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INFORMATION DESIGN AND (NEG-)ENTROPY: A desirable uncertainty

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ABSTRACT
Twentieth century's last decades witnessed a growing importance of information design, since then characterised and named in many ways, in a process of affirmation and self-discovery. The flood of available data gave design, namely to this field of design for understanding, an increased visibility and responsibility to find new ways of making sense through information. From design to computer sciences, there are several disciplines that converge in this endeavour, even if under different tools and models.
This convergence enables a comparison between models of representation, which tend to be more respected if neutral and rational like. However, are not metaphor, paradox and poetics also tools able to provide structure to a set of complex data? The fear of uncertainty reveals a kind of insecurity, natural on a discipline with such a recent history in the academy, and that sometimes seems, for that same reason, to behave non-critically in choosing its own path. But if even physical sciences admit uncertainty, why should not design do it?
We argue that it is possible to represent with accuracy without blindly accept generic and algorithmic systems, and that the doubts that can emerge from such representations may contribute to non-communication but also elicit curiosity, enabling understanding thus promoting knowledge. It is the metaphor that will render possible the communication of the new, thus subjecting it to the rigors of poetics. Only poetics will make 'newness' possible.

KEYWORDS
Culture. Representation. Freedom. Knowledge.

INTRODUCTION

This text is part of a larger study on information design, a field that has been growing in the last decades in the proportion of the need for making sense of an ever-increasing amount of data. As we shall see, even its name — information design – is not consensual, but *information* seems to be recurrent in almost all names proposed for this operation of visually representing a data set. Starting from this, we will somehow evolve around subjects apparently disconnected from information design but nevertheless important to understand the complexity and extent of the field. So, what are we talking about when we talk about information?

INFORMATION AND DESIGN

In 1948, Claude Shannon coined the term 'bit' (from *binary digit*), "a unit for measuring information" wrote Shannon, "as though there were such a thing, measurable and quantifiable, as information" (Gleick, 2011). It now seems incredible that something so apparently common in nowadays could not exist only sixty years ago. And this is not, even today, a trivial matter. Gleick describes very well how difficult the task was facing: "The raw material lay all around, glistening and buzzing in the landscape of the early twentieth century, letters and messages, sounds and images, news and instructions, figures and facts, signals and signs: a hodgepodge of related species. They were on the move, by post or wire or electromagnetic wave. But no one word denoted all that stuff." Shannon, while corresponding it self with another researcher, came up in 1939 with a basic concept: *off* and *on*.

It is important to take into account that information has different values. According to Fernando Ilharco (2003), information is a "basis for action, communication and decision (...) primary and fundamental expression that seems to mark our time, which, significantly, is referred to as 'information society'"[1]. However, the

[1] "fundamento da ação, da comunicação e da decisão, (…) manifestação primária e fundamental que parece estar a marcar a nossa época, a qual,

word ‘information’ that Shannon uses when describing his theory, which then gave rise to the society Ilharco mentions, has nothing to do with semantics or decision, quite the opposite. As Shannon stated: “«information» here, although related to the everyday meaning of the word, should not be confused with it. In everyday usage, information usually implies something about the semantic content of a message. For the purposes of communication theory, the «meaning» of a message is generally irrelevant”(Shannon, 1993).

Shannon was only interested in how to transmit a certain amount of information from one point to another (hence the importance and necessity of a measuring unit); and for that, it would not matter if that information was a poem or an accountant report. Nevertheless, the impact of these proposals was so comprehensive that the word 'information' has become part of many disciplines. In fact, everything could now be considered information in communication, “not only written and oral speech, but also music, the pictorial arts, the theatre, the ballet, and in fact all human behaviour” as Warren Weaver would say. (Shannon & Weaver, 1964 (original 1949), p. 3).

In this context of a growing number of disciplinary fields associated to the word information – information theory, information sciences, philosophy of information – it’s normal to find all the names we are addressing now: information design, information architecture, information representation or visualisation. Rob Waller, a founder of IDJ states that "when Information Design Journal was launched in the UK in the late 70s, the term was deliberately employed to divert graphic designers away from a simple concentration on graphic issues, and see design processes – that is, planning processes – applied to all aspects of information, including its content and language.” (Waller, 2011, original 1995). Waller also said that this activity was not being invented at that time, but an attempt to group all activities related to this practice under a same label.

Information, the “very elastic term” that Hartley was talking about

sintomaticamente, é referida por ‘sociedade de informação’”

in 1928 (Gleick, 2012), was now allowing to group under a designation, multi-disciplinary practices difficult to characterize.

DESIGNATING THE DESIGN OF UNDERSTANDING

Information design, Communication design, Information architecture or Information visualisation are only some of the most current terms that designate a design field that we are now trying to describe, in order to find a stable base upon which we can build an argument. It is fairly simple, for those who work in design, to single out information design examples, namely the ones that come from graphic design: transportation networks diagrams; buildings or city signage; statistics data tables; bar graphs and others. The growing need to organize and represent information endows this field an apparent autonomy, which, in turn, generates discussion on the practice and the relevance of this new space. The symptom of this 'autonomy' is, as the word implies, the creation of new ideas (new laws) and the birth of new designations.

But these attempts to find the right name are troubling giving its polissemic nature. If 'design' already implies form and content, why then add, in a pleonastic way, the word information (In-formation – form giving)? Some authors choose to emphasize the importance of content (information or message) over form (appearance, graphics). Others will say that there is nothing beyond form (form is content). Thomas Kuhn (Chalmers, 2000, p. 103) argues that escaping a precise definition is in the nature of a paradigm, being however impossible to build knowledge if the essential foundations of a research field are continually questioned. Chalmers addresses this issue by stating that it is impossible to assign precise meaning to concepts not embedded in well defined theories, giving as an example the concepts of 'mass' in Newton's law, or 'democracy'. While the former is perfectly framed, *democracy* is not, which enables rather different and often contradictory readings.

Almost every authors discussing these information design ontological concepts present their own word combination to

define this field, each one differently enhancing its social, economic or emotional characteristics. The thing in common in most of them is its eminently functional role.

DESIGN AS INTERFACE

By trying to describe design, Gui Bonsiepe proposed an ontological scheme where interface emerges as the key concept. According to Bonsiepe (1999), design does not operate within a specific paradigm as science or technology, but within several paradigms. Interface would thus be the intellectual mechanism that enables the link between the necessary skills that can render design possible, that being the normal context of the designer. Also Providência (2012) defines design as the *desenho*[2] of artifacts, devices and services for cultural mediation, hence, as an interface.

It is important to recall Krippendorf when he states that "probably the most notable pathology of design discourse is its openness to colonization by other discourses" (Findeli, 1999). From the perspective that Bonsiepe proposes, this openness does not entail a loss of identity, but, on the contrary, that it is the identity of a discipline thus unique, not part of other paradigms. Some other authors, like Fatina Saikaly (2004), argue that to the three traditional areas proposed by Bonsiepe - Science, Technology, Arts (Humanities) – it should be added design as a new field of knowledge.

Connection with other fields is mandatory in information design. According to Jef Raskin (1999), fields such as physics, computer sciences or medical information have a lot more experience on working with information, and this implies that acknowledging the role of interface should be clearly restated. Will then technology have the first word about information design? How would Bertin

[2] *desenho* is a portuguese word that in english could be tranlslated as *drawing*, or, in spanish, *dibujo*. However, when used like in this text of Providência, it has a different meaning, closer to the spanish *diseño*, that in english would be *design (*also the Portuguese word for *design)* and not *drawing*. Hence the difficult in translating this sentence, in which design would be defined with its own verb: "design is the design of artifacts…". As Joana Quental puts it: "(This) drawing (…) is not confined to graphic marking, but also something prior to representation, the «drawing in the mind»" (Quental, 2009, p.50)

write a XXI century's 'sémiologie graphique'? How would he address issues such as multidimensionality or computer sciences' powerful tools of handling data sets in order to get different readings? Multidimensionality was never an exclusive of technology. Regarding information design, the question can be discussed in the context of quantitative data, namely the dimension of a given sample. In other contexts, in signage for example, multidimensionality is, and has always been, part of the project – posting any kind of (bidimensional) information on a wall of a city has to take into account all three-dimensional space around it, possible paths, reading speed possible, the incidence of light on the chosen material or to whom this information can be helpful, etc.. This proves, once again, the mediator character of design when users and products interact (Bonsiepe, 1992) and, as Providência argues, its "emotional and affective dimension".

MEANING, ENTROPY, CONSEQUENCE, FREEDOM

It is important to note that Raskin directly relates the how information should be presented with the expected results in a particular audience, an expected meaning. We therefore have a *before* (that Raskin calls information, content) and an *after* (meaning), information representation (the form). This notion of a result, the fruit of the representation (albeit being a representation already a fruit) is perhaps the strongest concept on the definition proposed by another author, Robert Horn (1999) – *Effectiveness*. This concept values what happens after the created form, the downstream effects of conformation, a concept of action linked to information representation, an idea reaffirmed several times that led to expressions such as DD4D: *Data Designed for Decisions*[3]*,* or to more theoretical approaches such as the one Klaus Krippendorf (2006, p. 58) proposes, linking *action* with *sense* and *meaning.* But does this efficiency imply an exact or absolute kind of message, like the one mentioned before, through binary code? The thrill caused on the scientific

[3] DD4D – Data Designed for Decisions. Enhancing social, economic and environmental progress. A joint IIID and OECD conference. Paris, 18-20 June 2009. http://www.dd4d.net/

fabric by Shannon's theory in the 50s, led many disciplines to question its consequences on their own fields of study. While engineers and mathematicians were trying to find *how* to transmit, social sciences' researchers were concerned with *what* was being transmitted. We saw earlier how Shannon was trying to take 'meaning' out of the equation. On the other hand, philosophers and anthropologists were centred on the message. Norbert Wiener, mathematician, on the interest of other disciplines in those recent findings, said that "all these sciences, the social sciences especially, were fundamentally the study of communication, and that their unifying idea was the *message"* (Gleick, 2011).

Margaret Mead, anthropologist, then introduced an important issue: "if you are trying to communicate the fact that somebody is angry, what order of distortion might be introduced to take the anger out of a message that otherwise will carry exactly the same words?" The question we address here is if this distortion Mead is referring to is comparable to entropy, another key element of Shannon's theory. "Entropy", according to Norbert Wiener, was a measure of disorder; to Shannon, it was a measure of uncertainty. "Fundamentally, as they were realizing, these were the same" says Gleick (2012, p. 293).

The etymological meaning of words has always been more or less fluid, depending on several variables such as culture, geography, literacy, age, among other factors that may be summarized as context. Oral language allowed and encouraged this fluidity of sounds, accents and places. With writing came the ability to set the spelling of these sounds into words, and with this normalization, the need to stabilize the meanings of these spellings. The first dictionaries were created, periodically revised, trying to keep up with the speed of production of new sounds, new spellings and especially new meanings.

Science, while searching for unambiguous clarity for its models, attempts to isolate these variable factors creating a specific context in which the words mean only what the peers decide that they must mean. Newton had to (re)define words for his gravity theory, but, as always, our communication is based on pre-

established levels, experience. Hence the contingency, even the scientists use existing words, which then become metaphors given the semantic contamination between different contexts. They then coexist in two universes: the everyday, subject to the entire history of meanings; and the particular context to which that word was recruited, a context that sometimes is strengthened by the creation of new symbols that can be used instead of the word. They can sometimes coexist in more than two universes, being the first one (the everyday) already a universe of different universes.

There is thus a factor of uncertainty in the speech. And despite continuous efforts to purge it, even in science uncertainty is a given fact. It is also one of the most interesting philosophical debates: with those who argue that this uncertainty is an evil to eradicate, an evidence of human inadequacy – *God does not play dice* said Einstein; and those who argue that this uncertainty is fruitful. As Gregory Chaitin, another mathematician, explained, "in spite of incompleteness and uncomputability and even algorithmic randomness, (…) mathematicians don't want to give up absolute certainty. Why? Well, absolute certainty is like God" (Gleick, 2011). In science, as in other contexts, there are the rules but also the vices.

This idea of incompleteness leads us to Heisenberg and its uncertainty principle. It's a rather evident tie, although there are no certainties about the link between what Heisenberg proposes and what in mathematics is studied under the designations of entropy, incompleteness or even randomness, especially for being stated in a conceptual framework (quantum physics) very different from classical physics. "Roughly speaking, the uncertainty principle (for position and momentum) states that one cannot assign exact simultaneous values to the position and momentum of a physical system".[4] Even more roughly, this principle has sometimes been interpreted has stating that it is impossible to make an accurate measurement without affecting it – the observer affects the observed.
A matter of fact is that something changed after Quantum

[4] http://plato.stanford.edu/entries/qt-uncertainty/

Theory, as Schrödinger notices: “The great revelation of quantum theory was that features of a discreteness were discovered in the Book of Nature, in context in which anything other than continuity seemed to be absurd according to the views held until then.”(Schrödinger, 1992 (original 1944)). Although this change was laid down in terms of quantum mechanics, and its inference for design can be a long shot, it is possible to notice a convergence of arguments about information design and its meanings, namely on the effects of rhetoric of form over the content it holds.

If to a physicist “entropy is a measure of uncertainty about the state of a physical system”, “to the information theorist, entropy is a measure of uncertainty about a message (Gleick, 2011). But we are still within the scope of mathematics and this message is only a body of signals, we are not yet talking about meanings. "I complained about the use of the word 'information' in situations where there was no information at all, where they were just passing on signals" said Van Foerster, reinforcing his opinion: "The moment one transforms that set of signals into other signals our brain can make an understanding of, then information is born! It's not in the beeps" (Conway & Siegelman, 2005, p. 189). We, humans, “propagate structure” states Gleick (2011), adding that “curbing entropy” appears to be our “quixotic purpose in this universe”, a reading that considers unpredictability as a problem but not as an opportunity.

WORLDMAKING

figure 1 PARKing, Banksy.
Graffitti in a parking wall, Los Angeles.
(Banksy, 2010)

It is now consensual to state that information design covers a wide spectrum of practices, objects and objectives, so wide that the very name is evolving in order to take in its body new examples, new practices and even new interpreters that continually question discipline’s limits and properties. Within this mass, hard to portray, it is also relatively consensual that on an information design project – seen through the ‘triangles’ of Vitruvius, Enzo Mari or Francisco Providência (Costa, 2007) – the main vertex is Program (Function or *Utilitas*): a graph with vital data of a patient can not be dubious nor reading a plan of a building on fire while their occupants try to escape therefrom.

Scientific and technological evolution constantly and frantically updates the second vertex – technology (*Firmitas*): new materials and tools tend to be usual as quickly as their efficiency and, above all, profitability. However, there is not, despite numerous attempts, a unique formula that contains the secret of precise communication, even when the message is. What role does then Expression (*Venustas* or authorship) play in this alchemy of contents and forms? What is its role in the transmission of objective information? What came first: the form or the content, the rhetoric or the idiom?

According to Nietzsche all language is rhetorical because whatever 'origin' it might have, it will only be an analogy or metaphor of what exists already, a translation, as Steiner[5] would say. Nietzsche states (1995): "The full essence of things will never be grasped. Our utterances (*Lautausserung*) by no means wait until our perception and experience have provided us with a many-sided knowledge of things (…) Instead of the thing, the sensation takes in only a sign (*Merkmal*)". The names of things that cross our paths are only representations, and even the initial content has depended upon its utterance, that then gave it an existence.

How can information design participate in world's understanding? By not limiting itself to existing languages, we now argue, creating new designs that anticipate the certainty that there will always be other worlds, thereby design the possible. "New worlds" are only new representations of what we call world. And those new representations depend on new means of representation: new mathematical formulas, new symbols, new words, new designs.

"La creativitá è l'attitudine a immaginare possibilità alternative a ciò che si conosce.(…) Il concetto di libertà si contrappone al vincolo delle leggi e delle norme"
Enzo Mari (2003)

[5] "Uma língua lança a sua própria rede sobre os mares abundantes da totalidade. Com esta rede, recolhe riquezas, múltiplos pontos de vista e formas de vida que, de outra forma, jamais seriam actualizadas" Steiner, G. (2001). *Errata: Revisões de Uma Vida*. Lisboa: Relógio D'Água.

In the portuguese edition of Goodman's *Ways of Worldmaking*, Carmo d'Orey uses the science-art dichotomy to exemplify different models of world construction: "Science favours those systems that allow measurable experimental results and scientific community agreement, basic requirements for science. (…) Art favours *density*, *repleteness*, *exemplification* and *multiple and complex reference.* Goodman puts these characteristics as 'symptoms of the aesthetic' and they respectively oppose to articulation, attenuation, denotation and direct simple reference, 'symptoms of the non-aesthetic'". "This results in a pluralism not only methodological (there are many processes of world making) but also ontological (there are many worlds)"[6] (Orey, 1995). This pluralism has much to do with what designers make, but also with the effort users are being asked in order to make sense od data and information. "Sense is always *someone*'s sense" (Krippendorff, 2006, p. 51).

We saw earlier how even science recognizes uncertainty as part of its theories, namely on quantum physics. If science acknowledges the value of the indeterminable, why then rest in this unlikely objective certainty the role of design in the academy? Shannon, while trying to clarify his point of view, declares: "the larger the set the *more* information". Wiener considers however that the larger the set (data, signals) the more uncertainty. If we take this last opinion we could say that, in fact, the larger the set, the more entropy, but also, the more information hence a better understanding. A direct proportionality between a data set and its information would render impossible the representation of complex systems, if design wouldn't make use of metaphor as prime resource. Complex systems are understandable through simple metaphors, the same principle that we can see in the algorithmic design of computer programming.

[6] Original text: "A ciência favorece os sistemas que permitem a determinabilidade dos resultados experimentais e o acordo da comunidade científica que são, para ela, requisitos fundamentais. (…) A arte favorece a *densidade*, a *saturação*, a *exemplificação* e a *referência múltipla* e *complexa*. Estas características são postas por Goodman como 'sintomas do estético' e opõem-se, respectivamente, à *articulação*, *atenuação*, *denotação* e *referência simples* e *directa*, que são 'sintomas do não estético'". "Daqui resulta um pluralismo não apenas metodológico (há muitos processos de construir o mundo), mas também ontológico (há muitos mundos)". Orey (1995).

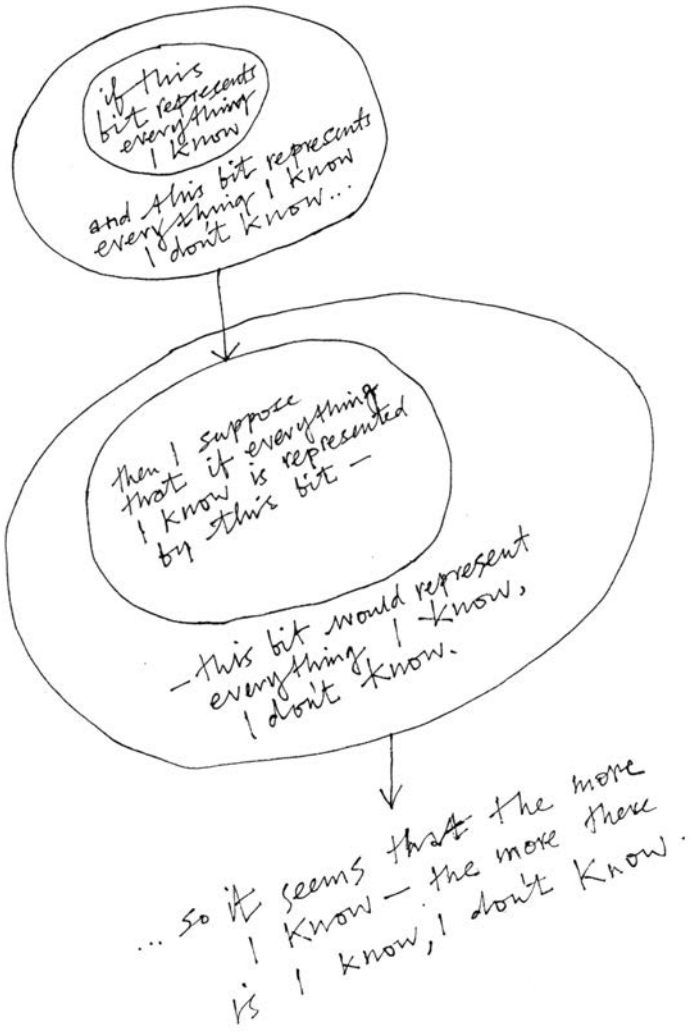

figure 2 Alan Fletcher The art of looking sideways (learning), 2001

As we make more powerful tools for world observation, telescopes, microscopes, x-rays, beta rays, etc., we expand the world, making it larger in terms of visibility. At the same time, we realize that the part of the world we can't reach also grows, proportionally or exponentially. The curve of our growth remains positive, even though the ration between what we see and what we don't see tends for zero, hence the importance of the concept of entropy. Werner Loewenstein (1999, p. 94) said that if there were a guidebook for living creatures, the first line would be something like: "*Make thy information larger*".

CONCLUSION

Added information is a condition of living beings (or at least those that have survived) and information does not exist outside representation. Representation of the new will inevitably have to be new, unknown, thereby taking the risk of being or contributing to non-communication. Therefore, communication of the new depends on the design that represents it, and this design is subject to a certain degree of uncertainty in terms of information. How is it then possible to advance scientific dissemination in this field? Being the communication already an act of design and not a mere consequence of a data set, we argue that this can only be possible by requiring from the receiver a great interpretative effort, so that understanding can be achieved. Alternatively, if proper linguistic means are lacking, he may rely on a language built on previous experience, therefore making use of metaphor. It is the metaphor that will render possible the communication of the new, thus subjecting it to the rigors of poetics. Only poetics will make the new possible.

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