Agency and artefacts

A cognitive semiotic exploration of design

JUAN CARLOS MENDOZA-COLLAZOS
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This thesis investigates the role of artefacts in relation to human agency and design within a cognitive semiotics framework. It deals with questions such as *What is agency? What are artefacts and how does agency relate to them? What kind of intentions are involved in the activity of designing? What is human-specific with respect to agency and design? How can the origins and evolution of design be explained?*

Addressing these questions, the thesis proposes a layered model of agency for explaining the relations between different grades of agentive complexity. The model is also useful for empirical studies of agency such as those of neuroscience. The thesis contends that the activity of design is a key feature of human agency. Thus, it delves into the cognitive processes of design, proposing the notion of enhanced agency as the prosthetic incorporation of artefacts into the agentive capabilities of the agents. The thesis also explores the origins and evolution of design and proposes a stage-based model in which the progressive complexity of the artificial world is parallel to the increasing complexity of enhanced human agency.

This thesis rejects human exceptionalism which places humans as ontologically unique and biologically discontinuous with the rest of the living world. At the same time, it recognizes that only human agents have the power to stop the current environmental obliteration. This can be done by recognizing the potential of human agency, instead of diluting it into abstract networks; highlighting its differences and similarities instead of equating human agency with inert matter or anthropomorphizing the agency of other animals. This also highlights the moral responsibilities of human agency.

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AGENCY AND ARTEFACTS

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Juan Carlos Mendoza-Collazos

DOCTORAL DISSERTATION

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Abstract:

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Paper 1 explores the origin and evolution of design: an activity in which agency is present in the intentional adaptations of the material world for the benefit of human purposes. Delving into the evolutionary emergence of design helps understand the relevant cognitive processes underlying this activity and their relationship with other key semiotic resources such as mimesis, pictorial representations and polysemiotic communication. Paper 2 addresses the current debate on the role of materiality for human cognition and the status of artefacts as agents, critically reviewing the concept of material agency. Paper 3 is based on an empirical study consisting of contextually situated observations of the process of design of artefacts in Amazonia. This paper proposes the notion of enhanced agency, the prosthetic incorporation of artefacts into the agentive capabilities of the agents. Paper 4 investigates how intentions are involved in the cognitive processes of design. Paper 5 proposes a layered model of agency with the goal of explaining the relations between different grades of agentive complexity. A further goal was to apply a proper cognitive semiotic approach to third-person studies of agency, specifically those of neuroscience.

Key words: Agency, enhanced agency, agency hierarchy, derived agency, material agency, intentionality, prior intentions, intentions in action, pictorial representations, artefacts, tool-making, design theory, design semiotics, design research, phenomenology, cognitive semiotics, agentive semiotics, semiotic hierarchy, 4E cognition, bio-cultural evolution.

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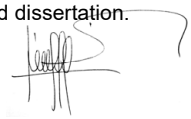
Signature  Date 2022-10-31

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Cover photos by Juan Carlos Mendoza-Collazos. «*Weaving a basket is like weaving knowledge*.» Baskets of the Bora native people of Amazonia in the process of making. Leticia, Colombian Amazon, March, 2020.

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«Es un ser, no es solo carne y hueso».
Álvaro Torres,
Industrias fonográficas Victoria, 1983.

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A PhD is like a F1 race in which you must endure until the end and win. You always depend on the team behind you. They do not have space in your single-seater car, but they have a panoramic point of view that is crucial for strategy and for tuning your car. And what a wonderful team I had. From friends (including here my supervising team) to relatives and colleagues.

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heard my readings aloud and read them herself, discussing and asking for elaborations to the point that I suspect she is better prepared to answer questions than me now. If I continue describing her assistance, I will use fifty pages more. I wish the Metal Gods bless you for your unconditional support, Nadi!

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Finally, thanks are given to the anonymous or known friend that is reading this section, hoping to find your name here but to no avail. To the future reader that may use this thesis for his or her own research, thank you for navigating within these lines. Please contact me if you love (or hate) any claim that is made in the following pages. In both cases I would be much obliged.

Juan Carlos Mendoza-Collazos
Lund, October 25, 2022

List of papers

This doctoral dissertation is a compilation of original research from the following five papers, referenced by the number of the paper throughout the thesis:

Paper 1

Mendoza-Collazos, J., Zlatev, J., & Sonesson, G. (2022). The origins and evolution of design: A stage-based model. In E. Pagni, & R. S. Theisen (Eds.), *Biosemiotics and evolution: The natural foundations of meaning and symbolism* (pp. 161–173). Springer. https://doi.org/10.1007/978-3-030-85265-8_8

Paper 2

Mendoza-Collazos, J. (2020). On the importance of things: A relational approach to agency. *Cognitive Semiotics* 13(2). https://doi.org/10.1515/cogsem-2020-2034

Paper 3

Mendoza-Collazos, J., & Sonesson, G. (2020). Revisiting the life of things: A cognitive semiotic study of the agency of artefacts in Amazonia. *Public Journal of Semiotics*, 9(2), 30–52. https://doi.org/10.37693/pjos.2020.9.22012

Paper 4

Mendoza-Collazos, J., & van de Weijer, J. (2022). “Sketching with my mind”: The role of prior intentions and intentions in action for the creative process of design. Submitted manuscript to *Design Issues* (The MIT Press).

Paper 5

Mendoza-Collazos, J., & Zlatev, J. (2022). A cognitive-semiotic approach to agency: Assessing ideas from cognitive science and neuroscience. *Biosemiotics* 15, 141–170. https://doi.org/10.1007/s12304-022-09473-z

Individual contributions to co-authored papers

In Paper 1, I wrote the first full version. Jordan Zlatev strengthened the theoretical framework based on the work of Mervin Donald. Göran Sonesson elaborated on the connection between the evolution of design and bio-cultural evolution. I proposed the first version of the stage-based model, mapping the stages of design evolution with corresponding semiotic resources. The three authors worked on the improvement of the model, adding accuracy to the time stamps, to the species involved in each stage, and to the technical terms for the semiotic resources. I collected, analyzed, and integrated the findings taken from relevant literature, while Zlatev and Sonesson suggested key references. I contributed to the main thesis of the conclusions and with the elaboration of each stage of the model. Zlatev and Sonesson improved the style of the writing throughout the paper.

In Paper 3, I wrote the first full version. I did the fieldwork, collecting and analyzing the data, integrating the main findings to the paper. Further, I proposed and elaborated the notion of *enhanced agency.* Göran Sonesson added and elaborated on the phenomenological basis of our approach, particularly integrating the notions of *remote intentionality* and *sedimentation*. Sonesson added the *emic/etic* distinction which was useful to improve my arguments on the problem of the agency of things. He also improved the academic writing in terms of style and clarity. Both authors worked on revising the paper after the comments of anonymous reviewers and discussing the references.

In Paper 4, I ran the experiment and wrote the first version of the text, except for the statistics section. Joost van de Weijer conducted the statistical analysis and contributed to important clarifications for the understanding of the results. Both authors worked on analyzing and discussing the data. Joost van de Weijer helped improve clarity and conciseness.

In Paper 5, I wrote the first version, and further versions of the section "Assessing approaches to agency in neuroscience," analyzing and reviewing the articles on the philosophy of agency and neuroscience of agency. I proposed the first version of the agency hierarchy as well as its application in cognitive science and neuroscience. Jordan Zlatev expanded and improved the sections "Cognitive semiotics and agency" and "Assessing approaches to agency in cognitive science." He also

integrated key references from philosophy to strengthen the main arguments of the paper. Both authors worked on refining the agency hierarchy and on the summaries and conclusions. Jordan Zlatev improved the academic writing in terms of style and clarity.

Other publications connected to this thesis

(referenced in the sections below)

Mendoza-Collazos, J. (2021). La agencia de las cosas: Una semiosis de las redes de transporte en Bogotá [The agency of things: A semiosis of transport networks in Bogotá]. *DeSignis* 34, 55–65. http://dx.doi.org/10.35659/designis.i34p55-65

Mendoza-Collazos, J. (2021). Responsibility of Action and Situated Cognition in Artefact—User Relationship. In N. L. Black, W. P. Neumann, and I. Noy (Eds.), *Proceedings of the 21st Congress of the International Ergonomics Association*, *IEA 2021* (pp. 211–216). Springer.

Mendoza-Collazos, J. (2021). Los artefactos y el lenguaje: una mirada desde la semiótica cognitiva a los universales [Artefacts and language: A cognitive semiotic approach to universals]. *DeSignis* 35, 73–82. http://dx.doi.org/10.35659/designis.i35p73-82

1. Introduction

Agency seems to be one of those things, like time, that everyone knows what they are until we are asked to explain them. In fact, there is anything but agreement in the current literature on what agency is, and where it is to be found. Further, one of the key characteristics of us as human beings is that we produce *artefacts* (Stout & Chaminade, 2007; Vaesen, 2012), and the process through which we do this is that of *design* (Buchanan, 1992; Bayasid, 2004; Acha 2009). But what these are, and how agency relates to them is not clear either.

Thus, in this thesis I investigate the role of artefacts in relation to human agency on the basis of a methodology taken from the new transdisciplinary science of *cognitive semiotics*. This science combines methods and concepts from semiotics, linguistics, and cognitive science, for exploring the multifaceted phenomenon of meaning (Sonesson, 2012, 2015a; Zlatev, 2015; Zlatev, Sonesson and Konderak, 2016). Given its transdisciplinary character, cognitive semiotics is open to integrating and combining methods from other fields as well.

What is characteristic of cognitive semiotics is the primacy of first-person methods (e.g., intuition-based analyses) and at the same time triangulation with second-person methods (e.g., interviews) and third-person methods (e.g., experiments). The first-person access to knowledge is grounded in Husserlian phenomenology, understood as "the study of human experience and of the ways things present themselves to us in and through such experience" (Sokolowski, 2000, p. 2, see also Sonesson, 2009, 2015b, 2015c; Zlatev, 2010, 2015, Konderak, 2018). This means that intuition-based analyses initiate the investigations with systematic reflections on the phenomena in question (e.g., agency, artefacts) without prior commitments to established theories. The reflections are then combined with methods based on social interactions such as interviews or participant observations, for the sake of reaching intersubjective convergence. Finally, the triangulation may include detached observations and experiments, supporting or refining the initial reflections. This establishes a particular combination of methods known as *phenomenological triangulation* (cf. Pielli & Zlatev, 2020).

An additional characteristic of cognitive semiotics is the interplay between conceptual matters (e.g., asking what agency is) and empirical questions (e.g., asking how agency is manifested in human design), creating a continuous iteration: the *conceptual-empirical loop* (Zlatev, 2009, 2015). Thus, investigations are always

open for further empirical validations or new conceptual reconsiderations, moving the frontier of knowledge. This approach avoids the conceptually-laden bias typical of humanities or the primacy of data-laden research as typical of natural science.

In Section 6, I explain the specific way in which phenomenological triangulation and the conceptual-empirical loop were applied in this thesis. Thus, I show that the methodology of cognitive semiotics is particularly apt to investigate agency and artefacts. This is precisely because the approaches to agency from the humanities are seldom empirically validated, while experimental studies on agency tend to have low construct and ecological validity (this is an argument that is further elaborated in Paper 5). In addition, phenomenological triangulation permits us to deal with the complex notion of agency in a systematic way, combining multiple perspectives throughout the process. Cognitive semiotics allows us a deeper understanding of the "multifaceted phenomenon of meaning" (Zlatev, 2015, p. 1043), transcending both traditional semiotics and cognitive science (Konderak, 2018). Meaning can in general be understood as the relation between an organism and its physical and cultural environment, determined by the value of such an environment for the organism (Zlatev, 2003). There are, for example, different types of meaning, depending on different kinds of value systems: biological, phenomenal, cultural, and language-based (Zlatev, 2009). The Semiotic Hierarchy described below elaborates this further.

Using a cognitive semiotic framework, the following questions are addressed in this thesis:

- *What is agency, and who can be said to possess it?*
- *What are artefacts and how does agency relate to them?*
- *What kind of intentions are involved in the process of design?*
- *What is human-specific with respect to agency and design?*

The following four sections present the main debates around the notion of agency and how the thesis contributes with methodologically supported standpoints within such debates. Accordingly, I propose a synthetic approach to agency along with a novel path for understanding our interactions with artefacts and how they affect human agency. Thus, sections 2 to 5 highlight key ideas from the published papers at the same time as I elaborate on the central arguments, introducing new contributions and, to a limited degree, updating some points. This should hopefully allow the reader to obtain a global overview of the thesis as an invitation for delving deeper into the details of each paper, summarized briefly in Section 7. Finally, in Section 8 I conclude this "coat" of the thesis with a summary of the contributions of my work, and some suggestions for further research.

2. Towards a synthetic concept of agency

In a book that has the ink still fresh, Luca Ferrero explains the two fundamental poles of the discussion on agency, with the following literary wit:

> For the most part, it seems that we can easily classify the things that happen, both in the universe at large and around us, between those that *merely* happen, with no point or purpose, and those that are *done* by someone or something, with some kind of point or purpose. Sure, there are going to be some ambiguous or borderline cases—when the children laugh at the clown, when you sneeze, or when you are in the grip of some compulsion, for instance. But the reason why we find these cases somewhat difficult to classify is that they seem to partake of some of the special features of the straightforward and uncontroversial examples of 'doings'— or what we also refer to as acts, actions, or activities. The distinction between mere happenings versus doings is something that matters a lot to us (Ferrero, 2022, p. 1, italics in the original).

Negotiating between these poles has been the source of myriad approaches to the multifaceted phenomenon of agency. A pattern can be identified: those approaches striving to expand the *happenings* into *doings* and those reducing the *doings* into mere *happenings*. In the latter pattern we can locate mechanistic approaches (Dawkins, 1986; Dennett, 1991, 1994, 2017; Okasha, 2018), while the processual approach to agency (Latour, 1992, 2005; Ingold, 2013; Malafouris, 2013; March, 2019) fits well in the former pattern.

We can look at two representative scholars of each pattern.[1] Then, I will expand some theoretical issues presented in Paper 5 to propose a synthetic notion of agency. The aim is to provide a concept of agency that can be open to phenomenological triangulation. As explained in the introduction, this means that the concept is the outcome of systematic intuitions without prejudices, and at the same time it is open to intersubjective corroboration and can be operationalized for empirical research.

Daniel Dennett is often seen as one of the most representative scholars of the mechanistic approach to mind in general, and to agency in particular. I cannot here do justice to his vast work and to potential subtleties helping to ameliorate the

[1] Additional approaches to those present here were discussed in Paper 5.

stigma. However, his position seems to be clear enough. For instance, Dennett (2017) considers that the specific differences between brains and computers are not important. Fundamental features like analog versus digital, parallel versus serial and carbon versus silicon are not essential differences, and neither is the obvious fact that the brain is part of a living organism, while a computer is not. He claims: "The brain is an information-processor, and information is medium-neutral" (Dennett, 2017, p. 157). Following this path of reasoning, Dennett conceives of neurons as little robots. Consciousness is the user-illusion created by these smart neurons. The complex depth of human agency is reduced to "nano-intentionality" in which neurons are seen as "highly competent agents" (Ibid., p. 162). Thus, for Dennett, we are little more than "brain tissue subject to the laws of physics and biology" (Ibid., p. 373). This is diametrically opposite to the epigraph of Álvaro Torres that opens this thesis: *Es un ser, no es solo carne y hueso* ('it is a being, not only flesh and bones') from which most of my arguments are developed.

A good representative of the opposite pattern, the processual approach to agency, is Tim Ingold. He is one of the main influences behind the notion of *material agency* (Malafouris, 2013, discussed at length in Papers 2, 3 and 5). In this pole, the *doings* of proper agents are extended to the *happenings* of physical laws. For instance, Ingold (2013) addresses the relationship between human actions and materials (including tools) from the perspective of transactions of *agentivity*: the capacity to act on the world and others (cf. Paulus, 2021). Thus, the making of artefacts is a dance of agency in which each partner (maker, material, and tool) acts upon, and is in turn acted upon by, the other two. This echoes the reflections of another representative of this pattern, Lambros Malafouris, on the "ecological-enactive vision of participatory mentality where bodily acts and materials act together to generate rather than merely execute thought processes" (Malafouris, 2021, p. 107). The dance metaphor is representative of the processual approach in which things are not mere objects; they are generated within processes of life. The flows of materials are included within those life processes (Ingold, 2013; Paulus, 2021). A good way to sum up the main standpoints of this approach is the following quote: "Every act of making (not just the making of a stone tool) is an act of collaboration between the agency of human bodies and the agency of materials" (Malafouris, 2021, p. 117).

A cognitive semiotic take on this debate should view the concept of agency from a different perspective: agency-related phenomena are complex, multiple, and layered. Agency is strongly related to consciousness and semiosis (Ferrero, 2022; Sharov & Tønnessen, 2021) and this can be analyzed in terms of the *Semiotic Hierarchy* (Zlatev, 2009, 2018, see Paper 5), a layered model of the consciousness-semiosis nexus, which has helped formulate the original model for an agency hierarchy proposed in this thesis.

In a recent version of the Semiotic Hierarchy, Zlatev and Konderak (2022) point out the ambiguity of the notion of consciousness and the complexity of meaning-making and propose that the relation between consciousness and semiosis is non-unitary,

consisting of interrelated layers. The key ideas of the theory are formulated in terms of four fundamental theses. The first is that the central phenomenon of consciousness is *intentionality*, the "openness to the world" of subjectivity, which is the directedness of experience beyond itself, implying alterity. The second thesis is that semiosis is an equally complex, layered phenomenon marked by the activity of meaning-making that is not reduced to sign operations. Thus, semiosis is related to any process of meaning-making and not only to the use of signs. The third thesis is that subject and world (or object) stand in an irreducible, reciprocal relationship. The relationship is asymmetrical, and the dynamic poles conform to one unitary experiential system in which consciousness is the world-directed aspect of the existence and semiosis is the subject-directed pole of this experiential unity. Consciousness is a compound of multiple kinds of internationalities that vary in terms of their complexity. The final thesis is that the relation between higher and lower layers of consciousness/semiosis is based on the phenomenological notion of *Fundierung*: lower layers are the foundations and preconditions for higher ones, which are more explicit, "sublimated" forms of the lower, but without becoming independent of their origins. On this basis five layers with blurry borders of the consciousness-semiosis nexus are proposed (see Table 1).

Table 1. The Semiotic Hierarchy, adapted from Zlatev and Konderak (2022).

Layer and label	Consciousness	Structure of semiosis
5. Language	Linguistic intentionality	Predication, syntax
4. Sign Use	Signitive intentionality	Signs
3. Intersubjectivity	Shared intentionality	Mimetic schemas, conventions, rituals
2. Subjectivity	Perceptual intentionality	Noemata, Leib/Körper duality
1. Animation	Operative intentionality, drive intentionality	Schemas, goals, emotions

The first layer, starting from the bottom of the hierarchy, is that of *animation* in which a kind of pre/unconscious intentionality serves as a "non-representational background of subjectivity" (Zlatev and Konderak, 2020, p. 179). This includes the affective tone of every act of perception or movement in a kind of latent level of mind, something that may become fully conscious on a higher layer.

The second layer is *subjectivity* and *perceptual intentionality* in which the relation subject–object becomes clearer since intentionality is directed to an intentional object. Consciousness is here still pre-reflective but nevertheless self-conscious, since acts of subjectivity "are not only intentionalities directed outward, but simultaneously, before any explicit act of reflection, felt as 'belonging' to a

particular subject of experience" (Ibid., p. 181). The third layer is that of *intersubjectivity* and *shared intentionality*, which allows the sharing of experiential content. On this layer, we have a clear sense of an "objective" world consisting of objects and other subjects.

The fourth layer introduces non-verbal *sign use* and *signitive intentionality*. Following Donald (1991), Zlatev and Konderak propose that bodily mimesis, the use of the body to produce iconic and deictic signs, serves as foundation for this. A synthetic definition of sign is given in which the awareness of the sign relation distinguishes the associative use of signals in non-human animals from the use of signs in human beings. An important point here is that perceptual intentionality is not mediated by signs. When we use signs, our consciousness is directed to an absent object by means of a present object under a sign relation with the former. Finally, the transition to the highest layer of the Semiotic Hierarchy, *symbolic intentionality*, is made possible by the evolution of *language*. The five layers of this hierarchy are dialectically permeable and regulated by synthesis of spontaneous acts of meaning-making with sedimented norms, solving in this way the interrelation between meaning-as-structure and meaning-as-process.

The layered model of agency proposed by this thesis (see Paper 5) emerges naturally from this basis since intentionality, consciousness, meaning-making (semiosis), and agency are closely interrelated. To begin with, Zlatev and Konderak propose the reciprocal relation between intentionality and semiosis in which intentionality is directed to the world while semiosis is more directed to the subject. In an analogous manner, agency and subjectivity are irreducible aspects of intentionality in which agency is the more active, world-oriented aspect, while subjectivity is the qualitative feel that emerges from semiosis, being the more subject-oriented aspect.

As shown in Table 2, in this thesis six layers of agency are distinguished and grouped in two main types: original and enhanced agency. *Original agency* corresponds to the agentive capacities of "the naked body," the biological body, from a third-person person perspective, or the lived body (*Leib*) from a first-person perspective. *Enhanced agency*, on the other hand, implies the prosthetic incorporation of artefacts into the agentive capabilities of the agents. It emerges from agents' ability to design and incorporate artefacts for expanding their capacity to act. The hierarchy should be seen in terms of complexity, not of importance. Lower levels are necessary preconditions for the emergence of higher levels of agency, both conceptually and in evolution. Thus, the relation between lower levels and higher ones follows the *Fundierung* principle as in the Semiotic Hierarchy, as explained above.

Table 2. A layered model of agency (see Paper 5 for elaborations).

Agency type	Level / type of agency	Examples of acts	Examples of agents
Enhanced agency	(6) Mediated by language and other symbolic media	An act of story-telling	A community
	(5) Sign-mediated	Performing a pantomime	A performance troupe
	(4) Artefact-mediated	Making a stone axe	A manufacturer
Original agency	(3) Joint	Dancing in group	A group of dancers
	(2) Reflective	Jumping up to pass over a barrier	A high-jumper
	(1) Operative	Skilled movements without conscious attention, e.g., running	A runner

We can recognize original agency in other animals, either from our interactions with them, or from scientific studies on animal behavior. However, the examples of the right column are based on human experience. Operative agency is exemplified with the act of running since the complex coordination of bodily movements in this exercise does not require conscious attention. It is a kind of pre-conscious intentionality. Reflective agency, on the other hand, does require the ability to imagine the act in question in advance, for example an athlete practicing high jumping. The agent here has to focus their full attention on the target, and to "visualize" the movements they are to perform in order to succeed. Joint agency can be interpreted more narrowly as the product of explicit shared intentions, as when the goal is to carry a heavy object together, or more broadly as the spontaneous intersubjective coordination of movements in a group dance. Both are in their more developed forms human-specific (Tomasello et al., 2005).

The three different layers of enhanced agency (4 to 6 in Table 2) are uniquely human. The simplest of these, artefact-mediated agency, is epitomized in the acts of ancient tool-makers when they used natural objects—like stones—as hammers and anvils to produce novel artefacts. The characteristics that made enhanced agency human-specific are based on the human way of designing (see Section 4). Human specificity is even clearer at the level of sign-mediated agency. This is explained by the human-unique ability to externalize imagination via mimesis serving as the foundations for the use of signs. The awareness of the sign relation differs from the associative use of signals in non-human animals (Zlatev, Zywiczynski & Wacewicz, 2020, see above).

The language-mediated form of enhanced agency adds greater complexity, and this is further enhanced by *polysemiotic communication:* "the synergy of two or more sign systems" (Stampoulidis, 2021, p. 34; see Zlatev, 2019). A paradigmatic example in relation to design is corporate identity and branding (Efer, 2017) in which a company establishes a coordinate array of communicative media under a unique, pre-established strategy, from the style of written texts to an identifiable

style of industrial design. The model of cumulative layers of agency opens the possibility to the analysis of different types of agencies by means of systematic intuitions. At the same time, each layer can be discussed and investigated on the basis of second-person methods such as participant observation. In addition, the model is productive for operationalizing the notion of agency in detached, experimental studies.

To sum up, this thesis proposes a synthetic concept of agency in which a minimal level of consciousness (a sense of agency) and subjectivity is required for agents proper:

> Agency is the active, self-generated aspect of intentionality. It compounds an irreducible dyad with subjectivity, the "qualitative feel" of experience, the more receptive aspect of intentionality (Paper 5, p. 164).

The laws of cause and effect have nothing to do with agency and the association of these laws with agentive capacities is a superstitious legacy of alchemists, as Sharov and Tønnessen (2021) suggest. The extended/processual approach to agency dilutes the notion into symmetrical relationships, ending in the rejection of the concept as a property of living beings. However, the issue is more difficult in relation to simpler forms of life such as bacteria, invertebrates, and plants. While the agency proper (with different grades of complexity) is likely a feature of *Metazoa* (Godfrey-Smith 2020), the notion of agency can be declined by means of coupled-words or modifiers for considering these boundary cases. I propose the use of *proto*-agency, for describing the capacity to act in simpler forms of life. The prefix *proto* (from Ancient Greek *πρωτο-* [prōto] first, before) is suitable not only because it denotes something that existed before (a precursor, see Paper 1) but also because it conveys the idea of something that is not a fully-fledged form of agency. The prefix *proto-* is commonly used in literature, for instance, Zlatev uses *proto-mimesis* (Zlatev, 2009), and Giorgio Prodi coined the term *proto-semiosis* for referring to the cases of molecular signaling (cf. Sharov and Tønnessen, 2021).

Proto-agency should not be understood as a type of agency but only as a precursor to agency. It shares some basic, primordial features with agency proper and it serves as the basis for agency, but at the same time, it is clearly distinct. Good candidates for such shared features are those proposed by Barandiaran, Di Paolo, and Rohde (2009, see Paper 5): *Individuality* as the fundamental distinction between the agentive system and the environment. *Interactional asymmetry* is the feature allowing the agentive system to break the symmetry of its structural coupling with the environment. Thus, the agent is the source of activity, not "a passive sufferer" nor a system driven by functioning sub-modules or internal mechanisms. *Normativity* is the active regulation of interactions with the environment on the basis of agent-internal norms and goals.

Keeping the notion of agency delimited to a minimal level of consciousness and subjectivity allows a concept that is both intuitive and easier to operationalize in empirical research (see Paper 5). This also facilitates the investigation of cases ranging from proto-agency to basic, operative agency to enhanced, complex agency. The functioning of AI systems and robots can be clearly distinguished from that of true agents, which is important for issues such as responsibilities of action, and for avoiding the confusion provided by the media (and some scientific research). This confusion is generated when statements that are in fact metaphorical are taken to be literal:

> Linguistic permissiveness make us less likely to notice linguistic corruption and the conceptual muddles that may follow from it. We start imagining that machines that help us to carry out certain functions actually have those functions. This is particularly likely to happen when the machines in question are computers. When I speak of a "clock telling the time" I do not for a moment imagine that it is doing so of itself. What I mean is that the clock enables me to tell the time. When, however, I speak of a computer "doing calculations" I might be inclined to take this literally: to think of the calculations going on in the computer itself, rather than simply assisting me in getting from the beginning to the end of a series of sums. In other words, I make the mistake of thinking that a prosthetic aid to an activity actually does that activity. We forget that in the absence of any human beings using the tool its function would not be performed. It is I, not the computer, who make the calculation, just as it is I, not the walking stick, who walk and I, who shelter my head from the rain (Tallis, 2016, p. 185).

Another example of this typical use of language appeared in a BBC documentary under the title “The Blob: A genius without a brain” (Mitsch, 2021; see also Davis, 2012), claiming that a slime mould can think and possess reasoning capacities similar to that of animals. Tallis (2016) describes such cases as the anthropomorphizing of animal behaviour. But the “memory” of a slime mould or the “learning” of even the most advanced AI-systems are categorically distinct from human beings’ memory with explicit time-temporal depth, the capacity of time travelling and the narrative character of such a complex form of agency. The boundless use of the word “agency” fails in recognizing the different levels of agentive complexity and the differentiation between proto-agency, simple forms of operative agency and higher levels of agentive complexity (see Table 2 and paper 5).

I conclude this section by noting the importance of recognizing the crucial differences between different forms of agency and between proper agents and things. From these differences, we can develop respect for non-human beings, treating other beings with empathy, and building better ecological relationships, instead of anthropomorphizing non-human agencies. Ecological relationships should be understood as the harmony of differences within co-dependent interactions. Building ecological relationships from our differences and similarities

with other animals can be the way to ameliorate the still prevalent view on non-human animals as "sub-human." We can also establish strong relationships with things. However, artefacts clearly do not qualify as agents since they lack intentionality, which leads us to the next section.

3. The problem of "the agency of things"

In everyday life, our interaction with artefacts is ubiquitous. Paraphrasing the titles of two bestselling books of Donald Norman (1993, 2004): this relationship with artefacts can *make us* feel *smarter* (but also more stupid), which is one of the reasons *why we love (or hate) everyday things*. According to De Léon (2003, p. 27), this direction of influence, from artefacts to us, is "rarely taken into consideration." When we investigate the power of things to influence emotions, feelings, and cognition, we may be tempted to attribute the agency of human beings (and of other living beings) to artefacts. In this section, I briefly present the main standpoints of this tendency, and then explore an alternative way for understanding the so-called "agency of things." At the same time, I point out the importance of preserving an asymmetry between people and things in terms of agency.

A well-known approach for addressing the problem of the agency of things in anthropology is that of animism. It was recently revitalized by Santos-Granero (2009), claiming that the "life" of things is not just a metaphor. Interestingly, such animism is not a projection of any kind of life into things, but that of *human* life. Santos-Granero explains that, according to some peoples in Amazonia, animals and artefacts are believed to be human beings in primordial times, and they still are in some sense humans, but in a different outer guise (see Paper 3). This belief permits many native peoples of Amazonas to interact with artefacts in an analogous manner to that with other people. For example, artefacts are often described by the makers as their "children;" the makers and their artefacts are related in terms of filiation. These peoples see an artefact "as if it were their daughter and as if it had agency" (Franky, 2004, p. 168, my translation).

A more general and modern conception that also attributes agency to things is the thesis of *material agency* (Knappett & Malafouris, 2008; Malafouris, 2013). This concept is derived from the processual approach to agency (Ingold, 2013; Latour, 2005), and from the so-called *4E cognition* approach: the view of the mind as embodied, embedded, enactive, and extended (Newen, De Bruin, & Gallagher, 2018). Proponents like Malafouris (2008, p. 22) claim that "If human agency *is* then material agency *is*, there is no way that human and material agency can be disentangled." The proposal is that we endow artefacts with material agency by

means of a kind of "methodological fetishism" (Malafouris, 2013, p. 133; see also Papers 2 and 3).

The dependence of artefacts on human intentions and purposes is said to be a traditional stance, while the dependence of human cognition and action on artefacts is seen as the forefront of new approaches to the problem (Preston, 2022). In this thesis, I propose a synthetic approach updating the traditional approach and at the same time incorporating the prosthetic role of artefacts (Paper 3), and their own way to operate (Malafouris, 2013).

The key idea is that artefacts can perform *functions but not actions*. Thus, any agency of artefacts is not intrinsic but *derived* (Niño, 2015). Derived agency is a type of agency in which the capability to act requires proper agents. Thus, derived agency is not even a form of proto-agency, which applies to simple organisms without any subjectivity (see Section 2).

The functions of some artefacts can be executed automatically, but still depend on what Sonesson calls *remote intentions* (Sonesson, 1999, 2021), the cumulative series of prior human intentions. This can be illustrated by the example of auto-finish photographs in races. This could never have happened if not for the people rigging up a camera at a particular place, directing it in a particular direction, and installing a mechanism which triggers the camera off. Not to mention the invention of the camera, nor that of various kinds of racing. So even if artefacts automatically perform functions, they still depend on the (remote) intentions of their designers.

Therefore, this thesis proposes the notion of *enhanced agency* as an alternative explanation of the relationship between human beings and artefacts. Enhanced agency is the prosthetic incorporation of artefacts into the agentive capabilities of the agents. The prosthetic character must be understood in a general etymological sense as addition (from the Greek πρόσθεσις [prósthesis] addition, attachment).

The incorporation of artefacts can be done in various ways: from artefacts attached to the body to telematic or remote actions dislocated from the body. For instance, intradermic implants of bio-compatible microchips are attached inside the body as in the case of microchips for keys, tokens, business cards, and credit card replacements (Lima & Belk, 2022). The more common artefacts like sunglasses or watches are artefacts externally attached to the body. A drone is the case of telematic incorporation of artefacts for enhancing human agency since they are operated by means of remote control. Traffic lights implement rules that are dislocated from the body; in a sense, they replace the actions of a traffic officer.

In some cases, agency is not enhanced compared to a standard but *restored*. For instance, the incorporation of a prosthetic limb, which provides a functional if not fully experiential substitute for a missing limb (Pielli & Zlatev, 2020). Other examples of enhanced agency concern artefacts that have been designed to diminish or destroy the capacity to act, such as the drones that we read about daily. These

ominous types of artefacts still enhance agency from the perspective of the victimizer as they expand the capacity to injure.

The idea of artefacts as expanding human capacities is of course not a novel one (see, for instance, De Léon, 2003; Ingold, 2013; Colomina & Wigley, 2016; Lima & Belk, 2022). However, the notion of *enhanced agency,* in relation to the philosophical study of agency, was coined in this thesis. Being linked to the layered model of agency presented in Section 2 and Paper 5, enhanced agency offers new explanatory insights from the perspective of human bio-cultural evolution (e.g., Donald, 1991; Dunér, 2016).

The standpoint one assumes with respect to "the agency of things" can have important implications when contextualized in practical situations, such as how public policy is assumed or how work environments are designed. If artefacts are taken as equal partners (i.e., a symmetrical relationship), the design of workflows could lead us to put the emphasis only on interactions between the elements of the system. This approach disregards who is the originator of actions, who defines the purpose of actions, and who is responsible for such actions.[2] This explains the still prevalent analysis of work activities in which a deep understanding of situated, subjective experience of human agency is omitted. On this basis, designers may propose artificial systems focused on efficiency instead of user experiences. An example is the public transport system in Bogotá. According to some data analyses it is one of the most efficient in the world (Peña & Moreno, 2017; Hidalgo, 2017). But, at the same time, studies have shown that the user's experience is negative, and the satisfaction of users' expectations is low (Vega, Rivera-Rodríguez, & Malaver, 2017). This can be seen as the result of a Latourian approach, in which the *actants* can only "proceed to action" and their ontology is not relevant:

> One can only associate mediators, no one of which ever, is exactly the cause or the consequence of its associates. Thus it is not the case that there are actors on the one side and fields of forces on the other. There are only actors – actants– any one of which can only "proceed to action" by association with others (Latour, 1996, p. 237).

Latour's argument is based on the idea of a network in which each action is connected to the previous one and the next one, in a permanent flow that has a completely diffuse origin. The notion of *actant* refers to any active element of such a functional network. The nature of this "active element" (things, persons, programs and so forth) is not relevant. My point is that it is mistaken to equate artificial things with living agents, endowing things not only with agency but even with ethics (Adam, 2008) and moral agency (Latour, 1992; Malafouris, 2013). This path of reasoning could dilute human responsibility for actions. Artefacts are not moral actors. For instance, in the case of an autonomous vehicle, the driverless machine

[2] For a critique of this approach, see Mendoza-Collazos (2021a).

could be seen as "responsible" in the event of a pedestrian run over on the road if we accept the moral or ethical status of artefacts. As elaborated in Mendoza-Collazos (2021b), the responsibility must always rely on true agents—designers and manufacturers—as the vehicle embodies the remote intentions of the designers. Responsibility of actions should be not diluted in AI or emerging technologies, nor artefacts can be considered as a moral entity, as argued by Parthemore & Withby:

> A moral agent must be embedded in a cultural and specifically moral context and embodied in a suitable physical form. It must be, in some substantive sense, alive. It must exhibit self-conscious awareness. It must exhibit sophisticated conceptual abilities, going well beyond what the likely majority of conceptual agents possess: not least that it must possess a well-developed moral space of reasons. Finally, it must be able to communicate its moral agency through some system of signs: A "private" moral world is not enough (Parthemore & Withby, 2014, p. 141).

These authors point out the importance of the differences between the entities of a system. My proposal adds to this an emphasis on the asymmetric relationship between agents and artefacts (see Paper 2 for the details). The asymmetry relies on the nature of one of the elements in the system: agents are beings with intentionality, subjectivity, and an intrinsic capacity to act. These agents follow a complex system of values and norms that differ from instrumental functionality. The asymmetry also relies on the capacity of those agents to attribute agency to artefacts by means of designing their functions. *The result is enhanced human agency, not material agency*. Artefacts and their systems are the outcome of the activity of designing, as discussed in the next section.

4. The activity of designing

Design can be seen as the integrative activity underlying the wide range of cognitive skills associated with the conception and manufacturing of artefacts. An artefact is an object "made intentionally, in order to accomplish some purpose" (Preston, 2022). In this case, "made intentionally" should be understood as "made for a purpose," but not in the philosophical sense of intentionality that was discussed in Section 2. The distinction between objects and artefacts is important. Following a dictionary definition, an object is any inanimate material thing that you can hold or touch (Longman, 2022). A rock and a chair are thus both part of the category *object*. But a rock, as a natural object, is not an artefact. Artefacts imply the shaping and assembly of materials. A natural object can be used for practical purposes; for example, a trunk can be used to cross a river. In this case there is no making process (shaping and assembly of materials); therefore, the trunk is not an artefact, regardless of its usefulness. These cases of natural objects used for some specific purpose can be called *manuports* (Leakey, 1979), a natural object that has not been artificially shaped (Oxford, 2022).

Some non-human animals have the ability to elaborate objects from natural materials. However, the making of artefacts, with planned improvements and (usually) fast rate of innovations is uniquely human and constitutes a fundamental difference between our and other species. The objects made by non-human animals can be seen as *proto-artefacts*. As stated in Paper 1 and 5, animals are able to *proto-design*, that is, a stage that is a precursor to proper design. The capacity for proto-design implies an understanding of causality and perceptual-motor control oriented to objects.

The human-unique activity of designing is grounded in higher cognitive complexity and the use of sign systems for communication. Design implies a complex process of iteration, involving different cognitive resources. Figure 1 presents the stages of the creative process of design, showing the dynamical character of the process and the progress of ideas that are evaluated, combined, and filtered through multiple iterations.

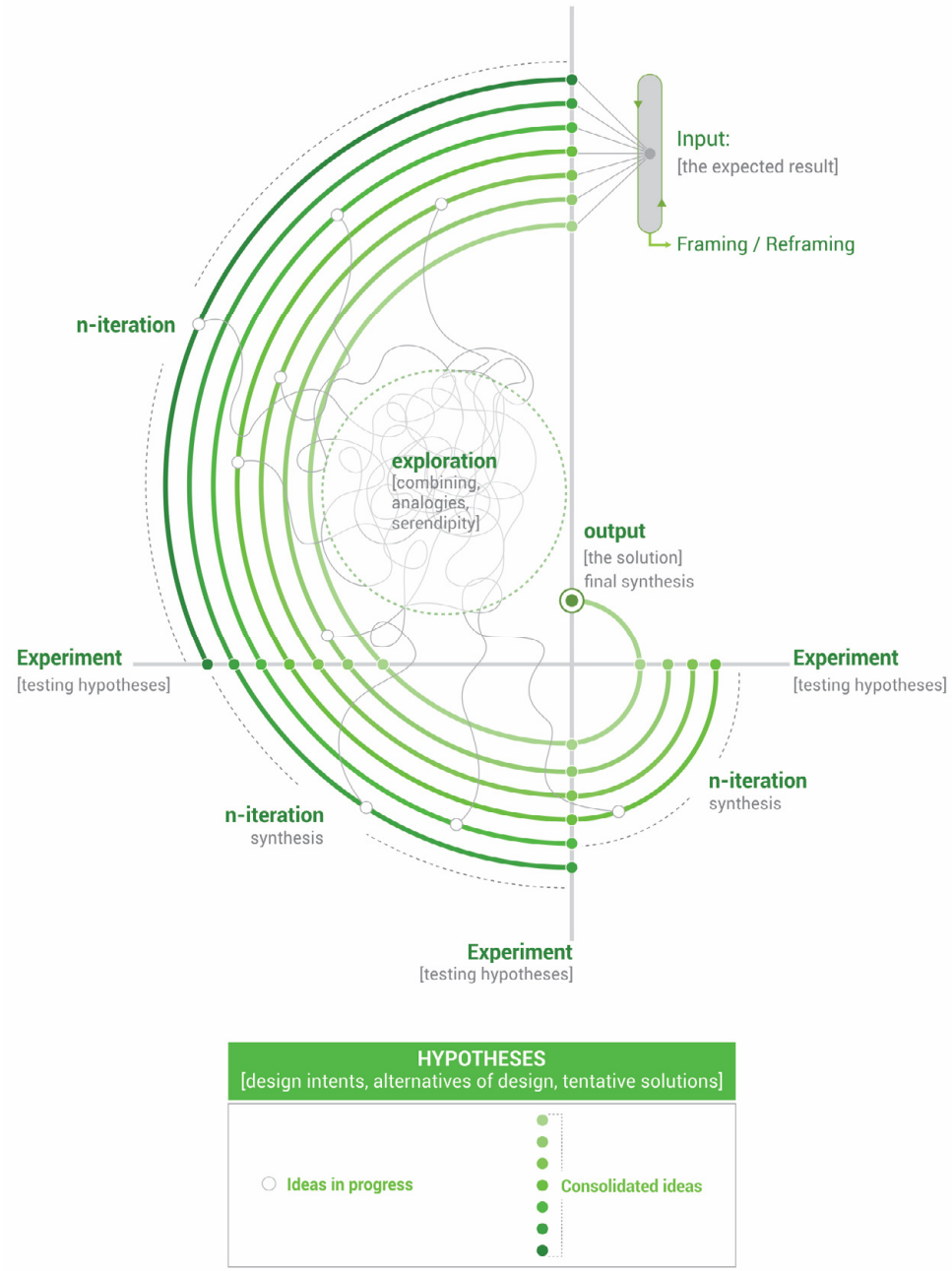

Figure 1. An illustration of the iterative process of design.

Designers create hypotheses when they formulate tentative solutions or ideas. The dots in Figure 1 indicate the ideas emerging during the process. They can be consolidated ideas (green dots) or working ideas (white dots). These ideas emerge at any point of the process. The process starts by framing and reframing the expected result (also called *the problem*). As stated in Paper 1, *framing* is the reflective conversation with oneself and others, with iterative formulations of the questions "how" and "what." Through such a process, "design goals are refined, and different mental representations of the design situation are constructed" (Casakin & Kreitler, 2011, p. 160). This process allows a more complex conceptualization of the problem, creating different scenarios before formulating solutions. The expected result usually is defined by a so-called *brief*. The framing and reframing of the problem are indicated by the loop of the arrows at the top of Figure 1.

Once the problem is framed, the generation of ideas commences, this is sometimes called *divergent thinking* (Erwin, Tran, & Koutstaal, 2022). At this stage, a pool of ideas emerges from the creative formulation of solutions (these ideas are represented by the green dots at the top of the *y* axis). The generation and development of ideas come from a process of exploration which is marked by improvisational discoveries and serendipity. The improvisational character of this stage is represented by the tangled lines connecting and combining several ideas in progress (white dots). The number of iterations is not defined and varies, it can be one single iteration for reaching the expected result or multiple iterations before solving the problem. That is why it is labeled as "n-iterations" in Figure 1.

In some points of the process, an assessment of ideas is required. This assessment in design is a kind of experiment, a way for testing hypotheses. An idea can be seen as a hypothesis. Ideas are also called design intents, tentative solutions, or alternatives of design. The experiments for testing ideas can range from simple models to advanced prototypes tested in laboratories. Simple models for testing ideas are common at the beginning of the process, while advanced prototypes are used at the end of the design process.

The outcome of testing hypotheses usually is a synthesis of ideas. This is represented in Figure 1 by the reduction of green lines, a process that is called *convergent thinking* (Simonton, 2015). Multiple iterations of divergence/convergence can emerge during a process of design. This is represented by the white dots returning to the process of exploration. The final synthesis marks the end of the process. This final idea could initiate a new round of framing/reframing which is represented by the *y* axis connecting the final idea to the starting point of the process. This indicates the potential for new improvements or innovations, even for the case of suitable and well-designed artefacts. In sum, Figure 1 helps understand the complexity of a design process and why it is effective for rapid innovations and continuous improvement.

It is the stage of framing and reframing that is crucial for conceiving the activity of designing as clearly human-specific. This implies the cognitive capacity to form *prior intentions*, visualizing and imaging future scenarios, and conceptualizing the problem before the process of making the artefact. However, at some points during the process, thoughts and actions are one. This is the case of so-called *intentions in action*. How these two kinds of intentions are involved in a creative act of design is the topic of the next section.

5. Intentions in the creative process of design

The activity of designing is often seen as a compound of prior intentions. These intentions are usually visualized in imagination, but they also can be externalized as pictorial representations (sketches and drawings), or in speech and gestures. Prior intentions embody *reflectively conscious* planning, and shaping and assembly of materials, as least on layer (2) of the agency hierarchy (see Table 2).

This view on design gives primacy to the intellectual and immaterial exercise of imagination. It is the conception of *idea over matter*, in which designers can visualize complex forms in the mind without recourse to materials (Alberti, 1988). From this perspective, ideation and planning are the most important part of the work, while the making is only a secondary issue of the process (Le Witt, 1967).

However, researchers that are more positively oriented towards "material agency" (see Section 3) hold the opposite view. In this take, the creative process of artefact making does not depend on imagination but on material engagement (Malafouris, 2020). On this *matter over idea* perspective, prior intentions are at best internal representational states without pragmatic effects in the world (Malafouris, 2008) and intentions in action have primacy: "Intention no longer comes before action but is in the action" (Malafouris, 2021, p. 108). And this is the case even for complex projects of design such as those of architecture, as Ingold contends:

> The building of the Chartres did not bring to glorious completion the speculative vision of an unknown architect. No one could have predicted, while the work was underway, exactly how it would turn out, what complications would arise in the process, or what means would be devised to deal with them (Ingold, 2013, p. 57).

These opposed views on the design process lead us to ask: What is the role of prior intentions and intentions in action in the creative process of design? There are some empirical studies addressing this frame of discussion with inconclusive findings (see the details in Paper 4). For these reasons, I completed the methodology of phenomenological triangulation in this thesis with an experimental study. This aimed to investigate the cognitive strategies involved in solving design tasks, and how prior intentions and intentions in action affect the process of design. Prior

intentions were implied in the making of sketches in one condition, where the task was defined as a goal-oriented activity in which sketching is meant to help the participants to develop their ideas for the artefact to be designed. In another condition, participants did not sketch but had to solve the task by material engagement alone.

An index of design performance to assess the quality of the outcomes was defined for the experiment. This index is a contribution for further experiments; it has the potential to become an experimental paradigm. The design performance was evaluated in terms of novelty, efficacy, and efficiency. Novelty is the originality of the model. The less a model resembles a common solution, the more novel it is. Efficacy is the accuracy of the fulfillment of the intended function. A model is effective if it accomplishes its function, i.e., if it works. Efficiency, finally, is the economy in terms of the use of material and number of processes. The operationalization of these variables, the statistical analysis, and the procedure appear in Paper 4 (and summarized in Section 7 below).

Considering that prior intentions are implied by, but not limited to external representations such as sketching, the experiment was complemented with the second person method of post-experimental interview. It could be noted in the reflections of participants that they frequently used expressions such as "sketching with my mind," even when they negatively reported the experience of sketching during the design process. These expressions were common in both conditions. Such reports are indicative of the formation of prior intentions. This challenges the thesis that human creative agency is a compound (at most) of intentions in action. Taken together, the results indicate a dynamic interplay of prior intentions and intentions in action during the design process.

Once more in synthesis, the design process is not an issue of *idea over matter* or *matter over idea*. It is rather a combination of *ideas and matter*. Prior intentions and intentions in action appear to be intertwined during the design process. They are not mutually exclusive but complementary cognitive processes. The findings indicate that human agents naturally combine prior intentions with intentions in action in search of an effective use of the available resources. There is no reason to believe that intentions in action have cognitive priority. Although the dynamic and reciprocal relationship between "mind" and "matter" cannot be denied within an ongoing process of artefact creation, it is also true that human agency is marked by the formation of remote intentions, that is, as discussed in Section 3: the cumulative series of prior intentions that formulate the need for designing a functional object in the first place.

6. Methodology

As stated in the introduction, the investigations described in the previous four sections applied a cognitive semiotics methodology. Given its phenomenological orientation, this implies that the phenomenon of agency was initially approached from first-person (subjective) and (second-person) intersubjective perspectives. Third-person perspective methods (detached observations, experiments) come only at a later stage since there is no "view from nowhere" (Zahavi, 2010). On this basis, my framework applied the two methodological principles of cognitive semiotics, the conceptual-empirical loop and phenomenological triangulation, to the study of agency and artefacts.

The first principle, the conceptual-empirical loop, proposes a dynamic iteration between conceptual analysis with empirical, data-based studies. The conceptual pole of the loop is based on careful reflections and analysis of the research topic, avoiding any commitment with prior theories or paradigms. The aim was to obtain a systematic first-person perspective on the phenomena. This conceptual side addresses the "what" questions of the thesis. The empirical side aims at investigating how the relevant phenomena (agency, design, artefacts) manifest in practice. The iteration of the loop refines the contributions from conceptual and phenomenological analysis, which in turn lead to new iterations (Zlatev, 2015, Stampoulidis, 2021). Figure 2 shows the conceptual-empirical loop in relation to the research questions on this thesis.

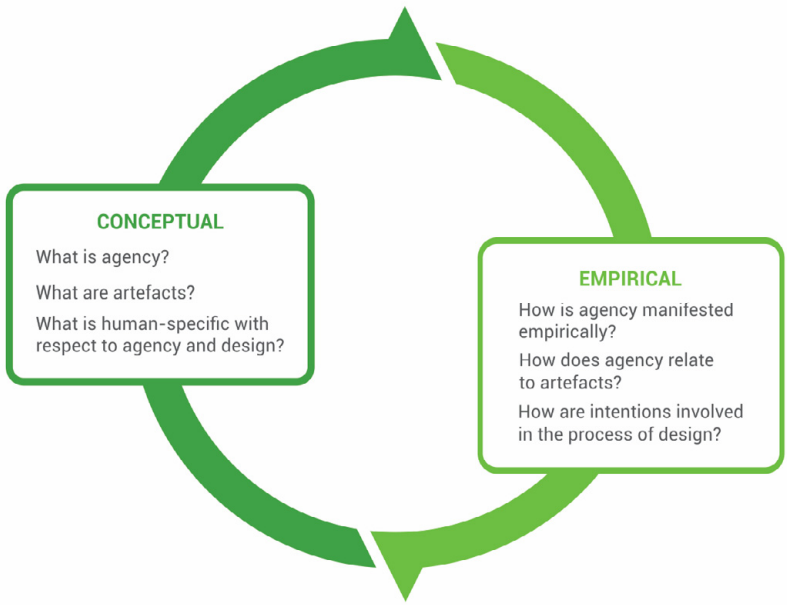

Figure 2. The conceptual-empirical loop of cognitive semiotics as applied in this thesis.

The second principle is phenomenological triangulation, that is, the application and combination of first-person, second-person and third-person methods in this specific order. Accordingly, I started by addressing the phenomena under investigation with first-person methods such as phenomenological analysis and systematic intuitions, leading to ideas of the *agency hierarchy* and *enhanced agency* discussed in the previous sections. The outcome of this conceptual step was triangulated with the more empirical second and third-person methods. The second-person methods applied in the thesis included intersubjective validations, participant observation, and interviews. Finally, third-person methods such as experimental studies, detached observations and inferential statistics were applied for the analysis of data-based evidence, and in the study discussed in the previous section. The direction of this triangulation is important, given the primacy of first-person and second-person methods, which is based on the rejection of the illusion of a "view from nowhere." At the same time, the more intersubjective second-person and third-person methods help avoid subjective bias. Table 3 shows the application of the second principle of cognitive semiotics methodology in the thesis.

Table 3. The phenomenological triangulation of cognitive semiotics as applied in this thesis.

Perspective	Methods	Papers	Applications
First-person (subjective)	Phenomenological analysis	1 to 5	Intuitive notions
	Systematic intuitions		Conceptual systematicity
Second-person (intersubjective)	Intersubjective validations	1 to 5	Discussions and agreements with participants and co-researchers
	Participant observation	3	Participating in the activity of designing from an indigenous perspective in Amazonia
	Interviews	3 and 4	Eliciting and analysing verbal reports
Third-person (objective)	Experiments	4	Collecting data for the role of prior intentions and intentions in action during a process of design
	Inferential statistics	4	Operationalization and quantification

Thus, the cognitive semiotics methodology was applied throughout the thesis in a way that can link the different papers, giving a higher degree of epistemological unity.

7. Summary of the papers

While the previous sections discussed the content of various parts of the papers, let me summarize each of the individual papers for the sake of the reader.

Paper 1 explores the origin and evolution of design: an activity in which agency is present in the intentional adaptations of the material world for the benefit of human purposes. It is argued that the intentional shaping and assembly of materials is a central capacity for discussing the notion of agency and the relationship between human beings and artefacts. Delving into the evolutionary emergence of design helps to understand the relevant cognitive processes underlying this activity and their relationship with other key semiotic resources such as mimesis, pictorial representations and polysemiotic communication. Design is thus treated as a feature that integrates an array of cognitive skills associated to artefact production such as decision-making, planning, innovativeness, and continuous improvement.

Paper 2 addresses the current debate on the role of materiality for human cognition and the status of artefacts as agents, critically reviewing the concept of *material agency* (Malafouris, 2013). For the sake of a better understanding of the human–artefact relationship, I propose a distinction between agency and meaning. It is the latter, and not agency itself (as claimed by Malafouris), that emerges when an agent acts in the world. The interaction between an agent and the world establishes the reciprocal relationship of intentionality (which is world-directed) and semiosis (which is agent-directed), as argued by Zlatev & Konderak (2022). Thus, the active aspect of intentionality corresponds to agency. In turn, I suggest that agency needs to be complemented with *subjectivity*, which like semiosis in general is agent-directed, a theme that is developed further in Paper 5. This implies that agency is an exclusive property of living beings who are capable of intentionality and subjectivity. Thus, artefacts are not proper agents. Inert matter exists, but it does not act. Artefacts are created by specific agents for specific purposes; they do not simply appear in the world. These arguments establish an asymmetry between human beings and artefacts in terms of intentionality and agency.

But still, what is the role of artefacts for human agency? Paper 3 addresses this question by means of an empirical study consisting of contextually situated observations of the process of design of artefacts in Amazonia. Data from participant observation and interviews collect evidence supporting the thesis that the agency of artefacts is *derived* (Niño, 2015), and a product of *remote intentions*

(Sonesson, 2021). Nevertheless, this does not mean that the role of artefacts is secondary in human meaning-making. On the contrary, artefacts are fused into human actions. On this basis, the paper proposes the notion of *enhanced agency* for better explaining the effect of artefacts in human agency. Enhanced agency is the prosthetic incorporation of artefacts into the agentive capabilities of the agents. The notion is better understood in opposition to the original agentive capacities of the biological and lived body. Enhanced agency emerges from the human ability to design artefacts to fulfill both individual and shared goals. The planned improvement of artefacts marks the difference between the activity of making *objects* by some non-human animals (proto-design) and the activity of designing *artefacts*, which is a human-unique capacity.

Based on the discussion of the notions of extended and distributed cognition, Paper 4 investigates how intentions are involved in the cognitive processes of design. The goal was to further understand human agency, focusing on the role of prior intentions and intentions in action. Can these notions be combined, or mixed during a process of design? Which one of these is crucial for design and under which conditions? Answers to these questions have implications for design theory, teaching, and practice. An experiment was conducted, involving second-person (interview) and third-person (inferential statistics) methods. Participants had to perform two simple design tasks and construct a model of the solution using cardboard and basic tools. In one condition, they could also use pen and paper for sketching, thus necessarily engaging in prior intentions. In the other condition they could, in principle, have resolved the task only with intentions in action. The third-person methods did not show clear advantages of prior intentions, as operationalized by sketching. However, in the interview the majority of the participants claimed that they preferred prior sketching, and indeed when they did not have that option, the participants sometimes reported "sketching in their minds." This gives support for the crucial role of prior intentions.

Finally, the fundamental notion of agency itself is in focus in Paper 5, compiling the findings and contributions from the previous papers. An original agency hierarchy is proposed, based on the *Semiotic Hierarchy* (Zlatev, 2018; Zlatev & Konderak 2022), but developed theoretically and empirically with the goal of explaining the relations between different grades of agentive complexity. A further goal was to apply a proper cognitive semiotic approach to third-person studies of agency, specifically those of neuroscience. As pointed out earlier, agency is argued to be the active, self-generated aspect of intentionality, the reciprocal side of subjectivity, which is the "qualitative feel" of experience, and the more subject-oriented aspect of intentionality. Agency and subjectivity are thus two complementary and irreducible components of intentionality. This implies that a minimal level of consciousness, and a minimal sense of agency is required for agency to exist. These conditions preserve the active role of agency within a living and sensing body, avoiding the inflation and loss of its meaning. The hierarchy includes a progression

of agency in simple, but still sentient, animals all the way to complex forms of enhanced agency (discussed in Paper 3). This implies that artefacts and other forms of inert matter are not genuine agents and the laws of cause and effect in the physical world are distinct from those of agency, subjectivity, and intentionality.

The proposal of an agency hierarchy links the previous papers, following the distinctions between original and enhanced agency, and between intentions in action and prior intentions: the lower levels of the hierarchy correspond to original agency dominated by intentions in action while the higher levels are those of enhanced agency in which prior intentions may dominate. Further, it is argued that the gradation of the layered model is useful for refining theoretical constructs in experiments on agency. At the same time, all the layers are essential for agency, and for its study. Thus, the agency hierarchy should be understood in terms of increasing levels of *complexity* but not of importance.

8. Conclusions

The contributions of this thesis derive from applying cognitive semiotic concepts and methods to address the contentious topic of agency. The findings challenge "the materiality turn" and similar approaches claiming that material agency and intentions in action suffice for a creative process of artefact making. Consequently, I propose a synthetic approach to agency, clarifying the concept and its relationship with other notions such as consciousness, intentionality, semiosis (meaning-making), and subjectivity. Such a notion of agency avoids diluting the concept with its application to generic physical laws, chemotaxis, or automation.

Instead, my thesis adopts a phenomenological standpoint in which agency is the active, self-generated aspect of intentionality in conjunction with subjectivity, the qualitative feel of experience that emerges from semiosis as the more subject-oriented aspect of intentionality. There is no (true) agency without at least a minimal sense of agency. Meaning emerges from the dynamic interaction of the two aspects of intentionality—agency and subjectivity—with the world. Subjectivity is more oriented to the agent in the sense that it is what meaning produces in terms of the experience *for* the qualitative feel of the subject. Agency, in contrast, is the active, self-generated aspect produced in terms of the experience *by* the subject. This definition parallels the reciprocal relation between consciousness and semiosis discussed by some scholars in cognitive semiotics (e.g., Zlatev & Konderak, 2022), in which these two dynamic poles establish a unitary experiential system. Consciousness is a compound of multiple kinds of internationalities that vary in terms of their complexity.

Since agency is one aspect of intentionality, it is also complex and varies. In this sense, the thesis also contributes to a fine-grained model of the cumulative layers of agency. The proposed model distinguishes six layers of agency. One of the main contributions of the model is the possibility to operationalize the notion of agency for empirical studies such as those typical in neuroscience or cognitive science.

Further, the thesis proposes an alternative explanation of our relationship with artefacts and how this relation affects human agency. Thus, the thesis that inert objects possess life amounting to animism (Santos-Granero, 2009), while important from an *emic* perspective, is not convergent with the external (*etic*), as well as more general phenomenological point of view. My thesis also differs from fetishism, which claims that inert matter has its own agency, and can establish symmetrical

relationships with living beings similar to those established within living beings (Malafouris, 2013). On the contrary, I have argued that artefacts do not have agency, proposing the notion of *enhanced agency* to better explain our relationship with things. Artefacts are indeed important in the sense that they can modify the agentive capacity of human beings, but that does not make them agents proper.

Finally, I have also argued that the activity of design is a key feature of human agency. The stage-based model presented in Paper 1 is one way for explaining the origins and evolution of design, in which the progressive complexity of the artificial world is parallel to the increasing complexity of human agency. Although archeological research in tool-making and technology are abundant, studies on the origins and evolution specifically of design are few. This is of greatest interest for design research and theory.

Additional applications of these contributions range from design theory to empirical studies on agency. The experimental study of Paper 4 can be applied in design teaching, integrating the findings in design curricula, since it provides insights on the cognitive processes for designing. The notion of enhanced agency developed in Paper 3 can be applied for a better understanding of human—artefact relationships.

Further directions of this research from the empirical side can delve into the experimental paradigm for a better understanding of the role of pictorial representations and the enactive character of this semiotic resource. From the conceptual side, a promising path of research is going deep into the interplay between bodily mimesis and tool-making for the emergence of advanced cognitive capacities. The analysis can be complemented with experimental studies and fieldwork.

To conclude, a tendency in much current scientific literature is the condemnation of any form of "anthropocentrism." In this thesis, I have proposed a different approach. On the one hand, my approach has been to reject human exceptionalism, viewing humans as ontologically unique and biologically discontinuous with the rest of the living world. Accordingly, the layered model of agency (Paper 5) and the stage-based model for the evolution of design (Paper 1) were built on the basis of the notion of *Fundierung*, which means that the lower layers or levels in a hierarchy are sublimated and consolidated by higher levels along a continuum of increasing complexity. Thus, the hierarchical models do not imply superiority or mastery but only different layers of accumulation of features without breaking away from lower levels.

On the other hand, I have emphasized that only living beings are true agents and only human agents have the power to stop the current environmental obliteration. Instead of denying or diluting human agency, I celebrate what is different in the agency of human beings with the hope that this can be useful for making the best of it. The "sin" of anthropocentrism should be transformed to the "virtue" of channeling the agency of human beings towards ecological relationships. This can

be done by recognizing the potential of human agency, instead of diluting it into abstract networks of “actants;” highlighting its differences and similarities instead of equating human agency with inert matter or anthropomorphizing the agency of other animals. This also implies the moral responsibilities of human agency.

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