

Interactivity, arts and new technologies

Essay on the notion of interactive work

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Translated from French

With the burgeoning of new technologies, every field is affected. The possibilities offered and the novel ways of conceptualizing our relationships with technology are in constant flux. Interactivity seems to emerge as a major epistemological theme. Indeed, interactivity is talked about more and more, and is applied to all sorts of contexts. But a legitimate question arises: What exactly is interactivity? In this essay, we will attempt to shed light on this concept. It is clear that several authors have already tackled the subject, each in their own way, and the different approaches they present can help us better grasp the problem surrounding interactivity. As we will see by exploring these various perspectives, interactivity isn't unique to one particular field and there is no unanimous agreement on what it is. In fact, many have tried to define interactivity by cataloging instances where it appears to be discernible. This statistical approach gives us a rich and diversified panorama of the uses of the concept of interactivity but poses a problem. The plurality of approaches does not allow us to derive sufficient uniformity to settle on a clear definition.

Therefore, starting from multiple viewpoints on the subject, we will

attempt to identify the elements that make up the problem of interactivity as an epistemological concept. After recognizing the common elements among all these approaches, we will be better positioned to understand the implications of the notion of interactivity and link them to the artistic context. We will then try to answer two preliminary questions to establish an analytical framework for interactivity in relation to art. First, the notion of the "spectator," usually used to describe the recipient of a work, does not seem relevant in analyzing an interactive work given the author's loss of authority. Furthermore, the implications of interactivity disrupt the structure of the "traditional" work, leading us to question, "Where is the work?"

This leads us to the core of this essay. Bertalanffy's general systems theory¹ and Mairlot's new cybernetics² will guide us in trying to elucidate the fundamental roots of interactivity. Through these two key theories, we will discover that interactivity is essentially a communicative act that fits within an open dynamic system. We will attempt to identify the various dimensions of the interactive work as a system and their operation within it. Finally, with these insights, we will better understand the concept of interactivity and its potential for expansion in new technologies and their artistic applications.

Some authors who have approached the question and their respective approaches:

Umberto Eco and the notion of an open work. Eco, in fact, proposes a certain openness in any type of work, whether it is considered open or closed. According to him, every work of art, however finite it may be in structure and design, will always be open at the time of its interpretation. This notion of openness will recur in several other

authors who have addressed the question of open work. Due to its similarities with the notion of the open system proposed by Bertalanffy, this concept cannot be obscured. Interactivity here is considered to take place between the reader and the work itself.

Jacques Derrida and his notion of “free play.” Derrida offers a systemic approach that supports the theory of the “reader as author.” This notion seems very important to us as it raises the question of the denomination of the sender in the context of an interactive work. If we consider the reader as the author, we grant them power over the work. This power actualizes at the moment of contact with the work and the interpretative power of the reader. The process of unfolding the work then becomes interactive, as it is the result of a free play of language that Derrida qualifies as “free play.” It is the absence of semantic transcendence that allows dethroning the author from his authoritative status over the work's significance.

Roger Callois and the postmodern conception of language as a game of transgression of its own rules “lilix.” For Callois, the notion of play can be divided into four genres. Agon is the archetype of competitive play where one must “defeat the game.” It involves a strong deontic framework that surrounds the act of play with fixed restrictive rules. Alea is the game of chance like the lottery. Mimicry is the game of imitation, such as the game that children use to learn the world of adults by imitating them. The last type of game Callois proposes is lilix. It is the one closest to the notion of “free play” or open work. It is a game based on the principle of transgressing its own rules. We can make the analogy between the concept of lilix and that of the open system proposed by Bertalanffy and developed by Mairlot. Lilix, Aléa, and Mimicry are all examples of open systems, and Agon well represents the principle of a closed system. The metaphor of the

game applied to certain written works seems to support the idea that an interactive work does not have to be presented on an electronic medium. As Eco pointed out, the reception of a work is never entirely passive. The act of selecting and constructing the narrative by the reader seems to be considered as an act of interactivity from the moment we accept that the work lies at the level of the narrative resulting from a dialectic of mutual influence between the narrative material and the reader's interpretation. This remains valid if we apply the same reasoning to a more deterministic and authoritative work. Let us take, for example, a work where the narration is fixed. Janet Cardiff's sound walks propose a recording containing a guided tour of a place with real-time narration of a past moment. The narrative cannot be changed. Even if the rhythm is interrupted, the path of the sound narrative remains the same. However, interactivity takes place in the same way as in the case of the metaphor of the text as a game. If we locate the work at the level of the completely free topographic experience of the interactor and consider it as a narrative with which the latter can interact, we can consider Janet Cardiff's sound walks as interactive works.

Söke Dinkla and the approach to interactivity according to the freedom of the interactor and the degree of intentionality of his interventions, with the distinction between selective and productive interactivity. First, Dinkla attempts to make a classification of the different degrees of interactivity by the notion of reactive interaction, which implies that the interactor will produce a retro-action of a device involuntarily. He places voluntary action having uncontrollable repercussions one degree higher on the interactivity scale. Selective interactivity is positioned above the other two due to its nature of an act made with full knowledge. Finally, the pinnacle of interactivity for Dinkla lies at the

level of productive action. It is the involvement of the interactor that leaves a lasting mark. We notice the importance that Dinkla attaches to the "intelligent" aspect of interaction. He places interactions involving human intelligence most at the top of his hierarchy. Although we feel that human interaction is the most attractive and most relevant as far as art is concerned, we must note the anthropocentrism of this approach. This detail will take on its full importance in the last part of our essay "Deployment of interactive potential in new technologies" where we will see the link between the notion of interactivity as an epiphenomenon and anthropocentrism in the face of new technologies.

Espen Aarseth and the notion of "Ergodic design and sensitivity to user input." The notion of "Ergodic design" involves the cybernetic concept of a feedback loop, which we will discuss in more detail when we analyze the structure of interaction. Through an integrated protocol in the organizational structure, a written work can be transformed into a matrix from which a plurality of narratives can be generated. Marie-Laure Ryan points out that "... some ergodic texts are closed systems, and their feedback loop generates transformations without human intervention." We find in this notion of "ergodic design" a systemic conception of the text. Specifically, this means that the structure of the text can be a closed system and does not interact with its environment. This does not imply in any way that it will not impact the encompassing system, only that it is not affected itself. To cite the example given above about Janet Cardiff's sound walks, the recorded narration is a closed system that feeds the interaction between the interactor and the narrative.

Brenda Laurel and the metaphor "Computer as theater." Laurel is interested in the more instrumental aspect of interactivity. She

approaches it through the design of electronic interfaces. Although, as we will see, this is only part of the issue, it is relevant to notice that Brenda Laurel perceives the development of new technologies as a field offering great artistic potential. She considers interface design as belonging to the same family as poetry, writing, and theater. This is what she supports by approaching interface design with the metaphor of theater. Indeed, opera and romantic theater are the ancestors of multimedia, but we must be cautious. Multimedia does not necessarily imply interactivity. It is the notion of the interface that gives Laurel's approach an interactive character.

Peter Brook and his approach to "living theater." Peter Brook's living theater, on the other hand, directly involves the audience. "When they leave the room, they are not quite the same." The notion of living and the involvement of the viewer are two facets very present in the theme of interactivity. Moreover, the mutual influence between the components of an interactive work is evident in Brook's living theater. This type of interactive work is completely devoid of technological devices, and yet, we find an extremely lively form of interactivity. We will see below that the notion of living implies an open systemic structure. This is one of the characteristics that seem inherent to interactivity.

Bretz and Schmidbauer and their analytical grid: real interactivity, quasi-interactivity, and simulated interactivity based on the interchangeability of sender and receiver roles. Here we are dealing with a communicational approach. Bretz and Schmidbauer propose a qualitative analysis grid according to the position of the sender and receiver. We believe this notion is one of the most fundamental. It is important to note that for Bretz and Schmidbauer, communicating elements are not necessarily human. "A communicant may be either a

human or a sophisticated machine, such as an elaborately programmed machine." The first level of interactivity is called "Quasi-interactivity." It includes an action from one component on another and a reaction. The positions of the communicants are not interchangeable. This is the case, for example, if a human sends an argument to a machine that gives a pre-programmed response. If the argument is not valid, there will be no response. The second level of interactivity according to Bretz and Schmidbauer is called "Simulated Interactivity." This case specifically deals with artificial intelligence. The roles are interchangeable, but only in a simulated manner. Finally, "Real Interactivity" involves three communicational actions: Action 1: from A to B. Action 2: from B to A. Action 3: from A to B.

Interactivity according to Bretz and Schmidbauer seems to us the most promising and has the advantage of being general enough to apply to any interactive work. We will see later that it fits very well with the systemic and cybernetic notions that will serve as our theoretical framework. We are now ready to delve into the heart of the subject. But first, it seems important to better define certain concepts.

The Spectator in an Interactive Work?

From a communication perspective, the notion of "oeuvre" implies both a sender and a recipient, but is interactivity between this recipient and the work necessary to speak of an interactive work? We will see later that this is not the case. Yet in situations where there is indeed interaction between the recipient and the work, the interactivity

partially alienates the sender from control, transferring it to the recipient. It is this transaction that leads us to reevaluate the relevance of the term "spectator," often used in art.

Various terms have been used to refer to the recipient: in communications, one often refers to the "récepteur" (Mairlot), the "communicant" (Bretz and Schmidbauer), or the "destinataire" (Greimas). These terms will be useful in our analysis of the interactive process, but they only apply to a fragmentary portion of interactivity.

From a computer science perspective, terms like "user" or "usager" are used. In ludology, references are made to the "player" or "participant," and in psychology, terms such as "subject" or "experimenter" are used. In literature, the traditional term "reader" is used, a notion that is close to that of the spectator, but insufficient in an interactive context.

Therefore, our analytical context leads us to prefer the term "interactive component" or simply "interactor" within a specifically "interactive" framework. It's noteworthy that the "interactor" is not necessarily human, but can also be a material component such as a robot, or even a conceptual one like the narrative story of a work as approached by Umberto Eco, Jacques Derrida, Espen Aarseth, and several other authors who have addressed the notion of the "oeuvre ouverte" (open-ended work).

Where is the Work?

In this context, the notion of interactivity implies the possibility of the

recipient's intervention in the work. This feature highlights the need to position oneself concerning the question, "Where is the work?" Does the recipient become part of the work if they must participate in its deployment? For us, this question can be bypassed by the systemic and cybernetic approach. Indeed, Bertalanffy's general systems theory suggests that everything can be reduced to a system. This implies that the work, as a theoretical construct, is an expandable concept, a system within a system. As we will see later, the interactive work must necessarily be an open dynamic system, including interacting components.

Systemic Structure of an Interactive Work

We believe that interactive work can be considered a system that can unfold at several levels, which can be reduced to domains or dimensions. These dimensions can be considered as subsystems of the work. They can and may interact with each other and contain other subsystems. Each of the subsystems can be regarded as constitutive elements that may be considered as the smallest units having a bonding capacity for a domain or a dimension of the work. Identifying these constituent elements is crucial and determines the scope of the analysis domain. The notion of dimension, therefore, relates to the scale on which we choose to analyze the work and can range from the smallest details to the broadest generalities.

We will, therefore, attempt to establish the general dimensions by which we can analyze the structure of an interactive work. The generality of the term "interactive work" seems to cause some discomfort among many. It is, of course, a notion in full effervescence, possessing the common traits of any new epistemological subject of study, i.e., imprecision. But after all, isn't it to try to clarify this term

that we approach the concept of interactivity? Let's start with the aspects most commonly applied to interactivity.

Alain Mongeau (Mongeau, 1994) notes the dual essence of interactivity: "The essence of practice, then the underlying human essence." Marie-Laure Ryan also attributes two main dimensions to it, echoing Mongeau's vision: "Interactivity appears on two levels: one constituted by the medium, or technical support, the other intrinsic to the work itself." One is rather instrumental and tied to the form or support, which we will name the formal dimension, and the other more symbolic, more intrinsic to the work itself, which we will name the organizational dimension. To better bring out the specifics of each, we will consider them separately as two distinct systems, then move up a level to evaluate them together in interaction within a single system that includes them as constitutive elements.

Formal Dimension

Environment

The environment consists of all the systems, dynamic or not, that are not part of the work, but that can come into contact and even interact with it (e.g., the exhibition hall with its lighting, topography, temperature, noise, etc.). We will not comment on the impact of these systems on the aesthetic experience. The choice of elements to exclude from the work and the distinction between the work and the reception experience belongs to another problem set. It's the selection of elements to be excluded from the work that delineates it and gives

it its semantic shape. This choice seems arbitrary to us, as the criteria motivating it are not unanimous in the field of art.

Components

The set of identifiable constitutive elements of the work and their bonding capacities. If a human interactor is necessary for the work to function, the interactor will be considered a constitutive element of the work. This leads us to think of interactive work as a system encompassing the interactor. As Mairlot notes in the new cybernetics, it's the identification of the components that will determine the shape of the system. The components can be closed systems (invariably returning to the same states regardless of their environment) or open systems (receiving inputs from the environment and interacting with it).

Interface

An open system will have an interface, which will be the set of possible contact points between the environment and the system itself. It's through the interface that the system will connect with other systems, even going so far as to interact with its environment. To be considered interactive, the work must contain systems interacting within its structure. The use of new technologies has accustomed us to think of the interface as a place of exchange with a computer system. Here comes into play the question of the positioning of the work that we mentioned earlier. Depending on the choice of system components, we will have established the level where the work is found. We must not confuse the device's interface with that of the work. It is also possible to find interfaces between the system's components themselves. The concept of the interface, therefore,

positions itself as the totality of the work's relationships with the elements excluded from it. If there is a human interactor, they will be included in the work and may even be part of the interface of that work with its environment.

Organizational Dimension

The organizational structure of the work during its design can be closed at certain levels, in which case the structure will be considered deterministic and non-interactive, or it can be open and thus considered self-generating. It is in this case that we seem to be able to truly talk about interactivity. We must remind ourselves here that, from a systemic point of view, some levels of the work may be interactive while others are not. For example, the work may have a closed narrative structure but offer an interactive interface. Nevertheless, this work will still be referred to as an "interactive work." The concept of interactivity must therefore be considered as a component that may be present at some levels of the work's organization and absent at others. The organization of the work usually determines its meaning or purpose. Yet, as mentioned earlier, if there are open interactive components, the author of the work does not have total control over the meaning of the work during interpretation. Open interactive components can influence the organizational structure of the work. This is why it is called "self-generating." This coercion is also valid in the reverse direction. As we will see below, the organizational structure of the work determines part of the field of interaction possibilities depending on its degree of openness.

Dynamic Dimension

The dynamic dimension is the realization of dynamism between the formal and organizational dimensions. The deployment of the work's dynamism is located in a spatio-temporal dimension. It is the organization that allows us to identify the system's transformations and enables us to establish a heuristic understanding of the different states of the system. This is what we call dynamism. At this level, the nature of the connections between formal and organizational elements gives rise to interactions that Alain Mongeau describes as instrumental and interpretative. These dimensions correspond to the formal dimension in which instrumentality is possible and the organizational dimension that structures symbolic interpretation. It is possible that interactions of both types occur, which confers a high degree of interactivity to the work, but it is not mandatory. One type of interaction is enough to speak of an interactive work.

Instrumental

For Edmon Couchot, the direct interactions of the interactor with the formal constitutive elements produce a "techno-aesthetic" impact. It is a phenomenon where contact with the formal aspect of the work ends up conditioning perceptions. According to him, the technical act provides a "techno-aesthetic experience" which "constitutes a kind of perceptive habitus of sensory knowledge." The techno-aesthetic experience would nourish figurative thinking, which, according to him, would serve as imaginative material. He differentiates this figurative thinking from symbolic thinking. The techno-aesthetic experience would build an aesthetics of interactivity that would be not only formal but also organizational. This aesthetic "would not only be an aesthetic of shapes and their morphogenesis, but also an aesthetic of their

distribution..."

Interpretative

This involves interactions with the organization of the work at the level of symbolic interpretation and therefore of experience. This interpretation may lead, for example, to interaction with the narrative of an open narrative work. It is also this type of interaction that will lead to a change in the meaning or purpose of the work. This dimension is crucial in the case of many works called interactive, which are so because of the involvement of the interactor in internal communication processes. Some may object that these are false interactivities given their metaphorical nature, but we must keep in mind that if the work unfolds at the system level that encompasses the interactive components, these components can be very close both in a physical and biological device. In summary, the nature of the organizational dimension of the components does not make a difference for the interactive character of a work that takes place at the communicational level.

Dynamic Functioning of an Interactive Work

According to us, interactivity can only exist thanks to the dynamic dimension of the work as a system. This is what cybernetics calls INVARIANT. The INVARIANT is the object of study of cybernetics and would be common to all dynamic systems. This dynamic emerges from the temporality of the network of communication processes underlying the system. These communication processes are the

expression of an energy transmission that has been properly modulated to be receivable. This is what cybernetics considers as a mobilization of ENERSYAN. (A neologism proposed by Mairlot, aiming to express the combination of ENERgy SYntaxo-sémANTic) So it is in the types of mobilization of ENERSYAN that we will find the structure of the interaction as a microsystem underlying any interactive work.

Structure of the Interaction

Interaction is an act of communication that takes place in a microsystem including interactive components related to this transaction. The dynamism of the interaction is divided into several cyclical stages that we will borrow from cybernetics. Interaction modalities can directly connect two components or may involve transfer chains between two components as is often the case in complex systems such as living organisms or electronic systems. Bretz and Shmidbauer propose the following definition of interactive communication: "An interactive communication [...] is one in which each of two (or more) communicants receives and responds to messages originated by the others." Interaction can therefore take place between two constituent elements having a connection following this procedure:

1. Feed-Forward (voluntary action based on expectation of feedback) The concept of feed-forward implies an action aiming to elicit a reaction. This characteristic is essential. For feed-forward to be possible, component A must have already been informed. It will have acquired through this information the ability to intervene on the INVARIANT and will be able to communicate with component B. For example, in the case of a human interactor, it is not necessary for the interactor to be

conscious of his interaction. It's the system that "knows" the modalities of its components and enables interactivity. This process can be illustrated by a device forcing the interactor to position himself to react to another component. The energy and attitude deployed by the interactor will then be considered as the ENERSYAN transmitted to component B.

2. Information (state change) A faulty interpretation of the concept of information can lead to the belief that it is a signal or a flow that transfers between components, but this is not the case. Information here must be understood as assimilation, as IN-FORMATION. During the information phase, the receiving component integrates the syntaxo-semantic energy and changes state. This state change can be minimal and last only a very short period. It is through the transformations of the components following the information that the system constitutes and maintains itself. This is the fundamental process of the morphogenesis of the work as a dynamic system, giving it its form.
3. Feedback (reaction to the feed-forward) In the context of interaction, feedback must be the result of feed-forward. It is a process that reacts to the cause that produces it. With feedback, one might think that the interaction loop is closed, but there will be no interaction as long as the ENERSYAN produced by feedback has not been informed by the original sender A who will become the receiver.

4. Information (state change) Element A receives confirmation of its initial transmission and integrates it.

5. Feedback (reaction to the feedback) Finally, at this stage, we can speak of interaction. The loop is closed. The original sending element has been sent, and its transmission has been well received and integrated, then a response has been sent, received, and integrated. Component A finally sends component B a new transmission in response to its reception. This is an important point stated by Bretz and Shmidbauer. It is essential that there be a second bidirectional communication.

Definition of an Interactive Work At this stage, we can venture a definition of the interactive work:

1. An interactive work can be considered as an open dynamic system composed of a formal dimension and an organizational dimension.
2. To consider a work as interactive, one must be able to identify bidirectional communication between at least two of its components. This communication must lead to a transformation of the state of the involved components.
3. Interactivity in an interactive work can be of an instrumental or

interpretative type.

Deployment of Interactive Potential in New Technologies

For ordinary users of new technologies, this definition of interactivity remains very broad, and we observe that it's not without reason that the question leaves more than one analyst perplexed. It is clear that these restrictions allow for a wide range of applications that are not easily accepted. Some will scarcely accept the notion of interactivity without recognizing in it an electronic or human intervention. However, as we have seen, interactivity is not unique to one or the other. But then, what makes interactivity such an appealing concept, both in the field of art and for the computer or even the educational field? We have seen that interactivity is a complex communication process characterized by the open aspect of the system it composes. This notion is crucial to better understanding the enthusiasm surrounding interactivity. The open system par excellence is the living system. We believe that through anthropomorphism, humans tend to surround themselves with systems that are most compatible or similar. It is the attraction to the analogy of the living that would arouse enthusiasm for the subject of our study. Artificial intelligence fascinates. New technologies are the subject of countless fantasies about the possibilities of artificial life and biotechnology. We only need to mention the realm of science fiction that thrives on this theme, and the entire range of bio-tech and posthuman artists like Eduardo Kac and the famous phosphorescent rabbit, Sterlac, who one can almost consider a cyborg artist, not to mention the entire range of cyberart artists who magnify the possibilities of accelerating social evolution

or human enslavement by new technologies connected to the Internet.

By focusing on the possibilities offered by computers, we will better understand the interactive potential associated with them, which has the effect of granting them almost exclusivity in general opinion. Computer science is built on the cybernetic notions that we saw earlier. The organizational and dynamic foundations of a computer are fed by the processes of information, feed-forward action, and feedback action. The interaction between the user and the system is the basis upon which we engage with it through increasingly accessible interfaces. The evolution of the expert system concept allows for the production of increasingly intelligent systems that are tailored to user communication methods. The conditioning of the interpretive function by use enhances the skills and expertise of users. This adaptation of users operates in the same way as the education of audiences in the face of cinema and its increasingly complex codes. This results in greater interactive potential for any other type of interface. The notion of open work is the most convincing example. This is what, moreover, constitutes the core around which authors who have approached interactivity in hypermedia works, such as Aarseth, have elaborated. The opening of a story's structure enabled by computing multiplies the possibilities of interactivity for the recipient. This is all the more attractive due to the involvement it demands. The involvement potential of a work, reinforcing the recipient's attachment to it, increases its impact tenfold. It is on this potential for involvement that virtual reality feeds to produce the immersion that is specific to it. This particularity of involvement is explained by the cognitive dissonance theories developed by Léon Festinger. Pierre Lévy aptly summarizes the influence of computing on interactivity: "computing generalizes and multiplies the distribution of interactive, modular, and

potential works, but in doing so, it amplifies an earlier phenomenon which has deep roots in culture and contemporary sensibility."

Conclusion and Review of the Definition of an Interactive Work

To conclude, we will return to the main concepts of our definition.

An interactive work can be considered as an open dynamic system composed of a formal dimension and an organizational dimension. This rule appears to be suitable for serving as an analytical framework to determine if a work is interactive, as long as we agree to define the location of the work. However, the question remains ambiguous. The notion of open work seems to us to be the essential starting point for addressing this question. Despite this, we now have fairly clear criteria on the nature of interactivity, thanks to the systemic approach, cybernetics, and the specifications of Bretz and Schmidbauer.

To consider a work as interactive, one must be able to identify a two-way communication between at least two of its components. This communication must lead to a transformation of the state of the components involved. Starting from this definition of interactivity, several ambiguities can be eliminated, provided that the components of the work are clearly identified, and the form of the system is agreed upon. It is important to recognize the communication process of feed-forward action and feedback action, resulting in phases of information. This process is at the very foundation of the morphogenesis of interactive work.

Interactivity in an interactive work can be instrumental or

interpretative. Finally, the type of interactivity can allow us to better differentiate the domains involved in the act of interaction. In our opinion, it is on this point that most of the ambiguities arising from the nature of what can be considered interactive can be resolved. If one refuses to grant cognition the status of a component, the entire theory of open work and the part of the interpretative function are invalidated.

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