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**WHO LEARNS WHAT FROM THE NEW HUMAN-COMPUTER
INTERACTION?**

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Abstract

A new human-computer interaction (HCI) in which narrow-form interaction with devices serves broader-form interaction among people and organizations, especially over the Web, marks an important phase of the information revolution. Four forms of broad computer-mediated interaction among individuals are identified: informational, cooperational, transactional, and social. Who learns what from the new HCI varies significantly across forms. In addition to the parties to the interactions, third parties that facilitate them learn too, amplifying the overall process. The perspective of the new HCI suggests new avenues for research in information systems and related fields.

Introduction

Taking my morning coffee and perusing the L.A. Times at the Coffee Cat recently, I notice Mary Q, a local IT consultant, working on her laptop at a nearby table. I can only imagine what Mary is up to, but had I asked, here is what she would have told me. It would not have been that different from her typical coffee-hour work routine.

Upon arriving and sitting down with her latte, Mary first updated herself on several matters, going onto the Web, using local wi-fi access. She checked out the news at the New York Times, reading a couple of the stories, as well as the blog of a favorite columnist. She then went to the Weather Channel to get the 10-day forecast for Portland, where she had a work-related visit coming up (showers expected). She checked her G-mail, to see if there were any surprises, and finding that she needed to respond to a call for a meeting by one of her colleagues, she navigated to Doodle and made her availability known. Mulling over her upcoming business trip, she decided to book her tickets and hotel room now rather than later. She checked out alternative flights at Expedia, then went directly to United Airlines to make her choice and obtain her e-ticket. She booked a hotel room at a favorite place, going directly to the site, without bothering to look for alternatives. These things accomplished, Mary was now posting news on her recent activities to her LinkedIn page.

In short, Mary was intensively engaged in what is today commonplace human computer interaction (HCI), working at her laptop. However, this barely begins to describe her interaction in the larger and more important sense in which the term is used. For while it is true that HCI by means of laptops, smart phones, e-readers, and such is everywhere around us, what is also true is that this narrow-form interaction is used largely for broader-form interaction with other purposeful individuals, i.e. people and organizations. It is this machine-aided broader-form interaction among purposeful individuals that constitutes the important information revolution that has been with us over the last few decades, and continues with us today.

While Mary's interactions as described were indeed unremarkable on the face of it, they illustrate for us four distinct and basic forms of interaction among individuals that are the subject of interest in the present paper. The first form is *informational*, illustrated by Mary's updating herself on the news and weather. The second is *cooperational*, illustrated by Mary's making her meeting availability known to her colleagues. The third is *transactional*, illustrated by Mary's booking of her flight and hotel room. The fourth is *social*, illustrated by Mary's updating of her LinkedIn page. What is remarkable about such varied interactions as Mary's is the almost seamless way they are now blended by IT into everyday life and work. I will term this relatively recent phenomenon the "new HCI" to contrast it from HCI as more conventionally conceived. What I attempt to do in the present paper is take a deeper look at what is now being accomplished by the new

HCI. Given that it necessarily engages multiple parties, to motivate this look I ask who learns what from it.¹

Forms of Interaction

As just suggested, when individual people interact with other people or organizations, these interactions may be informational, cooperational, transactional, or social.² Having illustrated these forms above, here we define them and elaborate. Before doing so, we first clarify what we mean by interaction.

What is important about interaction, from our perspective, is that it takes place between two or more purposeful individuals, understood as those who choose the ends they pursue, not just the means. We include not only people, but organizations as purposeful individuals.³

Both people and organizations can act through their machines as well as through their human representatives, and when they interact, each party acts in response to the actions of the other. In the case of organizations, they often interact with others by means of their computer-based systems which serve as machine agents in their electronic transactions. For instance, commercial banks establish ATMs for their customers to withdraw and deposit monies. When a customer engages a bank's ATM, the principal interaction is that between the bank and the customer, while the narrower interaction between the customer and the ATM merely serves it.⁴

Because each party in an interaction is responsive to the other(s), interaction is fundamentally *informative* to participants. Each act of each participant reflects intention that may be read by others. A certain exchange of information always takes place, even where the interaction ostensibly takes place for another purpose. Of course, the exchange is not necessarily symmetrical or fair. One party may learn much more than another through the interaction. For instance, in human interaction, one form is that of the formal interrogation, intended by one party to extract information from another, although even here, the party being interrogated may learn something about his or her interrogator through the process itself.⁵

¹ My purposes are primarily expository. This is the second in a series of short essays addressing foundations for IS study and practice. The first was Swanson (2007). In the interest of increasing readability, references are confined to footnotes.

² While we take these four types to be basic, they are not necessarily definitive or exhaustive. Other types may be suggested, e.g. recreational, political, and analytical, and no doubt still others, which we do not include as separate types here. Forms of HCI excluded from our framework include those between a single person and an isolated machine, say a primitive game station, which (re)acts on behalf of no purposeful individual.

³ See Ackoff and Emery (1972) for a treatise on purposefulness as we use the term here.

⁴ In our interpretation, machine agents are purposed systems (Arthur, 2009) as distinct from purposeful individuals. Their actions may commit those they represent in interactions with others, however they do not also choose the ends they themselves pursue, as do human agents. Machine agents thus represent extensions of purposeful individuals, rather than displaying full human agency as commonly understood.

⁵ The subject of human interaction has of course been richly researched, far beyond the minimal attention we give it here. See, for instance Blumer (1969).

To be more precise about an interaction, then, consider that the simplest two-party interaction might be modeled as $P_{11} > P_{21} > P_{12} > P_{22} > P_{13} > \dots$, where P_{ij} represents party i 's j 'th action in an interactive sequence. It is easy to imagine a two-party conversation modeled in this fashion, for instance (and many have been). One sees right away that in studying interactions there may be some ambiguity in where an interaction begins and ends, although we will give this particular issue little attention here. What is more important, for our purposes, is the recognition that any interaction is fundamentally dynamic and adaptive, and that its course and outcome is largely and intentionally path-dependent. Thus, in the normal conversation, it is terminated when one or both parties decide that it should be, given where they have been and have now arrived in their exchange. Moreover, when they next converse, where the interaction begins will likely follow from where the previous one ended, and from what the two parties have thus far learned from each other, over say a series of such interactions.

Interactions as suggested by the simple model may also be conceived in studies to have certain important attributes. Among these might be the *intensity* of the interaction, as measured for instance by the length of the interactive sequence within a fixed time frame. Depending on the purpose of an interaction, its intensity may be conjectured to be closely related to its success and to the information exchanged between the parties. Other attributes of research interest might include the interaction's *richness* (following the concept of richness employed in media richness research), *structure* (to the extent this is governed, as in a blog), and *extent* or length (the time span over which the interaction, however intense, occurs).⁶

Following our remarks above, we allow for any party to an interaction to be represented by a machine agent. This is important, for in the world in which we now live, most organizations employ the Web as a primary means of interacting with others, and this has largely given rise to the new HCI, as we have termed it. Thus, for instance, a business school may use its public Web site not only to provide information and guidance to prospective applicants, but to initiate and administer the formal application process itself, that is, to transact with external others.

Where organizations employ machine agents, their systems can also accumulate complete records of their interactions, which can be informative beyond the interactions of the moment, and on the Web, even within these interactions. This too is a consequence of the new HCI and indeed is now being used to extend the reach of HCI on behalf of organizations. We shall have more to say about this below, but first we elaborate on the four different forms of interaction we have already introduced above.

Informational interaction

In informational interaction, one party seeks information from one or more others, or one party seeks to inform the actions of one or more others, or both. For example, (i) a consumer seeks product information from a manufacturer (of say appliances or automobiles). The manufacturer provides a Web site that makes such product

⁶ Daft (1986) provides an important treatment of media richness. See too Trevino, Lengel, and Daft (1987).

information available. Or, (ii) an employee seeks retirement plan information from her employer. The employer provides periodic updates of the plan to its employees and posts these to its intranet for retrieval. Or, (iii) a service provider promotes itself via Google's AdWords, coming to the attention of a potential consumer engaged in a search, who clicks through to learn more. Or, (iv), a student unfamiliar with the concept of Web 2.0 goes online to Wikipedia to learn about it.

Informational interaction, then, revolves around the supply and demand of information. Information may be sought, i.e. demanded, for all variety of reasons. It may be supplied for different reasons too. A certain exchange may take place. In particular, the information one party gains may be in return for influence sought by the other. For instance, the manufacturer which makes its product information available to consumers, even where it does not sell directly to them, hopes to influence the consumer's buying decision.⁷

In today's IT-driven world, informational interaction is most vividly illustrated by the supply of information via pages established by people and organizations on the global public Web and the corresponding demand for information of all kinds manifested by the searches of people and organizations on this same Web.

Cooperational interaction

In cooperational interaction, two or more parties act together to accomplish a task, and information is shared and knowledge gained in the process. For example, (i) members of a design team dispersed across multiple locations use a group support system to manage and document their work. Or, (ii) a firm's supplier accesses the firm's extranet and manufacturing schedule to determine when it may need to add capacity to reliably meet demand. Or, (iii) two bank representatives, one senior, the other a trainee, cooperate in responding to a customer request, while accessing and updating the bank's enterprise system records. Or, (iv) Wikipedia volunteers from around the world interact online to maintain the encyclopedia's content.

In cooperational interaction, information is shared as a means to accomplish a collective task. Such interaction is fundamental to organizations of all kinds, where people work together, usually with some division of labor. It is important not only to formally organized traditional firms, but to loosely organized enterprises such as that illustrated by Wikipedia.⁸

Cooperational interaction lies at the heart of the area of study termed computer-supported cooperative work (CSCW), which has historically focused on creative work such as that

⁷ Swanson (1992) examines the exchange of information for influence as part of a study of information accessibility.

⁸ Formal organization presumes cooperational interaction. Galbraith (1974) in a classic early work addressed the exchange and processing of information in organization design. More recently, Malone (2004) explores information sharing for coordinating work and in cooperative enterprise more broadly. Doan, Ramakrishnan, and Halevy (2011) discuss crowdsourcing systems on the Web.

of the design team mentioned above, but it is also more important than commonly realized to working with enterprise systems, where routines and associated data are highly structured, but where users must coordinate their efforts across multiple functions and locations.⁹

In cooperational interaction, the information shared also results over the longer term in a collective knowledge gained, i.e., in organizational learning. What is learned is a capability to perform that tends to transcend attempts to represent it in storable form in so-called knowledge management systems.

Transactional interaction

In transactional interaction, two parties exchange goods, services, monies, and information pertinent to the terms of the transaction. For example, (i) a consumer buys an appliance online from a retail firm and arrangements are made for home delivery and installation. While certain of this interaction is electronic, other is physical and specific to location. Or, (ii) an individual auctions off an item from his garage on eBay. Again, delivering the goods requires a physical process. Or, (iii) a purchasing agent for a manufacturing firm orders parts online from one of the firm's approved suppliers. Or, (iv) a trader for a bank initiates a routine trade. In this case, the entire transaction may be electronic.¹⁰

Much as cooperational interaction is basic to organizational operations, in terms of executing tasks, transactional interaction is basic to organizational survival and prosperity, in terms of achieving success in customer and supplier markets.

In transactional interaction, the information generated and shared typically establishes and explicates the terms of the transaction. The transactions themselves are governed by explicit or implicit contracts. The firm's accounting systems accumulate much of the basic information associated with the transactions, however, less formal information is also acquired by those individuals, such as purchasing agents, who act on behalf of the firm in executing the transactions.

Social interaction

In social interaction, two or more parties interact with each other around their mutual interests, and information is shared in the process. For example, (i) friends on Facebook share their various "likes," including those of products or services offered by firms who have established their own Facebook presence. Or, (ii) a business school dean employs Twitter to offer her thoughts and pass along school information to her followers. Or, (iii) a local bakery uses Foursquare to offer daily deals to passers-by, who are alerted to these

⁹ See, e.g., Yamauchi and Swanson (2010) for a study of a CRM system used cooperatively within and across multiple locations.

¹⁰ The notion that transactional interaction necessarily involves the exchange of information among parties, and that this information provides a sometimes neglected store of value, is nicely developed by Glazer (1993).

on their smart phones. Or, (iv) multiple parties who do not otherwise know each other interact through their avatars in the online game of Second Life.

In much social interaction the information generated and exchanged between the parties is often incidental to the interaction itself. Participants as social beings derive direct pleasures and satisfactions from their interactions with others, as is well known. They often build out and cultivate their social networks naturally, so to speak. However, social interaction can also be exploited strategically, to advance careers, for instance, as is illustrated by professionals who use LinkedIn to network aggressively and advance themselves. Businesses have of course also developed a keen interest in exploiting social networks on the Web, to advance their products and services by digital word of mouth. They seek social recognition and acceptance of their brands, in particular.

Who Learns What

In sum, human and organizational interaction typically involves an exchange of information, mediated through the interaction itself. This exchange allows for learning by all parties. It will be helpful to examine this more closely for each of the four interaction types.

In the case of informational interaction, as we have defined it, one party seeks information from others, reflecting demand-pull, and/or others seek to provide it, reflecting supply-push. The information obtained may be more or less what was sought, and/or more or less what the provider intended that the seeker should get. Thus, what the information seeker learns from an exchange is subject to the interests and sometimes control of the provider, in particular where the provider wishes to influence the learning outcome.

For this reason, the seeker of information will also seek to ascertain and learn about the reliability of the provider. A provider may similarly seek to ascertain how subject to influence the seeker of information actually is. What is learned by both in this regard is likely to govern their future informational interactions.

Some organizations may be in the business of supporting informational interaction. On the Web, the primary example is Google, which through its search service aims to help any information seeker find a Web page pertinent to the information sought. Google thus acts as an intermediary. Over little more than a decade, Google's influence on informational interaction has been transformative, extending the global reach of seekers and providers alike.

Just as the primary parties to an informational interaction are informed by it, so too of course are information intermediaries such as Google. In particular, where the interaction takes place over the Web, because it involves information provided via stored forms, and because the interactions themselves can similarly be recorded, the intermediary can accumulate its own store of information and make it useful to others.

Cooperational interaction, like informational interaction, also provides for participant learning, however, it further provides for a collective learning beyond individual learning. As mentioned above, this is in part because a substantial amount of the learning is tacit.

Cooperational interaction is also fundamental to learning by novices, who apprentice themselves and learn by doing in cooperation with experts. Because organizations are always renewing themselves with new hires as they expand or replace those departed, cooperational interaction is basic to the maintenance of organizational knowledge of many kinds. While firms have sought to capture this knowledge with knowledge management systems, because much of the knowledge is tacit, this has proved to be more difficult than envisaged.

In transactional interaction, the learning that takes place may often be more easily explicated than with cooperational interaction, reflecting a more “arms length” relationship between participants. Each party to the transaction may come to know rather precisely what information must be exchanged and how in order to complete the transaction. Still, while each party may also learn much about their trading partners through these exchanges, there is likely to be much more that remains masked from view.

Certain information in a transactional interaction is likely to be shared. Where the transactional interaction is commercial, the information exchanged may be explicit with regard to the terms of the transaction. The sharing of such information may be basic to enforcing the terms of the contract as necessary. Thus, when a consumer makes a purchase over the Web, he or she may be required to click a box that indicates that the terms of the contract have been read and accepted (these statements are often so elaborate that most consumers will not read them).

Where a commercial transaction takes place in a formal market, the information exchanged may further be explicit with regard to the market’s actions and workings. The market acts as a third party to the transaction and seeks to make its workings transparent as may be needed to secure participation. The market is thus also a participant that can learn much from the transactional interaction that take place under its auspices, as so too, at least potentially, can government agencies that provide regulatory oversight.

Certain transactional interaction may involve information exchanged as part of the transaction. Digitally represented information is a storable and transferable good. For instance, stolen credit card numbers may be sold on the black market. The New York Times provides the news to its subscribers.

Even where information is not exchanged as a good, each party to a transactional interaction is informed through the other’s actions. Thus, although certain information will be shared, the information acquired by one party will in general be different from that acquired by the other.

In social interaction, each participant learns from the process, but much of this is incidental to the interaction itself. Information is likely to be shared, but often asymmetrically. Information is not necessarily sought, nor is it strategically proffered.

There is no co-operative task to be performed, nor is there a transaction to be conducted. Rather, the social exchange takes place for its own sake. Where it takes place over the Web or through other electronic forms, however, new forms of learning are enabled.

In particular, where enterprises such as Facebook and Twitter are established to facilitate social interaction, these enterprises can learn much about the participants and their social networks. Moreover, they can selectively market the information they gather to others, such as those that deliver advertisements on the Web. Not surprisingly, much effort and money is now being spent to leverage the vast information acquired about individuals and their social networks.

Discussion

To summarize, who learns what from the new HCI varies significantly according to the forms of interaction that motivate it. In informational interaction, the learning by one or more parties follows directly from the supply and demand of information itself. In cooperational interaction, the learning is substantially organizational, derived from the parties accomplishing a collective task. In transactional interaction, the parties learn from market transactions with each other. In social interaction, learning by the parties may be incidental, driven by the social value derived from the interaction. Beyond the primary parties to these interactions, across all four forms, third parties that facilitate the interactions may themselves learn and capture value from them, much of which is itself informational and drives further interaction. And so we see that the relationship between interaction and information is a powerful one.

The late scholar Horst Rittel once remarked that “information isn’t stored, it happens to someone.” Less evocatively, information was more commonly defined by early IS scholars as “data in context,” a rather static notion where the context was often left unarticulated.¹¹ Now, many years later, Rittel’s assertion may be seen to have a fresh validity. For what we can observe everywhere around us, in a world now dense with IT, is that information increasingly happens to most of us through our computer-mediated *interactions*. To elaborate on Rittel, it is interaction which we undertake such that information happens to us. In this short essay, I have attempted a closer look at this interaction phenomenon, which has broad social ramifications and has drawn the attention of scholars across fields. Here I take the perspective of information systems, in particular.

Not surprisingly, a dominant view in the IS context over the years has been that of human-computer interaction (HCI). As a field of study, HCI originally focused on making computers easier to use, emphasizing the design of the interface, most typically concerned with the screen and its contents and with input devices, such as keyboard and

¹¹ Davis and Olson (1985) elaborate: “Information is data that has been processed into a form that is meaningful to the recipient and is of real or perceived value in current or prospective actions or decisions.” (p. 200) Distinguishing between data and information was once popular among scholars. The quote from Rittel is from my memory of his saying it circa 1972. Rittel is best known for introducing the concept of “wicked problems” to the policy sciences (Rittel and Weber, 1973).

mouse. The perspective was that of design science, anchored in psychology and engineering, with attention devoted to improving the technology for the human user. Subsequently, behavioral researchers, recognizing that new technologies often encounter problems when introduced, extended HCI studies to address individual acceptance and use in organizational settings. More recently, the social use of systems has also caught the attention of HCI researchers. A recent review finds that HCI research has “expanded beyond its roots in the cognitive processes of individual users to include social and organizational processes involved in computer usage in real environments as well as the use of computers in collaboration.” The notion of socially “distributed cognition” has in particular been advanced to provide a “new foundation” for HCI research. At the same time, artificial intelligence researchers aim to make the HCI experience more like a fully human one.¹²

While these more recent developments are welcome, having extended HCI research from the inside out, so to speak, I offer in the present paper a complementary perspective, which aims to position HCI more from the outside in. For if we observe more closely what is going on around us, we see that people are interacting not so much with the technology as such, but primarily with other people and organizations. HCI is with us, but in new ways.

This new HCI has not yet been fully grasped. Through its ubiquity, it has also become more background than foreground in our everyday observations. Of course, where we do focus on it, we see it everywhere, in places of both work and leisure. We see it especially now in mobile forms. And while the cell phone has from the beginning been a device for enabling human interaction, in its more recent smart forms its support of interaction has been vastly extended, via the Internet and Web, with profound consequences. While interaction with the cell phone as device remains important, it is the broader human and organizational interaction transformed through its use which suggests the need for a new HCI perspective.

In the present paper, we have sketched the beginnings of such a perspective. What then might be its promise for researchers?

First, the new interaction perspective might serve to focus theory on information systems dynamics, as distinct from statics. The conventional view of IS has long been concerned with its important artifacts, in particular, beyond its devices, its software and data. Ontologies for data modeling have accordingly attracted much foundational research attention, in particular. Much of this work has a rather static flavor, derived from the view of information as storable. An alternative, practice-oriented view, less developed,

¹² An early classic HCI work is Card, Moran, and Newell (1983). The design science perspective is articulated in Carroll (1997). Zhang and Li (2005) provides a review founded in behavioral research. Olson and Olson (2003) offers a review that includes the quote, taken from its abstract. Hollan, et al (2000) makes the case for HCI based on distributed cognition. Pantic, et al (2008) articulates the ambition of AI researchers to make HCI more human-centered. Grudin (2005) articulates the several schools of thought associated with HCI, that have largely failed to coalesce.

has proposed anchoring IS foundations in an organization's work systems.¹³ Through process descriptions, this view has dynamic potential, though it has arguably not yet exploited interaction as such. We suggest here that an interaction perspective is fundamental and might be complementary to both these views, offering an integrative vehicle for understanding why and how software and data come to provide informational support of individual and organizational interactions, in work, but not only in work.

The new interaction perspective should also serve to focus research attention on the role of individual and organizational agency in HCI. Some current research does just this. For instance, in informational interaction, studies of the individual navigation of web sites are illustrative. In the case of cooperational interaction, agent-based modeling of the performance of organizational routines is also promising. In transactional interaction, game theoretic methods are being applied to the analysis of the dynamics of markets such as eBay. In social interaction, research attention is being given to the study of "opinion leadership" and other means of generating contagion phenomena on the Web.¹⁴

The new interaction perspective further provides a foundation for theory that incorporates individual people and organizations at the same level of analysis, for certain purposes, rather than the present approach anchored in hierarchy and organizational behavior theory, in which organizations are usually studied at a "higher" level than are people, who are studied in organizational context. This traditional approach has been very useful to IS research, but it has at the same time been limiting, arguably undervaluing or underestimating people vis a vis organizations in many studies. Placing people and organizations in analytic parity allows for certain studies, such as those involving transactional interactions where the terms of the contract apply to an exchange relationship between say a person and a firm, or even those that involve social interactions that take place between people and organizations on Facebook, for instance.

Too, the new interaction perspective may motivate research that takes a more institutional view of interactions among organizations and people, recognizing in particular the rise of third party organizations based in IS that facilitate these interactions as we have illustrated here. It may allow us to understand more deeply what motivates and constitutes an "information economy" in the sense in which the term is popularly used.

Finally, the new interaction perspective also places computer-based systems in a new light, as machine agents for individuals, and organizations in particular. The new HCI is

¹³ See, in particular, Wand and Weber (1995), which presents a view of information systems anchored in its representational power: "The deep structure of an information system comprises those properties that manifest the meaning of the real-world system the information system is intended to model." (from the abstract). In principle, dynamic as well as static properties of real-world systems might be modeled. Alter (1999) argues for a theory of information systems based in their support of work systems.

¹⁴ Web site navigation produces substantial "path data" for subsequent marketing analysis, as described by Hui, Fader, and Bradlow (2009). Its dynamics are also of intense interest to delivering advertisements in realtime. With regard to cooperational interaction, agent-based modeling of routine performance is suggested by Pentland, Liu, and Becker (2009). In the transactional sphere, Zeithammer (2006) uses game theory to examine the dynamics of bidding on eBay. With respect to online social interaction, Szabo and Huberman (2010) examine the dynamics by which the content of Digg and YouTube achieves popularity.

essentially one in which people interact with organizations through systems that act as machine agents. Seeking an understanding of systems as machine agents, beyond their supposedly mundane and traditional information processing roles, might also place IS research on a newer and more profound footing.

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