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Communications of the Association for Information Systems

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Making Faces: Information Does Not Exist

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Abstract:

In this article we attempt three things. First, to show that common conceptions and usages of the term 'information' are misleading; they lead to particular misunderstandings and misdirections, particularly amongst those disciplines and practices which locate information at their core. Second, to describe a conceptual framework which helps explain why information as conventionally conceived does not exist; instead in-formation is better considered an accomplishment with forma in pursuit of performa. Third, to demonstrate how such a conception of information leads to a re-conceptualization of both information systems and information technology and offers a more profound basis for developing trans-disciplinary understanding across the information disciplines. To help ground our discussion, we utilize a nonstandard case—that of human emotive facial expression. We show how an unpacking of this basic form of face-to-face communication supports our re-conceptualization of information.

Keywords: systemics, semiotics, information, data, facial expressions, autopoiesis

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I. INTRODUCTION

The concept of information is clearly central and foundational to the 'information' disciplines (information systems, information management, information science, computer science). Since the term is used as a suffix to at least three of these disciplines, it is no surprise to find that debates about the nature of the disciplines themselves frequently revolve around debates about appropriate nomenclature, particularly as it concerns key loci for intellectual discourse within these areas, such as information technology and information systems [Baskerville and Myers, 2002; Benbasat and Zmud, 2003; Galliers, 2003; Hirscheim and Klein, 2003].

Not surprisingly, much debate has occurred over the proper conceptualization of the term 'information', not only within literatures such as information systems [Boland, 1987; Holwell and Checkland, 1998; McKinney, Yoos, and Kroenke, 2012] and information science [Capurro and Hjørland, 2003; Bates, 2006; Hjørland, 2007; Zins, 2007], but also more widely [Stamper, 1973; Dretske, 1981; Maturana and Varela, 1987; Mingers, 1995; Stonier, 1997; Brier, 1999; Floridi, 2011].

It is evident from a close reading of this literature that there are at least four fundamental conceptions of the nature of information employed in this literature, which we shall refer to here as the objective position, the subjective position, the inter-subjective position, and the null position. On the one hand, information is characterized as fundamental 'stuff' which helps any physical system maintain organization [Stonier, 1994; Bates, 2006]. As such, information is faceted as an objective phenomenon, independent of the actor. On the other hand, information is seen to be created within acts of sense-making by individual actors [Boland, 1987; Weick, 1995]. In this guise it is faceted as a subjective phenomenon, bound to the actor. More recently, information has been considered an inter-subjective phenomenon, reliant on the 'negotiation' of collective intentionality and intensionality [Tomasello and Carpenter, 2007; Searle, 2010]¹. As such, information is considered an inter-subjective accomplishment amongst groups or communities of actors [Mingers, 1999; Hjørland, 2007]. Finally, we should mention the most radical position which proposes that information does not exist—it is a null concept. Stimulated by the work of Maturana and Varela [1987] and their idea of an autopoietic (self-producing) system, this viewpoint maintains that information is merely a convenience imposed by observers upon situations of behavioural coordination through structural coupling [Mingers, 1999].

To help understand not only these different conceptions of information themselves but also the consequences of such conceptions for other parts of the nomenclature of the information disciplines, such as information technology and information system, we shall utilize a nonstandard case. During his voyage in the HMS Beagle, Charles Darwin pondered on how strange it was that he had no difficulty in understanding the facial expressions of the many people he met, even though he could not understand any of their spoken words. Hence, some twenty years after publication of his ground-breaking work, *The Origin of the Species*, Darwin published another book of which he was equally proud, *The Expression of the Emotions in Man and Animals*, in which he described his pioneering investigation of emotive facial expressions in humans and their closest evolutionary relatives, the great apes. His key conclusion was that '*... the young and the old of widely different races, both with man and animals, express the same state of mind by the same movements*' [Darwin, 1998]. The case of human emotive facial expressions is a particularly interesting one to consider primarily because its lack of discussion within the disciplines of information systems, information management, and information science makes it suitable as a means to help breakdown established conceptions.

Within this article we examine questions of how and why humans and apes 'make faces' but use a slightly different conceptual lens than that employed by contemporary biologists, psychologists, and even computer scientists: all disciplines that regard facial expression as a fascinating and fruitful contemporary area of research. Facial expressions as a significant part of nonverbal communication helps explain their importance in the recent explosion of business and personal development books purporting to reveal the 'secrets' of such body language [Morris, 1979]. The 'correct reading' of facial expression is particularly seen to be an important facet of what is referred to as emotional intelligence [Goleman, 1996].

¹ Intentionality refers to the relationship between mental states and the world. Intensionality refers to the property, quality, or concept referred to by a symbol.

This explains the great degree of interest in exploiting the developing understanding of human facial expression within technological applications of various forms, and, in particular, as the basis for improving aspects of human-computer interaction [Picard, 1997]. Rani, Sarkar, Smith, and Adams [2003], for instance, propose that '*endowing machines with a degree of emotional intelligence should permit more meaningful and natural human-machine interaction*', while Ortiz de Guinea and Markus [2009] propose that emotion has a key part to play in the continuing use of information technology systems. Much of this work can be seen as the attempt to represent facial expressions as systems that can be automatically interpreted and operated upon by algorithms.

After a brief description of the case, we shall unpack it in terms of the four different conceptions of information described above. We shall then attempt a reformulation of the concept of information in terms of an overarching framework which we claim allows us to make better sense of the key locus for the Information disciplines. In doing this we shall demand a reorientation of thinking about the nature of information systems and information technology.

II. MAKING FACES

Figure 1 provides six sparse illustrations of the most commonly recognized facial expressions found among humans. Before reading further, try to provide one word which you think aptly describes each illustration.

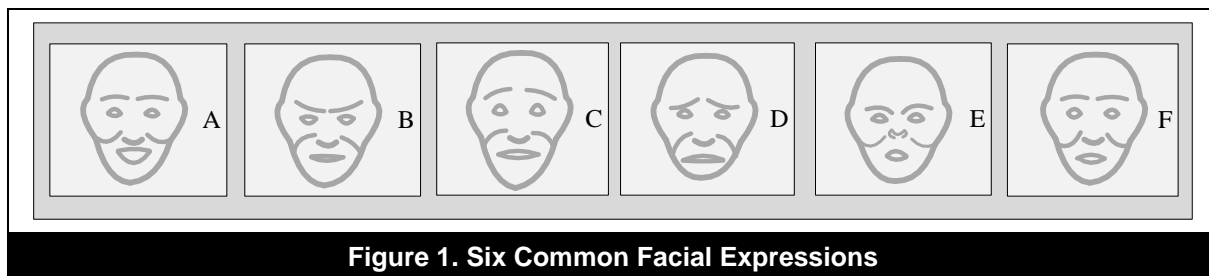


Figure 1. Six Common Facial Expressions

When people across the globe are asked what these facial expressions mean, they frequently come up with similar answers. It appears that facial expressions, such as the ones illustrated, are generally associated with some common human emotions and that the making of such faces is a major way in which humans communicate emotion or affect. Facial expression A, for instance, is normally seen to stand for something like 'happiness' while facial expression D is typically seen to stand for something like 'sadness'. Facial expression B stands for something like 'anger', facial expression E stands for 'disgust', C stands for 'fear' and F is a neutral expression—one which is not meant to signify any emotion.

The set of human facial expressions form what we would like to refer to as an important sign-system. A facial expression results from one or more movements of the muscles of the face, and these movements seem to be primarily used to convey mental state. As such, facial expressions are a form of nonverbal, embodied communication. They involve signs but do not involve use of the human vocal tract. They are an important means of conveying aspects of intent among humans in social interaction and rely upon certain cognitive abilities of individuals, particularly that of empathy.

Not all human facial expression is associated with human emotion, but emotive facial expression is certainly the most studied aspect of this nonverbal sign-system. Such expressions are typically 'about' such emotions as experienced by a person or at least some form of emotional intent that this person wishes to express. Ekman [2003] believes that an emotion '*is a feeling, a set of sensations that we experience and often are aware of*' [Ekman, 2003]. This feeling can be brief, lasting only a few seconds or minutes. If the experience lasts hours, Ekman describes it as a mood, not an emotion. As well as the expression being about some emotion, the feeling itself is typically about something in the 'world'. We also typically experience emotions as happening to us and not being chosen by us. Hence, an emotion can be considered a mental state. It is a conscious mental state that has some limited duration. As we shall see, such mental states are typically involuntary and typically about something in the world that matters to us.

There is no agreement as to the list of mental states that constitute emotions, even though there have been various attempts to build a taxonomy of emotions. Different human spoken and written languages clearly label emotions differently; some cultures apparently lack words for particular emotional states. Some common English words that act as labels for such mental states include agony, anger, confusion, contempt, desire, disgust, excitement, fear, frustration, happiness, sadness, and surprise. There is continuing controversy in this area, but many agree with Ekman [1998] when he maintains a certain unanimity amongst scholars that humans manifest at least five distinct emotions: anger, disgust, happiness, fear, and sadness (hence the illustrations in Figure 1).

III. FACIAL EXPRESSIONS AND INFORMATION

We can illustrate some of the problems surrounding the concept of information by considering a simple example, utilizing the material of human emotive facial expression and which bears a family resemblance to an example cited in Bates [2006]. Person α looks across at fellow person β situated at the opposite end of some room. She makes one of the facial expressions illustrated in Figure 1 and directs this expression at person β . Here we have the most basic form of 'face-to-face' communication. The key question we have is where information fits into this scenario.

To simplify somewhat, the same term—information—has been used in at least three distinct ways in explanations of situations, such as the one described: information is treated as an objective phenomenon, as a subjective phenomenon, or as an inter-subjective phenomenon. We shall also consider a fourth more radical conceptualization: that information is a convenient fiction which observers use to interpret situations of structural coupling between organisms.

As an objective phenomenon, information would be described as being transmitted in the form of a message from one actor α to another actor β . A particular communication channel, in this case associated with the transmission of light, connects together the embodied sensory and effector apparatus of the actors within the situation. A particular facial expression effectively codes a particular emotion and this is transmitted along the communication channel. This conception of information is, of course, that utilized within the information theory of Shannon [1949]. We would argue that the idea of information as an objective phenomenon is the dominant conception still employed within the information disciplines.

For instance, take the idea of information richness theory, a theory much cited within information systems literature. Information richness is defined as '*the ability of information to change understanding within a time interval*' [Daft and Lengel, 1986]. According to this theory, communication media or communication channels vary in relation to information richness. Interestingly, face-to-face communication is seen to be the richest type of medium because it provides immediate feedback and utilizes multiple cues for reducing the equivocality of a message. Information richness then is an objective property of the medium of communication.

As a subjective phenomenon, information would be seen as a process of making sense by actor β of the behaviour of another actor α . To make such sense, actor β has to accomplish an appropriate inward-forming of the actions of the other. In a classic paper published in the 1980s, Boland [1987] criticized a number of taken-for-granted assumptions associated with the concept of information that still permeate the literature (both within and outside of the discipline of information systems) some thirty years later and proposed a richer account of this concept based primarily in a mechanics of phenomenology. For Boland, conventional ways in which information is treated solely as a noun commit what Ryle [1949] refers to as a category mistake. Information relies on the patterning of the world in symbols [Millikan, 1984]; but information is not a given in the presence of such symbols. Instead, information is a process of sense-making within acts of communication. As such, it should be rewritten as a verb—*in-formation*—because '*Information is an inward-forming. It is the change in a person from an encounter with data*' [Boland, 1987].

In the case of human emotive facial expression, the process of in-formation appears to have much synergy with the concept of empathy. Empathy is typically described as the capacity or ability of some actor to recognize and, to some extent, share the feelings experienced by some other actor [DeWaal, 2010]. The emphasis here is upon sharing, not only of emotions but also the expression of such emotions.

Such a conception is not new. Edgar Allan Poe in his short story 'The Purloined Letter', for instance, has one of his characters utter the following words: '*When I wish to find out how wise or how stupid or how good or how wicked is anyone, or what his thoughts are at the moment, I fashion the expression of my face, as accurately as possible, in accordance with the expression of his, and then wait to see what thoughts or sentiments arise in my mind or heart, as if to match or correspond with the expression*' [Poe, 1845]. Merleau-Ponty appears to be of the same mind: '*I live in the facial expression of the other, as I feel him living in mine*' [Merleau-Ponty, 1964]. Lee [1994] has used a conception of in-formation (although he does not refer to it as such) in his critique of the account given by information richness theory of email as a communication medium. Reinstating the notion of an interpretive actor using email as a communicative resource allows him to demonstrate that richness is not a property of the communication medium itself. Instead, it is an emergent property of the use of email by interpreting actors within its organizational context.

As an inter-subjective phenomenon, information would be seen to revolve around some form of collective 'agreement' between actor α and actor β about appropriate signs and the proper use of such signs to communicate effectively. This means that actor α and actor β must share a common basis for signification founded in aspects of a

collective intentionality [Searle, 2010] and collective intensionality [Ogden and Richards, 1923]. If information is a change in a person experienced from an encounter with data, then data as symbols signify intensions. Such intensions are typically used to communicate the intentions of one actor to another actor. As such, information relies both upon a collective intentionality and upon a collective intensionality. It is through the stance that we take that the 'aboutness' of our mental states being similar to the 'aboutness' of the mental states of other actors that social interaction through communication becomes possible [Dennett, 1987].

An emotion is a mental state, but one rarely has an emotional experience in and of itself. Emotions are typically about something in the world. They are also embodied experiences [Mingers, 2001]. Part of such embodiment involves the production of some facial expression. A particular mental state (emotion) is therefore an intention in the sense of being about some aspect of the world. We are not normally sad, happy, or angry in isolation. We are typically sad, happy, or angry about something. As such, emotive facial expressions appear to form a significant part of our shared or collective intentionality as a species. But such forms of embodied and expressive communication are also used within conventional processes of signification and hence are shaped by cultural influence. This is primarily the realm of intensionality (with-an-s).

The final viewpoint considered is that information is a null concept—a convenient fiction. Maturana and Varela's [1980, 1987] theory of autopoiesis conceives of all living systems as self-producing systems. This means that such systems comprise networks of relations and processes which continuously produce and reproduce the components which realize such networks. A class of autopoietic systems of the same type can be described in abstract terms as a set of components and relations. This abstract description Maturana and Varela term an 'organization'—a human being is an example. The structure of an individual instance of organization is one realization of that organization—I am an example of such a structure.

All autopoietic systems by definition are organizationally closed, meaning that the behavior of the system is not specified nor controlled by its environment but by its own structure. Such structure determines how the system will behave in all circumstances. However, autopoietic systems are not closed systems in the sense implied by systems theory. They are not disconnected from their environments, but in constant interaction with them through an ongoing process that Maturana and Varela refer to as 'structural coupling' [Mingers, 1999].

Hence, an autopoietic system and its environment (which will be made up, in part, of other autopoietic systems) act as mutual sources of perturbation for one another. The changes in a living system may be triggered by some perturbation in the environment but are determined solely by the structure of the system. Autopoietic systems never receive 'instructive interactions' from their environment—meaning that there is nothing outside the system that determines the behavior of a particular living structure.

Maturana and Varela argue from this conception that social systems and the communication on which they rely arise naturally from the reciprocal structural coupling between organisms. Communication, in fact, constitutes the reciprocal coordination of behavior amongst groups of organisms. Communication thus comes before language and is the basic behavior through which language emerges. To an observer the signs organisms utilize may be seen to refer to objects in the world. But in autopoietic terms they are merely a reflection of the established coordination of behavior between organisms through structural coupling.

A disturbing consequence of the theory of autopoiesis is the rejection of the notion of information as an objective phenomenon [Beeson, 2009]. This means that an autopoietic account rejects the idea of information being transmitted as 'stuff' along some communication channel. At first glance, it also appears to reject the notion that information involves the interpretation of symbols on either an individual level or upon the level of the social.

Darwin in *The Expression of the Emotions in Man and Animals* detailed a number of propositions relating to human facial expression that support the idea of emotive facial expression as an instance of reciprocal structural coupling amongst primates. First, he believed that such facial expressions display evidence of the fact that homo sapiens as a species experience a common range of mental states, which we refer to as emotions. Second, such emotions are expressed by a common and shared range of facial expressions. Third, that humans share a range of such emotions and the facial expressions associated with them with the higher apes. Fourth, that the evidence of the universality of emotive expression in humans and their appearance in closely related species demonstrates the evolution of this range of behaviors in our species.

Darwin studied facial expressions in both humans and apes and concluded that there was a marked similarity between such expressions. Chimpanzees, for instance, can reproduce all of the standard facial expressions found in humans, except frowning. Hence, cognitive ethologists have started to propose a deep structure for such expressions based in a common evolution of human behaviors amongst primates [Ristau, 1991]. This provides

potential evidence for the evolution of forms of human communication from animal communication, related probably to what Dennett [1996] refers to as the sedimentation of 'minds' in humans.

Up until the late 1960s, most social scientists challenged Darwin's proposal of the universality of human facial expression. Instead, they argued for the relativity of human emotive facial expression—that it is a learned rather than an innate set of behavioral responses. Following the pioneering work of Ekman and Friesen [1971] and others, it is now generally accepted that there is sufficient evidence to support most of Darwin's original propositions, albeit in a modified form.

In such terms, an emotion is some change enacted in the structure (and more precisely the nervous system) of the organism. This change of state may stimulate other changes to the structure of the organism such as a change to aspects of an organism's effector apparatus: a facial expression. Facial expressions have evolved amongst human beings and the higher apes as a means of coordinating behavior. A facial expression created by one human actor acts as a perturbation in the environment of an observing human actor. This perturbation may enact a change to the structure of the observing actor—it may stimulate a state of his or her nervous system which we denote as an emotion. This emotional contagion [Hatfield, Cacioppo, and Rapson, 1994] may be one of the most basic forms of social interaction amongst humans.

IV. A SYNTHESIS

So is information objective, subjective, or inter-subjective? Or is information actually a fiction—a null concept? There have been a number of attempts to develop a synthesis of some of these viewpoints. Both Dretske [1981] and Mingers [1995] for instance have criticized the established objective or 'engineering' model of information in communication and wish to include the issue of meaning within any definition of information. As such, both lay claim that information is not only an objective but also a subjective phenomenon. Information is objective in the sense of comprising physical signals [Shannon, 1949]. It is subjective in the sense of relating to interpretation and meaning [Hjørland, 2007]. Mingers [1995] also importantly points to the inter-subjective nature of information. In his terms this is because meaning is expressed in and conditioned by language.

Hence, on the one hand we might argue that the term 'information' is overloaded in the sense that we use the same term to refer to actually three distinct phenomena. On the other hand, and in a similar vein to Maturana and Varela, we might argue that both the term and these three-fold conceptions of information are themselves misplaced and that we should search for a more accurate way of describing the architecture of communication between organisms and perhaps even of communication between organisms and machines.

The strategy we employ is to actually denote each of the three base conceptions of information with a new term². But these are not separate terms, they are part of a unified whole which we have referred to in previous work as the enactment of significance [Beynon-Davies, 2011a]. This acts as a level of meta-analysis which incorporates not only the conceptions of information discussed in the previous section but also is consistent with the idea of communication as reciprocal structural coupling established in the work of Maturana and Varela. In this section we describe this conceptual framework and apply it to the case of emotive facial expressions in humans. In the following section we examine some of the wider consequences of this perspective for the Information disciplines. In particular, we argue that such a perspective suggests a reframing of some of the held foundation of such disciplines, namely, information systems and information technology.

We propose that the patterning of order characteristic of organization is enacted through three entangled [Barad, 2007] forms of action that cohere in significant patterns. Through formative acts actors constitute forma, a term we use to stand for the various ways in which physical substance is given form. Through informative acts actors constitute informa, a term we use to stand for the various ways in which form serves to inform. Finally, through performative acts actors constitute performa, a term we use to stand for the various ways in which informed actors achieve coordinated performance.

By the patterning of order which constitutes organization we mean first that formative, informative, and performative acts recur in regular and repeating ways. We further suggest that such acts relate together as complexes which we refer to as formative, informative, and performative patterns. Finally, when these patterns achieve any reasonable

² The confusion surrounding the concept of information is evident in the ubiquitous use of the so-called data, information, knowledge hierarchy or pyramid to help explain what information is not. Typical of foundation definitions in many contemporary textbooks on information systems, information management, information science, and more recently knowledge management, such a hierarchy or pyramid frequently serves to confuse rather than clarify the nature of information. Zins [2007], for instance, identifies at least five different models of this pyramid used within the literature, each having a different conception of information.

size, it becomes possible to think of them belonging to larger units which we refer to as performative, informative, and formative systems. These three types of system provide greater precision to the concepts of information technology, information system, and organizational routine [Pentland and Feldman, 2008] or business process.

The terms 'forma', 'informa', and 'performa' are taken from the work of Dietz [2006] but given an expanded meaning within the framework described here. This tri-partite entanglement we take to constitute the unitary essence of the accomplishment of significance. It is the same essence which exists in the founding work of the semiotician Peirce [1931] when he defines a sign in terms of three component elements: representamen, object, and interpretant. It is also critical to the distinction made by the philosopher Austin [1971] among the locutionary, illocutionary, and perlocutionary aspects of a speech act, and which forms important foundation for the conceptual edifice created by John Searle [1970]. Finally, this arrangement of order bears a resemblance to Habermas's [1998] distinction among the objective, subjective, and social life-worlds.

Applying this conceptual framework to the case of facial expression, our key argument is that interpersonal affect is a critical accomplishment enacted through forma, informa, and performa. At the level of forma, a person's emotional state is signaled through various embodied cues such as facial expression. At the level of informa, such expressions are critical to ensuring the effective operation of communicative acts. At the level of performa, empathic response is important to the coordination of mutual performance amongst a multitude of actors.

Forma relates to the physical or objective life-world and thus stands for the objective nature of information. The forma of facial expression relies on the embodied experience of two types of actors: the actor making the facial expression and the actor observing the facial expression. The actor making the facial expression relies on the effector apparatus of the human body, primarily the musculature of the face. Facial expressions rely on the ability of a person to manipulate this musculature. Contraction of muscles, either singly or in combination with other muscles, changes a person's facial expression. Therefore, a given facial expression can be analyzed in terms of the combination of muscles activated and how they are activated over a period of time. The forma of facial expressions also relies on the sensory apparatus of observers. Perception of facial expressions relies on the human eye and its ability to sense certain defined wavelengths of light reflecting off some human face.

Informa relates to the psychological or subjective life-world and hence stands for the subjective nature of information. At the level of informa we are interested in the 'meaning' or intensionality imparted through such expressions. But meaning is not a given, it is an accomplishment. In Maturana and Varela's terms the act of making a facial expression by one actor perturbs the structure of another actor. When the changes of state in one actor (her emotional state) are similar to those induced in another actor, then we can say that communication has occurred and hence that meaning has been accomplished. Hatfield et al. [1994], for instance, argue that people in their everyday encounters tend to synchronize their facial expressions, voice, postures, and movements with that of others. Through this process we become continuously affected on a moment-by-moment basis and at a largely unconscious level by the emotional states of fellow actors. Hence, emotional states are 'contagious' in the sense that one person's emotional state can affect the behaviour of the close group with which they interact. Such 'infection' is clearly reliant both upon the communication of emotional states and the ability of individual actors to empathize. Emotion and its communication therefore are likely to affect the coordination of mutual action.

Performa relates to the social life-world and represents the inter-subjective nature of information. Goleman [1996] argues that emotions are in essence impulses to action. The root of the English word 'emotion' is the Latin verb *motere* which stands for 'to move'—with the prefix *e* connoting something like 'to move away'. This suggests that a tendency to act is implicit in any emotion—hence emotion is a key motive force in behaviour or performance, not only on the individual level but also at the level of the social.

People need to communicate affect to other actors because it is important in understanding the motivation of much action. The assessment made of another person's emotional state is hence typically important to many aspects of both individual and group performa. Performa is enacted through performative acts, but the performative acts of particular actors do not occur in isolation. Any performative activity is normally undertaken in response to, or mindful of [Mead, 1934], other actors and activities. As we have seen, facial expression is a crucial aspect of affective communication: the communication of emotional state between two or more actors. Such communication is important to the coordination of mutual performance between such actors in many social situations.

Consider the work of McGrath [2006] in this light. Her analysis of the work of control staff at the London Ambulance Service prior to a major computerization effort suggests the importance of emotion (in our terms) to performative, informative, and formative action. Control staff at this emergency response service, for instance, felt that establishing empathy both with a caller and patient at some emergency incident was critical to the performance of their job. Not only did they need to establish the emotional state of these actors, they also frequently needed to attempt to affect

aspects of such feelings to establish a situation in which effective dialogue could take place. Often, control staff would make judgments about the urgency of incidents on the basis of emotional signals (statements, intonation, dynamics of the voice) received from the caller and/or patient. This might lead to changes in the priority assigned to the dispatch of ambulances to such incidents.

V. CONCLUSION

This article has examined three conceptions of information promoted within the literature: as an objective, subjective, and inter-subjective phenomena. We have also examined the notion that information does not exist—that it is a convenient fiction for describing the structural coupling between organisms. This led us to propose a reframing of the issue of information in terms of a framework which attempts to explain the constitution of significance. The current problematic associated with the concept of information is caused by the attempt to use the same term for three different but entangled phenomena which we have denoted as *forma*, *informa*, and *performa*.

But does this discussion have any relevance to information systems as a discipline beyond providing more conceptual clarity to the problem of information? Taking a lead from our re-conceptualization of information, we would argue that the way in which we form signs informs our performance. Another way of saying this is that our ontologies—our theories of reality—help frame not only our communication but also our action. We conclude here with a brief demonstration of two ways in which our re-conceptualization of information leads to a reformulation of what it means to study information technology and information systems.

We have argued elsewhere [Beynon-Davies, 2009a] that the concept of a formative system provides a more precise rendering of information technology beyond that of digital computing technology. One might even say that the information disciplines appear dazzled by digital computing communication technologies but ignore the ongoing significance of simpler formative technologies that continuously help drive organizational action [Cooren, 2004]. The idea of formative technology allows us to understand the clear relationships among such diverse technologies as the Ancient Sumerian clay token [Beynon-Davies, 2012], the Inka khipu [Beynon-Davies, 2009c], the Hollerith electronic tabulator, the Victorian business paper form, and the modern electronic database. But the term 'formative system' is also useful in understanding the relationship of such technologies to embodied *forma* [Mingers, 2001] such as human speech, human facial expression, the waggle dance of the European honeybee [Beynon-Davies, 2010], and the bark of the Gunnison prairie dog [Beynon-Davies, 2011b].

Take a very simple example that proved relevant to a recent case of business analysis conducted by the author within a manufacturing organization. Within production at this organization, workers make much use of whiteboards placed at strategic positions on the shop-floor. Upon such boards workers place small, colored representations of human facial expressions—particularly the expressions for happiness and sadness, and the neutral face (Figure 1). These small pieces of what we would call 'formative technology' are extremely important for the workers themselves as collective expressions of satisfaction with their own performance such as levels of production or levels of stock accuracy. But interestingly these artefacts are not accounted for within the specifications of IT systems used by the manufacturing plant. The information systems literature also seems to have largely ignored what Cooren [2004] refers to as the textual agency associated with low-fidelity but significant artefacts of formative technology. The Information Systems academy, just like information systems practitioners, would appear to regard such formative technologies as outside of disciplinary consideration because they are not framed within the idea of information technology as digital computing technology [Orlikowski and Gash, 1994].

We have also argued that the idea of an informative system provides greater precision to the currently confused notion of an information system [Beynon-Davies, 2009b]. It helps separate out the notion of an information system more clearly from information—or more accurately formative technology—and provides a way of making sense of information or informative systems separate from considerations of particular classes of formative technology. It also raises our awareness of substantive areas of informative systems not currently well-studied or understood within the information disciplines, such as the role of affect or emotion within organizational communication, which has formed the central case material considered in this article.

In 2006, McGrath [2006] argued that the Information Systems Academy pays little attention to the affective domain. Several years later, the place of affect within information systems is still an under-studied area. Part of the reason for this might be the way in which the Information Systems Academy inherently utilizes background assumptions about the much-used distinction between thinking and feeling. This distinction is used in turn to substantiate a further distinction between rational and non-rational behaviour, particularly in such areas as decision-making. But such assumptions have been subject to critique by Ciborra [2006] and Mingers [1995], among others. These authors believe that distinctions between cognizing and feeling and that between rational and non-rational behavior is convenient but artificial. Ciborra [2006], for instance, draws upon Heidegger to argue that our actions are never

purely rational because we always encounter the world through our moods or emotions. Mingers [1995] also argues that all communication contains such an emotional modality.

But how does this help us in our approach towards informative systems within actual organizations? Take an example from another organizational domain experienced by the author—that of emergency response to healthcare incidents. Much modern communication, both within and without organizations, is of course mediated and remote communication: augmented through technology. Improvements in carrying capacity have already increased the modalities available for the communication of affect through such technology. Take the simple example of a telephone call to emergency response. As mentioned, currently the call-taker gains information about the emotional state of the caller either through the propositional content of the message or through various paralinguistic signals such as rhythm of speech and intonation of the voice. It is, of course, currently possible for emergency calls to be made through a communication channel that transmits video as well as audio data. In such situations, the additional modality of vision will enable the call-taker to read emotional state from the facial expression of the caller as well as from other aspects of body language.

How will this change in formative technology impact upon informative and performative practice within domains such as emergency response? According to information richness theory, call-takers should be better able to reduce equivocality in their decision-making by exploiting the additional nonverbal cues of facial expression. But how precisely is such form to be utilized in, for instance, judging the veracity of assertions made by callers and how in turn does this affect the ways in which the assignment of ambulances to emergency incidents is triaged? Such questions direct attention at the importance of studying, analysing, and designing informative systems separately but in concert with the design of technology, and always directed at issues of performance.

So information systems as a discipline faces a challenge on two fronts. First, it currently fails to consider and explicate a range of formative systems and technologies that although much used within organizations lie outside, sometimes deliberately so by design, that of digital computing systems. Such low-fidelity channels and technologies are critical to many informative systems within organizations and indeed help frame the realm of digital computing technologies within such organizations. Second, the current conceptions of information—information technology and information systems—much used within the information systems community make it rather poorly placed to handle ongoing developments in formative technologies and the impact such technologies are having or are likely to have upon informative systems. The developing technologies of automatic recognition of human emotive facial expression are a case in point.

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