couper, and D. Steiger. Humanizing self-administered surveys: experiments on social presence in web and IVR surveys. *Computers in Human Behavior*, 19(1):1–24, Jan. 2003.