Interfaces: between Drawing and Design

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Abstract

This article explores the role of drawing in relation to design, not so much as a specific creative act, capable of informing and representing design ideas, or as a 'manifestation of the idea' per se, but rather as a dense and sedimented knowledge that is increasingly relevant for interaction design – and extensively in any design project.
Looking at examples such as video game interfaces and other everyday use artifacts, as well as theoretical reference models for the interaction design community (from Donald Norman's to Paul Dourish's, from Anthony Dunne and Fiona Raby's to Branden Hookway's, etc.), it is possible to bring out and discuss the centrality of the role of drawing in rethinking strategies of the interaction project, while considering the interface as a specific 'place' where not only the mediation between user and designed content takes place, but also that between drawing and design is activated. If windows, mirrors, and lenses can be considered as mediation devices of the visible, interfaces of digital devices can synthesize, make coexist and multiply their functioning and consequences, for example when they are meant to relate collections of data with their possible representations. Furthermore, recent discoveries in other fields, such as chemistry and biology, lead us to rethink together both drawing and design, starting from new epistemological models which extensively rely on the notion of interface.

Keywords: interfaces, design, optics, metaphors, transparency.

"It seems to me that drawings […] do not lament distance,
but reply with a single word: HERE.
And this is not arbitrary.
It has nothing to do with a conceit called Drawing.
It refers to the essential structure of the human spirit,
without which there would be no recognitionof distance!
Drawings offer hospitality to an invisible company which is with us"
(John Berger, from a letter to James Elkins, 17 February 2004)
[Berger 2005, p. 117].

Introduction: about interfaces

An interface is, literally, a (sur)face between two (or more) spaces, organisms, or other entities. The term was borrowed from chemistry, at least in its modern use; chemistry stared using it not after 1882 [1] and today often employs it as a synonym for 'interphase'. Branden Hookway [Hookway 2014] has traced its contemporary origins also back to nineteenth-century fluid dynamics, before its migration to thermodynamics, connecting its salient characteristics – such as turbulence control– to information theories and cybernetics, even in their most critical, innovative, and political-philosophical facets.
The word entered the Italian dictionary only in 1972 [2]; since then, its specific meanings, as well as its uses, have been enriched and multiplied especially in the field of information sciences, and later also involving design, art, philosophy, architecture, and human and social sciences, given the potentiality and extensibility of the notion. Moreover, the same concept of surface, or 'face', has been and still is

used profitably in the most disparate fields, so much so that tracing its genealogies and applications can be a useful indicator for measuring the major interests of certain periods and cultural fields in recent history – for example, it is interesting to compare its definitions and applications provided by Gibson [Gibson 1979], Deleuze [Deleuze 1990], Stroll [Stroll 1988] and Tripaldi [Tripaldi 2022]. Different disciplines obviously make different uses of the notion of interface, which however has common origins and genealogies and, therefore, is particularly interesting as a possible connector, or vector, to transfers knowledge and methodologies between apparently distant theoretical and applied fields. The very notion of interface is, therefore, potentially an interface per se between disciplinary fields: it is not so much a metaphor (as are the desktop, the cloud, and so on), but an actual 'face' in which interactions 'take place'.
For computer scientists, an interface is a device capable of ensuring connection and communication between two otherwise incompatible computer systems, or between a central unit and peripheral units. I will come back later in this article to its being a connection with a central unit, since a subversion of this epistemological model is precisely at the basis of some of the most interesting and innovative contemporary perspectives, involving fundamental questions for representation and for design. Those who work in Human-Computer Interaction (HCI) and Interaction Design commonly speak of 'user interface' as a "graphic mode in which a program or operating system appears on the screen and interact with the user" [3]: this definition is burdened with legacies and biases that derive in part from medium theories, which until a few years ago were mainly adaptations of modernist studies on cinema and video. First of all, it is surprising that a user interface is still defined today in the dictionary only as a 'graphic mode', without taking into account sound or haptic information and interaction modes, which are becoming more and more relevant to the scientific community and companies in the information technologies and telecommunications; and it is evident how this oversight is inherent in thinking of the interface most of all still as a screen, even more than as a window – with evident (for those involved in drawing) as well as generally neglected (by others) references to the Albertian window [4].
We can consider this aspect as the first and most obvious link between interaction design and the knowledge of drawing and science of representation, and the main purpose of this paper is to help lay the foundations for a dialogue between the two disciplines. This dialogue, based on mutual awareness, seems especially necessary today, in an era when information –which plays a dominant role in every choice for the future of the planet and of mankind– is mediated by representations taking place mainly on digital interfaces.

Interfaces and the science of drawing

Alexander Galloway notes that the interface is commonly considered a surface [5], intended as a screen through which it is possible to access a virtual world [Galloway 2012, p. 18]. However, we must be aware of the (con) fusion between medium and interface, which is due to the efforts put on the latter's transparency [6], an ambition that has 'naturalized' smart devices by establishing a forced symmetry between user and computers. This symmetry can make devices more 'usable', but it also deceives, or even annihilates [Galloway 2012, p. 30]. If the interface that works best is the one which is not noticed, which allows us to interact with the content without deviations, and which we consciously perceive only when it does not work, making us nervous, then it means that we are indulging in the illusion of an immediate – not mediated – relationship with what is on the other side of the surface, and manifests itself on the surface. It doesn't surprise that the critical approaches, closer to post-modernism, have responded to the modernist myth of transparency with writings and projects aimed at making the user 'reflect' on her own relationship with artifacts, which is to say with a 'catoptric' critique, as in the well-known cases of Bolter and Gromala [Bolter, Gromala 2003] and Dunne and Raby [Dunne, Raby 2001 and 2005].
However, it could be argued that the computer is rather a 'dioptric' medium, radically different from those that preceded it. According to Galloway, McLuhan and Kittler considered media as externalizations of human beings into objects: this is why theories of mediums often do not consider with enough attention mediation, the key point of interaction and therefore of interfaces. Even Lev Manovich [Manovich 2001], referring mainly to the web and the world of software, according to Galloway would not have realized this enough, even though his work remains relevant as far as it shows the poetic potential of digital technologies and new media, situated in the very characteristics of technology, similarly to what modernism preached.

What has been most criticized of Manovich, starting with Mark B. N. Hansen [Hansen 2004], is primarily the cinematographic foundations of his theories, as if the immobility of the cinema screen and of the spectator, situated in a room with other spectators as if she were in a Platonic cave, were also the inevitable condition of the interface between human and computer.
Attempting a possible history of interfaces, Paul Dourish, about twenty years ago, suggested the possibility of hybridizing the usual technological perspective on the history of input and output devices with a political one (how interfaces have evolved based on what was requested to designers and researchers); he focused especially on phenomenological aspects, on how interfaces were and are designed to employ different human skills and attitudes. As a result, he builds a historical classification in four phases: electrical, symbolic, textual, and graphic, starting from the first computers and arriving at the (then) new tangible and social approaches [Dourish 2001, pp. 5-23]. Computers and digital artifacts can define our being (inter)active subjects, rather than passive spectators. And the interface is the 'in between' place where users encounter representations of the data and notions they use, the threshold which is itself an environment with its own space-time structure that configures rhythms, forms and rules, according to which information passes through the elements which it connects and separates at the same time [Hookway 2014, p. 5].
If we consider Drawing as knowledge built upon a set of specific theories and practices developed over the centuries, with theoretical and applicative foundations and applications that take on increasingly relevant values in the project –also considering the technologies employed and

Fig. 1. Panoramic screenshot view of the Monument Valley game play (Ustwo Games, 2014).

those that are based on those knowledge– we can recognize numerous cases in which drawing plays fundamental roles in interface and interaction design. It has already been mentioned above the importance of optical and perspectival notions in user-centered design models, as well as in those epistemological models that aim at repositioning the user in a more conscious, broad, and complex system of relationships [7]. For example, think of what some define 'fourth person perspective', which is to say a collective – rather than impersonal– and distributed point of view, activated by the collaboration of a system of users but also by the encounter between the disembodied and all-encompassing gaze of cartography with the situated and embodied gaze of perspective, that uses the geometric and mathematical laws of human vision [Koh 2020]. It would be impossible to render this view into a two-dimensional static image, but it is becoming increasingly familiar to those who participate in the creation, or the simple use, of online content in collaborative platforms, such as those video games whose interfaces are made up of different levels: from the one that relies on the avatar's point of view to the infographic of a dynamic plan, full of otherwise inaccessible information.

The evolution of videogames over half a century provides important clues for a possible history of the relationship between digital interfaces and design. In fact, gaming is one of the leading sectors of technological development in the field of digital representation: a relevant symptom can be considered the recent acquisition of Capturing Reality, a company that had developed and marketed one of the most advanced software for photogrammetric multi-stereo matching survey integrated with laser scanner clouds, by Epic Games, a giant company in the world of gaming. The first video games often featured flat figures, closer to schematic orthogonal projections: think of *Pac-Man* in 1980 or *Super Mario Bros* in 1985. Axonometry usually provides the player with maximum control over the scene, a glance 'from above' which, however, does not renounce three-dimensionality and spatial depth, as in the case of *SimCity 2000* (1994) and some subsequent versions, while the first edition of *SimCity* (1989) made extensive use of planometric cavalier axonometries, lighter in in terms of software and hardware management since they involved a single point of view from above. In the *Call of Duty* shooter series (started in 2003), it is instead the point of view (POV) of the protagonist that dominates the screen, but at the top left of the interface it is possible to see a simplified map indicating where she is, in which direction she is moving and which presences she could meet, similarly to what happens in *Fortnite* (2017), another successful multiplayer.

A famous example of how drawing can determine the design of a GUI (Graphic User Interface) in a videogame is given by *Monument Valley* (2014) (fig. 1), where the projective properties of isometric axonometry are combined with the illusions of the Penrose triangle, the Penrose stairs and the engravings by Maurits Cornelis Escher (1898-1972).The Penrose triangle is an impossible object because angles of 60° in the 2D drawing (60°+60°+60°=180°, in the case of an equilateral triangle) are perceived as right (90°+90°+90°=270°, impossible for such a polygon), precisely because of the axonometric conventions in the representation of three-dimensional objects on flat supports. Although the fairy-tale architectures on which the princess –the protagonist of this puzzle game for mobile devices– moves seem perfectly coherent in their three-dimensionality, the isometric axonometry allows transformations of many elements, altering the configuration of the architecture with rotations and translations in ways that would be impossible in physical reality. It is precisely this method of representation that determines all the (inter)actions conceived by designers and developers.

Considering again the notion of interface in its broad meaning, in the various areas that affect interaction design, the relationship between design and drawing is even closer and deeper in the use of optical tools –both actual tools, like cameras, and metaphorical models– in common digital devices: e.g., to run augmented reality applications that need digital clones, digital twins of portions of the real world, or to handle interaction with virtual models (fig. 2), or real vehicles driven by artificial intelligences. If the metaverse promised by Mark Zuckerberg already seems disappointing today, the next big platform could be what Kevin Kelly has called *Mirroworld* [Kelly 2019], a digital clone of the real visible world necessary to make all smart devices work, a map much adherent to the territory generated by processing optical machinic information [8] captured everywhere and constantly updated: a sort of widespread and ubiquitous panopticon, where *the punctum optimum* can be placed virtually anywhere.

The aim at objectivity in representation [9] is accompanied by the impossibility of such objectivity, which underlies boundless possibilities; some of these can be found in a device as well known today for its name, thanks to a very successful television series, as well as it is little known in its

genealogy [10]: the *black mirror*. This is an optical device whose origins are very far, even though most of the information we have come from restricted contexts, especially starting from the seventeenth century (fig. 3). A black mirror can distort the visible that appears to the observer's eyes, at the same time expanding the field of vision (given its convex nature), deforming the image, blurring it and projecting the observer herself onto the reflection surface. The scarcity of literary sources [Maillet 2004, pp. 27 et seq.] contributes to the mystery of such artifacts, which could vary in shape and size and were intended just for science and magic initiates. We find them generally represented as something demonic, even as the 'bottom of the devil' [Maillet 2004, p. 47], because as early as Alhazen they were considered causes of errors, or interfaces for accessing forbidden worlds, so much so that we find them banned by the church as early as the fourteenth century. Jean Ray, in his short story Le *miroir noir* [Ray 1984, p. 316], attributes to the seventeenth-century alchemist Elias Ashmole this passage from the *Theatrum Chemicum Britannicum* (1652): "with the help of this magic stone, one can see all the persons one wishes to see, no matter what part of the world they are in, and even if they are hidden in the depths of the most inaccessible apartments, or even in caves on the bowels of the earth" [Ray 1984, p. 316]. Mirrors made of obsidian or other dark materials were already used for divination purposes by pre-Columbian civilizations [Maillet 2004, p. 53]: they were tools of catoptromancy for initiates, and it becomes so more and more especially during the seventeenth century, given the development during the Baroque of optics and its scientific and magical applications –as in the well-known cases

Fig. 2. Frame of a 2016 video promoting Magic Leap, anticipating the way the startup's platform would have work.

of direct– catoptric and dioptric anamorphoses. What is most interesting here is the power of black mirrors to disturb the observer, because of the way they distort the experience of the world mediated by vision, similarly to what technology does when it allows access to previously unthinkable possibilities, while sometimes plunging the user into uncontrollable, uncanny, or frightening conditions, like in the *Black Mirror* (2011-2019) British TV series. Access to such possibilities and conditions is always mediated by an interface or, better still, 'within' an interface, if we consider it as a place that makes the representation of a content (designed, reflected, …) happen, and 'where' the contact between our experience and that content 'takes place'.
Today, one of the most revolutionary and transdisciplinary perspectives on the notion of interface is probably that offered by Laura Tripaldi [Tripaldi 2022], a chemistry scholar who, based on recent discoveries, argues that innovative materials –and consequently design– should rely less on centralized artificial intelligences, brains that control organisms similar to human beings or to robots that belong to our science fiction imagination, modeled on us, and instead more and more on widespread, diffuse intelligences, organisms without a proper brain but capable of adaptations to the environment, perceiving it with their whole 'body' and responding accordingly, with the same 'body'.
For example, by placing oat flakes on the hotspots of a Tokyo city map and growing a specimen of *Physarum polycephalum*, a mucilaginous mold –most precisely: a protist– a team of scientists from the University of Hokkaido discovered in 2010 that the organism grew and expanded spontaneously, creating the most efficient connections, similar to those that engineers and designers had spent many years estimating for the Tokyo city's rail transport network [Tripaldi 2022, p. 44]. *Physarum polycephalum* does something similar to what "in computer science is known as morphological computation, i.e. it is able to 'think with form', modifying its body to build complex networks that would require a prohibitive amount of calculation time for ordinary computation" [Tripaldi 2022, p. 46]. Its intelligence, which redraws its configuration instant by instant, "is built into the interface: its brain, if we can call it that, is precisely its surface, the cell membrane that both separates it from the world around it and allows it to actively interact with its environment" [Tripaldi 2022, p. 54]. The most interesting robots of the future could be just *soft robots*, automatons that are 'soft' but capable of performing much more complex tasks than we can imagine.
This perspective forces us to rethink the 'representational' cognitive model on which we traditionally base our relationship with the world and with knowledge, which «implies that intelligence is to be identified with a centralised model of consciousness: the only authentic form of cognition would be one that builds a model of reality before being able to act upon that reality. On the contrary, for an organism like polycephalous slime or an intelligent synthetic material, there is no representation of reality that precedes and directs action. Instead, intelligence and action are one and the same: every signal that comes from outside determines an immediate and contemporary response to the stimulus received» [Tripaldi 2022, p. 67]. Control is therefore delocalized and widespread. Tripaldi writes: "we are used to thinking of our perceptual experience as a mirror in which we see the reflected image of an objective reality always separate from us. It is not really important whether we believe that this reflection is perfectly accurate, skewed, or faulty in some way: in any case, the perceived object does not actively participate in cognition" [Tripaldi 2022, p. 74]. This happens instead in the case of 'intelligent materials', which are therefore not simple tools or extensions, as it was for McLuhan, but, potentially, they actively participate in the hybridization with our body and our culture. In these cases, intelligence emerges mostly from relationships.

Conclusions

There are close relationships between drawing and design [11], as well as between projection and project. Like words and language, drawing is an emanation of thought and has the capability to transform the world: when it is intended as project, it acts as an intermediary between knowing and doing.
The perspective that Tripaldi develops starting from her chemical knowledge is revolutionary not only for its epistemological significance, but also because, at the same time, it opens to ways that are free from the domination of optics, which has characterized at least the last six centuries of human history: «the spider is almost completely blind and has a rather simple central nervous system, which makes it incapable of storing long-term information or constructing a mental representation of its surroundings. In spite of this, it is able to orient itself within the complex three-dimensional space it inhabits, building with its own silk perfectly symmetrical structures that are of enormous dimensions relative to

Fig. 3. Claude glass, or black mirror, in shark skin case, believed at one time to be the scrying mirror owned by John Dee (1527–1608/9), the Elizabethan magician.

its own body, something that would be very demanding even for a human individual. The way in which the spider manages to accomplish such a complex task is determined precisely by its ability to use silk to draw a geometric map of the space around it, using it as a sort of spatial memory external to its body» [Tripaldi 2022, pp. 157, 158].
We are not spiders, but human beings; we cannot give up representations, to understand and to design. Our interactions with the world are not mediated by cobwebs we weave, but can be anyway augmented by the technology we continue to develop and use (fig. 4). Research on materials and on animal and plant behaviors seem to suggest lines of research that have never happened before, not only for all the design fields, including interaction design, but also for the disciplines of drawing: how to understand, govern and use forms of intelligence which are non-representational, but which could be the last hopes remaining for a habitable planet?
As with artificial intelligences, the big problem arising is how to deal with the unrepresentable, with what we cannot represent, because it is alien or inaccessible [12]. But we can count on the same cultural tools that our fellow humans used, already thousands of years ago, while facing what was unknowable to them: on the one hand, continuing to formulate and experiment with 'models', as we are part of a scientific community; on the other hand, refining metaphors and myths, such as that of Arachne. A first step may consist in trying to observe ourselves 'in fourth person', reflected in some appropriately designed magic mirror [13], using and developing the laws of drawing.

Notes

[1] Cfr. Cramer and Fuller [Cramer, Fuller 2008, p. 149].

[2] According to Devoto-Oli Italian dictionary. In English, 'interface' has been used extensively especially since the 1960s.

[3] These definitions, here translated, come from the Devoto-Oli dictionary. They have not been changed or updated during at least the last decade.

[4] The first study to fully reveal this genealogy was probably Friedberg [Friedberg 2006].

[5] This perspective might change if the notion is considered in specific fields, such as cybernetics or systems theory.

[6] The fundamental reference book that called for the need for transparency of interfaces, with enormous success among designers, is Norman [Norman 1998]. On the pervasiveness of the notion of transparency in the contemporary era, the most famous text is probably Han [Han 2015], which synthesizes and attempts to apply some philosophical ideas coming from the twentieth century.

[7] See Bergamo [Bergamo 2013].

[8] See, e.g., Arcagni [Arcagni 2018] and Anderson [Anderson 2017].

[9] On this topic, see Daston and Galison [Daston, Galison 2007].

[10] Some years ago, Arnaud Maillet remedied this gap with the publication of his research on the Claude Glass (this name coming from seventeenth-century French painter Claude Lorrain, although there is no certain evidence that he used such devices), a dark convex mirror that we can consider as a generalization of the black mirror.

[11] On a very pragmatic level, see e.g., Buxton [Buxton 2007].

[12] See in particular Bridle [Bridle 2018] and Bergamo [Bergamo 2020].

[13] By 'magic' I intend here a transformative potential, that also belongs to the technical world. See Campagna's book on technic and magic [Campagna 2018] and Marini [Marini 2022].

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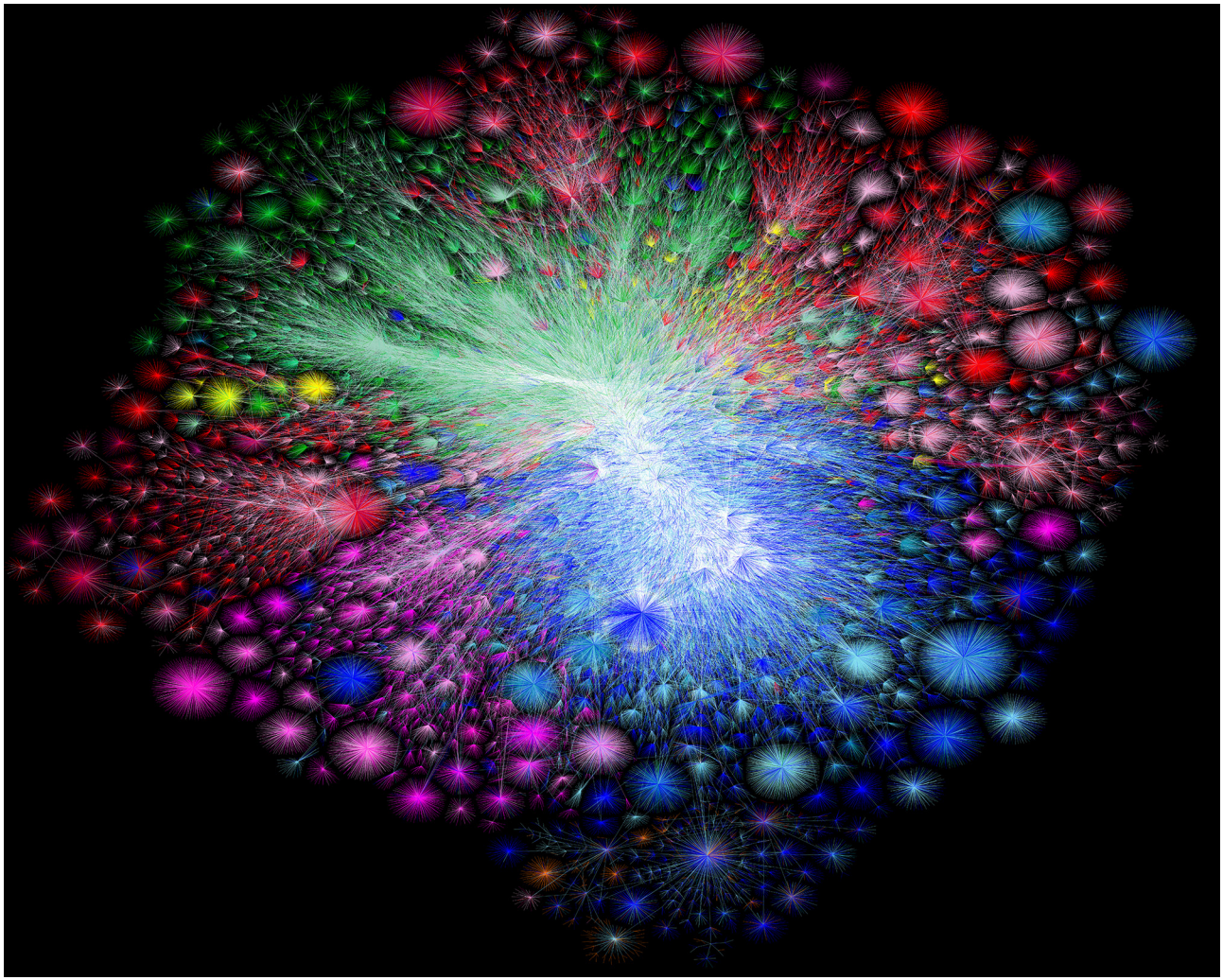
Fig. 4. Frame of a video showing the evolution of the map of the Internet from 2001 to 2021, Opte Project. The world wide web is a distributed network, a much-deployed model in today's information technologies.



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