On the Interplay of Images

Imaginaries and Imagination in Science Communication

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EXPLORING THE INTERPLAY OF IMAGES,
IMAGINARIES AND IMAGINATION IN SCIENCE
COMMUNICATION – BASIC CONSIDERATIONS

> There is something artistic in a scientific discovery and there is something scientific in that which the naïve call 'brilliant intuitions of the artist'.
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> Umberto Eco[1]

1. Introduction: Beginning an inner dialogue with an imaginary reader

Starting to write a text always requires making a decision about a point, a question or a perspective that is selected as first sentence. Simultaneously a dialogue with an imaginary reader begins. This is needed since all kind of inner considerations, reflections or explanations need a partner serving as virtual recipient of the communicative act performed when writing. The communicative act of writing is accompanied – or, according to recent findings of brain research, somewhat preceded – by an act of thinking or of arguing with oneself. The result, emerging from this inner dialogue, is a series of epistemic acts allowing to enter into mental interaction with a topic.

2. Transition: Providing some working definitions and examples

With this we are already 'in medias res' ('in the midst of things'). Some kind of imagined component seems to be essential for processes of cog-

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[1] Quote from *The Limits of Interpretation*, Eco 1990, p. 159.

nition, communication and consciousness (MITCHELL 2013). Subsequently, we are confronted with the task to prepare further considerations. First of all, a coherent determination of the different meanings we want to attribute to the terms 'images', 'imaginaries' and 'imagination' is required.

– 'Images' are items outside of the human brain. They share the quality of being able to stimulate or even to animate their visual perception as particular parts. Thereby they are emphasized from and hauled out of the context of the entire visual field of the beholder.[2] Viewed from the perspective of the individual human subject they are something *brought in*. Images flow from the outer world into the inner world of consciousness when they are perceived and recognized.

– 'Imaginaries' are items inside of the human brain. Their common feature is the requirement of a memory from where they emerge and are noticed with our 'inner eyes'.[3] They are (viewed from the perspective of the individual human subject) something *brought out*. Imaginaries are fed into the outer world when expressed while communicating with others.

– 'Imaginations' are better to apprehend as processes instead of items. Their decisive feature is a stronger link to the movement of our conscious-

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[2] Additionally it should be noted that with images which are intentiously created as images (e.g. drawings by an artist or graphics by a designer) this essential effect may be strongly supported by using framings. Framings, nonetheless, are much more than those wooden structures, typically in a gold or silver colour, which all paintings we look at in museums or art galleries are surrounded with. The term 'framings' refers to a general model introduced by Erving Goffman (1986). It quickly became a core concept of symbolic interactionism, prominently represented by G.H. Mead (2015). Originally coined to describe meanings, interpretations and definitions of situations shared by *actors* or contested among them (not to speak of the *observers* that may have the same pre-understandings as the actors or rather other ones for defining a situation) 'framings' became a widely used concept, particularly in sociology and social psychology, cultural studies and media and communication research (DILLON 2014). The approach of constructivism, in all its varieties, profits a lot from adopting 'framings' as an analytic and explanatory concept.

[3] Since the 'inner eye' is a quite common expression, frequently used in everyday conversation as well as in scientific discourse, we often forget to critically reflect on its metaphorical character. Metaphors have the advantage of being intuitively understandable and trying to grasp the nature of a more unknown or unclear phenomenon in comparison to more known or obvious phenomenon. The 'inner eye' uses that mechanism to designate a phenomenon that shares some aspects with visual perception by comparing it with the performance of the proper eye as a sensory organ. Nevertheless, you could also talk about an 'inner cinema' or make use of other metaphors or speak vaguely about 'inner perception'. But the phenomenon has particular aspects of its own, first and foremost referring to the fact that the visual impression that we 'see' with our ' inner eyes' is generated by the brain and not perceived by any other sensory organ, and therefore needs to be taken as something more than a derived form of a well-known sense (compare BUTLER 2013, who treats this topic, especially in her chapter about 'Poking Out the Inner Eye', pp. 16-40).

ness when constructing something in our mind than to the resulting prod-ucts: new ideas, contents or relations between phenomena. Instead of simply adding things together as with other cognitive functions imagina-tions can do more. They have the power to create novelties and to bring something completely new into the world by recombining elements that formerly were not connected or even seemed to have nothing in common.

So let's try to find some suitable examples:

– 'Images': Identifying a figure, an object or a scene at first glance seems to be a difficult task when looking at a 'Wimmelbild'[4] (a sort of hid-den picture puzzle). This format is characterized by full-spread drawings, sometimes across gatefold pages, depicting scenes of humans, animals, and objects in excessive detail. Apart from their recent career in children's books as an invitation to train the ability of identifying and discovering details, this particular format was originally invented and realized in paint-ings by Hieronymus Bosch and Pieter Brueghel the Elder. The point here is: the outer world (natural and / or artificial) we perceive is always very complex, full of elements which we either distinguish easily or with vary-ing degrees of difficulty. The evolutionary answer to that overwhelming complexity was by no means to develop sensoric mechanisms for 'reducing complexity' by a certain algorithm, but 'Gestalt'-perception that allows to structure complexity into a meaningful order. Against this background, images can be understood as artifacts that – from the very first cave art in the Paleolithicum until today's multitude of forms and techniques – are intentionally produced in correspondence to our ability to identify mean-ingful particular sections in the entire field of our perception.

– 'Imaginaries': What kind of object is a 'Cloud-Cuckoo Land'[5]? Clear-ly, when painted, it is an image. When talked about, it is a story. When built, it is a structural model. But how to describe its original form, its 'pro-to'-existence? It is a mental construction that includes visual impressions and interpretative features, that shows the ability to pass from one mind into other minds, and that is constantly open towards variations in form, content and shape. This openness towards variations is characteristic for imaginaries, since they are not only psychiphenomena dependent on con-scious and / or subconscious processes, that is dependent on a state of mind

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[4] If needed, simply refer to Wikipedia https://de.wikipedia.org/wiki/Wimmelbild to get an idea about this term.

[5] Here again, if you need further explanation regarding this term, please refer to Wikipe-dia https://en.wikipedia.org/wiki/Cloud_cuckoo_land.

in which they are refurbished. As such they are also social phenomena, appearing in society as soon as they are expressed in oral, written or visual communication.

– 'Imaginations': For an example we can refer to Umberto Eco here. In his famous book *The Name of the Rose* (1995, p. 201) he has his narrator, Adso of Melk (the Benedictine novice accompanying William of Baskerville, the Franciscan monk) explain how a surprising novelty (here: a 'golden mountain') is born by creatively relating two common, but distinct ideas (here: a 'mountain' and 'gold') by simply expressing the following insight: «This, in fact, is the power of the imagination, which, combining the memory of gold with that of the mountain, can compose the idea of a golden mountain».

Admittedly, the just stated descriptions and criteria are nothing more than a working definition. They would not suffice, if entirely satisfying definitions would be needed.[6] However, my intention is not to write a philosophical treatise but an essay. An essay is allowed to be more associative and to argue with the intention to explore a field, leaving open questions instead of final closing thoughts.

3. First consideration: Pointing out functions of images, imaginaries and imagination

Let us continue with the flow of our considerations regarding Umberto Eco, the famous Italian novelist and well-known professor of linguistics, who reflected deeply on boundaries between science and non-science, literature, art, hermetic respectively esoteric knowledge, journalism and further practices. According to him «there is something artistic in a scientific discovery and there is something scientific in that which the naïve call 'brilliant intuitions of the artist'» (Eco 1990, p. 159). Well, so far he expresses nothing special, only common sense knowledge. Yet his subsequent conclusion, reveals a great insight: «What they share is the felicity of abduction» (*ibid.*).

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[6] If you prefer to look for this type of definitions you may consider reading Immanuel Kant's monologues and statements in his *Critique of Pure Reason*. Nevertheless, following Matherne's (2016) summary, his understanding of imagination 'as a more pervasive mental capacity that contributes to the cognitive, aesthetic, and moral aspects of our lives' paved the way for the wide range of approaches in contemporary research. Cf. as well Rosefeldt (2021) who concentrates on Kant's examination of the role of imagination in epistemic processes.

What he wants us to recognize here becomes more clear with his semiotic definition of the somewhat strange term 'abduction'. According to Eco, as stated in *Semiotics and the Philosophy of Language*, abduction is to be understood as «the tentative and hazardous tracing of a system of signification rules which will allow the sign to acquire its meaning» (ECO 1984, p. 40). Following the explanation of Raffa (2009, p. 35) 'hazardous' is the key word here since abduction involves taking a gamble. The significance of 'hazard' is derived from 'playing with dice'.[7] He proceeds by showing that 'abduction' is a concept formulated by Charles S. Peirce. Related to, but distinct from «deductive and inductive reasoning, abduction is an inferential process followed when some strange event cannot be explained satisfactorily by a ready-made rule (deduction) or by experience in the form of sufficient empirical evidence (induction)» (RAFFA 2009, p. 35.). «The investigator in such cases may be tempted to 'think outside the box' to put forth a working hypothesis based less on sound reason than on a gut feeling (intuition) or on the aesthetic appeal of a particular solution» (*ibid*.).[8]

The sudden appearance of a solution through insight, the well-known 'aha'-effect – also treated by Victor Papanek in *Design for the Real World* (2006, p. 153) – is a peculiar phenomenal experience that people may have. It usually occurs when you are not (at all) busy working on a problem but enjoying a more relaxed situation when your mind is more open to intuition (TOPOLINSKI and REBER 2010). An alternate expression for this effect is 'heureca' the exclamation attributed to Archimedes, spontaneously expressed when the idea for his famous principle came to his mind.

Graham Wallas' pioneering theory (published 1926 in *The Art of Thought*) distinguishes four stages that each creative process needs to move through to finally become successful: i.) preparation, ii.) incubation, iii.) illumination, and iv.) verification. Using this scheme we can easily identify 'heureca' style happenings to take place in the third stage, 'illumination'. Stephen Gilligan, one of the leading theorists and practitioners of the systemic approach in hypnotherapy, describes this extraordinary experience

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[7] For an instructive discussion of the semantic relations between risk, chance, hazard and luck compare the *Etymologies du Risque* by Denis Duclos (1994); cf. as well Bonss (1995).

[8] Errors and even sheer luck may play a fruitful role in the abductive process. Subsequent events naturally determine the wisdom or folly of the investigator's abduction, but Eco reminds us that a good abduction, even if it is technically wrong, may «endure for long periods, until a more suitable, more economical, and more powerful abduction comes onto the scene» (ECO 1997, *Kant and the Platypus*, pp. 96f.). For Eco, abduction serves as an important function in many, if not all semiotic phenomena, from criminal investigations and medical diagnoses to literary interpretations and scientific discoveries (ECO 1990, *The Limits of Interpretation*, p. 159; cited from RAFFA 2009, p. 35).

in *Generative Trance* (2021, p. 38) as «an answer [which] 'flashes' out of the creative unconscious, often in symbolic language».

An extremely meaningful and momentous example of such an incidence in the field of science is August Kekulé.[9] He reported that he have realized the chemical structure of the benzene ring instantaneously during an intense dream about a snake biting in its own tail. Referring to the cultural and symbolic aspects of this individual experience we can assume that he had an encounter with an important figure out of the stock of images of our 'collective unconscious' which, according to C. G. Jung, provides shared mental concepts. This figure is the 'Ouroboros'[10] – depicting a serpent or dragon eating its own tail – an ancient symbol (somehow similar to the well-known Taoist concept of 'yin and yang') that expresses ideas of universal unity and connectedness, the eternal cyclic renewal of life, or the circularity of all processes of becoming and development, as seen in Fig. 1 and 2 on the next page).

Now, with Eco's great insight about the 'brilliant intuition' in mind, we are ready to conclude, at least preliminary, our exploration asking for the epistemic functions of 'images', 'imaginaries' and 'imagination'. According to Zittoun *et al.* (2021, p. 1) 'imagination' may be defined «as the process by which we temporarily leave the here-and-now of current experiences, to explore and play with the past, the future, and alternative spheres of experience».

But beyond the 'epistemic' functions (as addressed by Nicolson 1976) there is need to also address the 'poietic' functions (as dealt with by Suddendorf and Dong 2013a and 2013b). If I would be asked to put my insight associated with these functions into a concise written statement I would present the following thesis: Imagination has a somewhat intrinsic power to transcend the virtuality of the imagined towards its realization. Howev-

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[9] Antonietti (2021, p. 2) suggests that mental images of this type often support scientists «to figure out how reality might be conceived by discovering alternative possibilities to understand it», as documented in numerous biographical and autobiographical reports. As an example she refers to Albert Einstein, who, at the age of 16, imagined himself traveling at the speed of light sitting on the end of a light beam with a mirror in front of him. «In this mental image, the observer could not ever see the image of the traveler. The light and the mirror, in fact, were traveling in the same direction and at the same speed, so that the mirror was always a little ahead of the beam and the traveler could not reach the mirror and could not see his reflection. From this mental image, Einstein concluded that there could be no observer (i.e. no body) that can reach or exceed the speed of light. In this way, he went beyond the assumption, shared by past and contemporary physicists, that an object could achieve any speed, given a sufficient enough acceleration, and this change in comprehension was one of the bases of the subsequent theory of relativity» (*ibid.*).

[10] Please refer to Wikipedia for essential information about this mythological creature, https://en.wikipedia.org/wiki/Ouroboros.
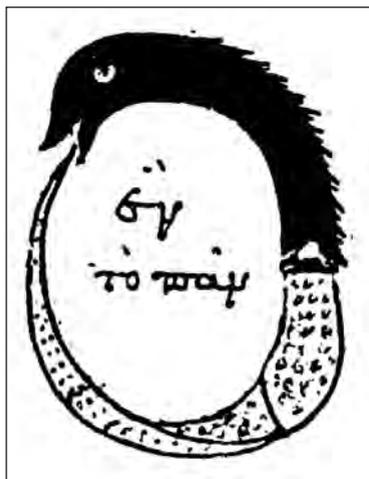
Fig. 1. (left) Alchemical illustration of the 'Ouroboros' from the 10th century, accompanied by the words 'ἓν τὸ πᾶν' ('all is one'), from the work of Cleopatra the Alchemist provided by the Marciana Library in Venice (public domain, https://commons.wikimedia.org/wiki/File:Chrysopoea_of_Cleopatra_1.png).

Fig. 2. (below) Structure of the benzene molecule (drawing by Friedrich August Kekulé von Stradonitz (1829-1896), public domain, https://commons.wikimedia.org/w/index.php?curid=11198902).
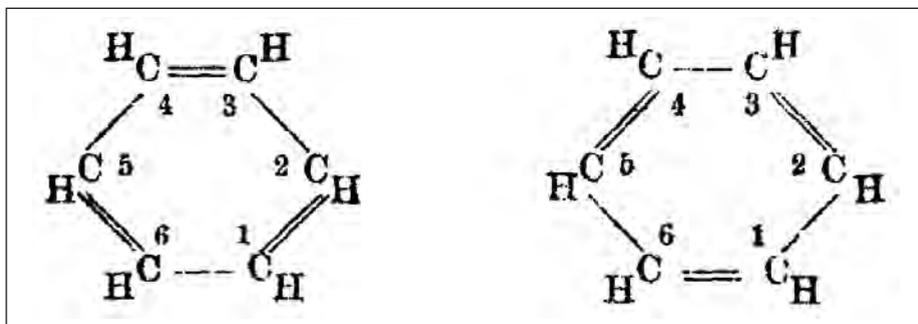
er, systematically I would prefer to introduce these creative and productive functions together with Zittoun *et al.* (2021, p. 2) while representing the following twofold thesis:

i.) Imagination plays a core role in the realization of individual and societal development;

ii.) Imagination contributes essentially to the construction of individual and collective realities.

The cultural dynamics of imagination (in its connection with imaginaries and images) unfolds in some strange dynamics involving phenomena dealt with by individual and social psychology as well as by micro- and macro-sociological approaches towards social change that are centered in actors and/or institutions. Frequently, imagination was (and still is) a victim of a misunderstanding. It seems to depict something unreal, dealing

with the impossible, and therefore being concerned with illusions only. Consequently, according to Zittoun *et al.* (2021, p. 4) this term became often qualified as infantile, escapist, unproductive and primitive, if not even associated with regressive states and mental disorders. Then again, there is a strong tendency of modern societies to 'prize imagination as an attribute of the creative individual' as Sheila Jasanoff (2015, 5f.) puts it in *Future Imperfect: Science, Technology, and the Imaginations of Modernity*. Imagination, favourably understood, is «the faculty that allows the extraordinary person to see beyond the limits of constraining reality and to make or do things that are out of the ordinary» (*ibid.*).

Indeed, making the impossible possible is a challenging task, because the inertia of the status quo needs to be overcome in our own consciousness, in dealing with our contemporary fellow humans, and in the reality we are living in. Doing so, requires reconfiguring the boundary between the domain of the possible and the domain of the impossible through imagination. In this context Zittoun *et al.* (2021, p. 4) point out that most social movements and political revolutions «began with an impossible idea, and then, as the imagination became shared, the plausibility increased, the impossible became possible and, sometimes, even actual (e.g., the welfare state)». Consequently, transformations of the boundary between that what is believed to be impossible and that what is acknowledged to be possible can – if a critical mass of believers of novel opportunities is transgressed – really alter the existing state of affairs (*ibid.*).

But let's come back to the just presented quote of Sheila Jasanoff to finish this thread. Subsequently she states: «We rightly celebrate the seer, the visionary, the transformative political thinker. But imagination also operates at an intersubjective level, uniting members of a social community in shared perceptions of futures that should or should not be realized» (Jasanoff 2015, p. 5f.).

Finally, in search of a systematic approach needed for unlocking this complex of ideas and matter, and needed also for the modes and ways to set them in motion, transforming them into manifesting futures, I would like to refer to the concept of 'co-production'. It comprises a two-way dynamic model based on the premise that «the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it» (Jasanoff 2004, 2f.). Framed like this, we can recognize that scientific knowledge is crucial since it offers a double standard: «It both, embeds and is embedded in social practices, identities, norms, conventions, discourses, instruments and institutions – in short, in all the building blocks of what we term the social» (*ibid.*). Similarly crucial is technology, our human-built material environment, that also embeds

and is embedded in social practice thereby opening up for lasting transformational processes, as described (among others) by Theodore Schatzki (2019) in *Social Change in a Material World*.

4. Second consideration: Incorporating science communication

According to an insight expressed by a famous quote ascribed to Isaac Newton, all scientists are like 'dwarfs standing on the shoulders of giants', and, being there, 'they can see farther than these themselves'.[11] The narrative, as illustrated in the following graphics, is in itself an example for the great power of imaginaries in science communication. Furthermore, narrative and imaginary give us an idea about an essential characteristic of scientific practice in its intertwinement with science communication, as shown in Fig. 3.

Scientific progress is a cumulative, recursive and iterative process of building-up on the achievements of forgoing generations while generating novel scientific knowledge. Along with this description focusing on the importance of interactive work for collective achievements some colleagues view even the aforementioned figure of the 'giant' not so much as a metaphorical expression for the overarching importance of famous scientists, like e.g. Galileo, Newton, Darwin or Einstein. Instead, they suggest to interpret even the 'giant' as a figure composed by a number of dwarfs (as in the case of Thomas Hobbes, *Leviathan*),[12] thereby appreciating all the work done by less famous contributors.

Fig. 3. Illustration of the aphorism of dwarfs on the shoulder of giants (from an medieval encyclopedic manuscript containing medical and allegorical paintings, provided by the Library of Congress, Washington, DC, LCCN permalink https://lccn.loc.gov/50041709).

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[11] Please refer to Robert K. Merton's *On the shoulders of giants: a Shandean postscript* (1998, originally published in 1965) for the putative authors of this quote, the origins of this parable, and some discursive exploration of its meanings and implications in and for the scientific community.

[12] See Bredekamp 2020 for details and context of this visual metaphor.
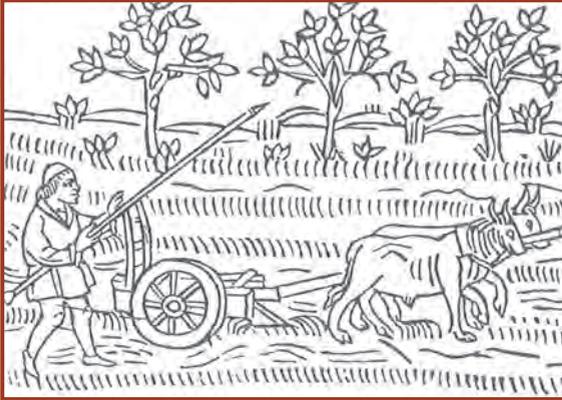
The dynamics of images, imaginaries and imagination play a crucial role – in academic as well as in public discourses! What kind of essential relations exist between different expressive forms and patterns of thought? How can we understand the principles determining the ways in which their dynamics take effect – in the practice of scientists and engineers, and at their interfaces with politics, economy, culture and the public? Which options do we have to make good use of our insights?

Despite of the diversity of topics – treated with either more interest in theoretical reflections, programmatic considerations or practice-oriented descriptions – all contributions to this volume share a common interest: to raise our awareness and understanding of the generative capacities of these processes.

Exploring this prolific interplay is of utmost importance for expanding our ability to identify emerging opportunities, to create future perspectives, and to assess the societal consequences of scientific and technological developments. This expansion is indispensable if we really want to be clear about our preferences whilst shaping the ongoing stream of inventions and innovations according to our values.