Entries in *The Encyclopedia of Semiotics* (P. Bouissac, Ed.). Oxford/New York: Oxford University Press, 1998: Max Bense (pp. 72-74), Ernst Cassirer (pp. 108-110), Computer (pp. 136-138), Eugen Coseriu (pp. 148-150), Interface (pp. 319-321), Parallelism (pp. 465-467), Structure (pp. 601-603)

Interface

The computer age brought to expression concern for human-machine interaction. Within this concern, interface evolved as the language through which computer users can attempt to accomplish their computational needs. Progress in digital technology soon made hardware considerations less critical for users of this technology than considerations of the many ways through which the performance of a machine is affected by the ability to address it in ways as close to natural language as possible. Strictly speaking, one can distinguish between user interface – describing how a user should "address" a machine – and process interface – describing the exchange of messages among a machine's various components. While the two should be understood as constituting a unity, it is clear that user interface is ultimately the decisive factor (accordingly influencing process interface). As the place where two different entities – the user and the machine (computer or not) – meet, an interface is supposed to "know" the user's language and that of the machine. The meeting point is one of transactions represented by a series of accepted commands or formats for the input of information to be processed.

By extension of the definition of communication as an act of bringing together, computer interface is seen as a communication instance between a living entity performing in language and other sign systems (images, sounds) and an artifact controlled by logical operations (best described through Boolean logic) and able to process data, including data presented in symbolic forms. As a framework for communication, interfaces can be designed around a limited subset of natural language, as a pictorial repertory to which admissible operations upon members of the repertory are assigned, or as any other closed "language", homogenous or heterogenous. From a computational viewpoint, what is significant is whether commands are followed by identifiers of entities upon which they are exercised, or if entities are selected first, and then operations chosen from a menu of acceptable actions. Contaminated by a tendency to anthropomorphize machines, that is, to describe them in terms pertinent to humans, the entire interface discussion sometimes succumbs to an animistic vocabulary: Machines do, machines understand, machines have a language. If we agree on the fact that machines are endowed by their designers and makers with knowledge in the form of stored information (data as well as logical operations), then the animistic conversation about machines and interfaces is less offensive and the epistemological consequences less important. Semiotically, this means that a certain artifact was prepared to accept a certain sequence of signs and, if they conform with the agreed code (which can be a format in database, or a specific command), execute what those signs represent, or act upon the data (within the paradigm of information processing).

It is true, and not the least surprising, that the advent of computers, as generalized semiotic machines, attracted attention to the semiotics of interface. But it is equally true that interface was implicitly part of human culture since its inception. Herbert Simon (1982) saw fit to view the artifact (in its generality) as interface, and the environment of the human experience involving the artifact (and making it necessary) as mold. In the context in which human activity becomes

increasingly mediated (by all kinds of artifacts, conceptual or material), the need for improved interpreters with adequate understanding of human and non-human components becomes critical. In many social instances (the practice of law, medicine, or financial consulting, among others), mediation is based on human-to-human communication. Nevertheless, the human expert uses an interface language, that is, a way to convey to those who require assistance (legal, medical, financial) contents of extreme specialization, expressed in professional languages striving towards precision (to the detriment of expressivity). Some of these interface functions have, in recent times, been taken over by artificial systems designed to address patterned activities. In such cases, the difficulty is again that of defining appropriate interfaces to bridge between those formulating their questions and the systems designed to answer them. Defining the sign as a mediating entity and semiotics as the theory and practice of mediation, we can actually elaborate a comprehensive solution to interface problems. The contingency of each interface mediation – its likelihood, relative unpredictability, intrinsic dependence on and conditioning by other factors – is reflected in the intrinsic contingency of the act of conceiving and designing the interface.

With this in mind, we could even introduce a generalized notion of design as interface. This reflects the fact that interface, regardless of its type, specifies the optimal set of semiotic devices for the interaction between two entities (animate or not). We see then that everything constituting our culture, all the artifacts and all our values require an interface in order to be optimally used. The sequence of actions leading to the desired pragmatics becomes, by extension of language definition, a language. The challenge of devising programs capable of generating interfaces (an area of artificial intelligence) is actually one of defining what languages are and how they function in certain contexts characteristic of specific human transactions.

It is clear that interface, in its traditional sense, is part of the designed object, and as such has only very limited potential for change. In recent years, interface considerations stimulated yet another area of artificial intelligence investigation that addresses the possibility that machines "learn" in the process of their use. Thus, the possibility of evolving interfaces was opened. Using neural networks and the training methods for these networks, scientists proposed intelligent interfaces that can recognize the user (by voice or patterns of commands), or even problems previously solved (and thus take an optimized path when a new problem resembles an old one). The cognitive effort in this direction and the implications of "evolving" interfaces are yet to be matched by a better semiotic understanding of the sign processes involved. What is known today is that an interface is a semiotic trade-off between precision and expressiveness. Machine learning might sharpen both or find the optimal compromise, the threshold at which an interface becomes an expression of computational knowledge as it is applied to the domain for which it mediates.

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