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Tipologia de desenhos no Design: uma revisão crítica

Design Drawings' typology: a critical review

PAULA, Bárbara Arantes de; Doutoranda; Hanyang University

emailparabarbara@gmail.com

LEE, Jaehwan; Doutor; Hanyang University

indd2000@hanyang.ac.kr

Este artigo é fruto do estudo estabelecido através de uma revisão critica sobre as tipologias, taxonomias e demais meios de classificação do desenho dentro do escopo do design. A princípio, visou-se enfatizar a importância contemporânea do desenho como alicerce nos processos em design. O método de análise utilizado foi a revisão crítica, onde doze estudos foram encontrados e escrutinados, com a intenção de ponderar quais são estes tipos de desenho, como cooperam para o processo em design e quais funções estes meios de representação visual desempenham na atualidade.

Palavras-chave: Tipologia do desenho; Taxonomia do desenho; Meios de representação visual.

This article is the result of a study established through a critical review of typologies, taxonomies and other means of classifying drawings within the scope of design. At first, the aim was to emphasize the contemporary importance of drawing as a foundation in design processes. The analysis method used was the critical review, where twelve studies were found and scrutinized, with the intention of pondering what these types of drawing are, how they cooperate for the design process and what functions these means of visual representation perform today.

Keywords: *Drawing typology; Design taxonomy; Means of visual representation.*

1 Introduction

Drawing is one of the first forms of recording known in human history, but it is also common knowledge that the term “drawing” designates too many categories of visual representation, making it an arduous task to precisely define the term. By reducing the scope and focusing on drawing as part of the design process, it is possible to perceive with some clarity what type of record we are referring to. However, design drawings are specific, with too many ways to be used, so there is still room for different terminologies, making it challenging to communicate among professionals who need drawing as a work tool (Pei et al., 2011). These terminologies are also correlated to the function, structures, and forms of presentation of drawings, in addition to its developments as a tool in design.

The drawings studied in this research are the design drawing: drawings used during the process of developing projects in design, from initial scribbles that help in the preliminary investigation of the briefing, to the formalized, structured drawings that configure the artifact for industrial production. These drawings may contain numerical and/or textual information, but they are not composed exclusively of them, and they are mostly made manually. This study will refer to

design as the HCD (Human-Centered Design) method, "we mean simply designers who design for people and society" (Meyer & Norman, 2020, p. 14).

Seeking to have an adequate understanding of this form of knowledge within the theoretical framework of design and related areas, the present research aims to carry out a critical review of different ways of classifying drawing in design, such as taxonomies, typologies, and others, to establish a scope of this form of visual representation, to understand its essence and its limits. That said, what is known about drawing in design?

2 Drawing in design

Drawing is probably the first language humans learn, whether manipulating a pencil or using their finger on the sand: drawing is an essentially human activity. (Goldschmidt, 2003). Although drawing can be considered one of the essential tools by which we configure a modern society, as well as the products consumed daily, and the contemporary material culture, for some decades it has become possible to see the decline in enthusiasm for teaching drawing, whether in traditional education or the training of educators in arts and/or design (Adams, 2017). Perhaps there are several speculations about why drawing no longer incorporates the curriculum of schools or even higher education as intensively as before, however it is known that many professions still use it as a tool throughout their professional activity. Therefore, if drawing as a skill is not taught, but is required professionally, it is possible to perceive a gap between the educational process and professional demand. Regarding its use in engineering, Ullman et al., (1990) state that it is customarily assumed that the ability to draw is natural, meaning intrinsic to human nature, even though this assumption is done without a theoretical or practical basis. It is also possible to perceive such a common misconception because engineers are not formally taught to sketch, but sketching usually is part of their everyday professional activities (Ullman et al., 1990).

Sketching seems to be one of the drawing categories that has drawn the most attention from scholars in recent years. Possibly this interest is due to sketching being a type of drawing that fits into different parts of project development because it is flexible and does not need many items to be carried out. If we consider the history of sketching in relation to the historical presence of the drawing, sketching is a skill considered recent: it has its origin amalgamated with paper becoming a popular item at the end of the 15th century in Europe, resulting in sketching being associated with innovation and development of technologies. (Goldschmidt, 2003). Even in contemporary times, drawing and visual representations in their entirety still remain deeply related to the development of complexities and technology. The speed of technology development is getting faster, and their levels of complexity are also increasing, so visual representations become a direct, fast, and effective communication platform (Danos & Norman, 2019).

Drawing is a complex knowledge, with several facets, and is usually related to the arts. However, drawing is configured as a language, featuring an activity of observing and recording, whether objects, ideas, or thoughts that are still under development (Have & Toorn, 2012). It can be used to communicate with others or with oneself, becoming a means of visual thinking, where the designer records, observes, and develops ideas from what one recorded and observed oneself (Goldschmidt, 1994; Have & Toorn, 2012; Meyer & Norman, 2020; Ullman et al., 1990). It becomes a cyclical process, considered a systematic dialectic of the person who draws with oneself (Goldschmidt, 1991). In general, it is possible to affirm that the drawing is still an essential tool in the process of creation in design. Beyond that, researchers point out that drawing is an essential form of communication, because if it was possible to convert the message expressed through the drawing in other languages, such as written or spoken, there would be no reason to draw (Ashwin, 1984).

Despite the apparent contemporary neglect of teaching drawing, academics reiterate the importance of teaching and learning manual drawing prior to the use of visual representation software. According to Have and Toorn (2012), manual drawing needs to be taught as a priority, because it takes more time to master the technique, likewise, it helps in the use of the software itself. Drawing is characterized by an activity that requires an intense abstraction process. The designer needs agility and flexibility when registering her ideas, adapting to the iteration between the cognitive processes generated as feedback to what is registered, and the visual representation per se. Inexperienced designers are considered less able to flow between the established feedback loop of thought and the visual register being drawn (Goldschmidt, 1991; Goldschmidt, 1994; Goldschmidt, 2003; Ullman et al., 1990). Have and Toorn (2012) also state that drawing is a structured process, not a step-by-step activity but an exercise that is developed through stages and consecutive retouching. Hence, whenever it is assumed that drawing is an unequivocal activity, it is possible to perceive that the situation is read from a romantic and unrealistic perspective, and not from the daily practice of drawing.

Considering the complexity that surrounds drawing, which is characterized as a tool, skill, way of thinking, and process, this study is concerned with investigating the types of drawing that exist within the academic universe of design. The present investigation is structured in seeking, collecting, and analyzing classification processes of drawings in design, to understand the limits of this skill, its structure as knowledge, and, if possible, criteria regarding its teaching and learning.

3 Methods

The methodology used in the present research is the critical review which, according to Grant and Booth (2009, p. 94), consists of a review study of a given topic, seeking to extensively explore the present literature and critically evaluate it, considering its quality and effectiveness for the study area. In general, this method seeks to go beyond the mere description and state of the art, it pursues to compile the pre-established knowledge, consolidating conceptual aspects and supporting a step forward in the development of the studied subject.

The current investigation seeks to understand the methods and processes of classifying drawings in design, to outline the theoretical definitions, their uses, as well as ways of teaching and learning. It is believed that, by compiling and comparing these studies, we can have an expanded and, at the same time, specific view of what drawing currently is in the design process, what are its expected and explored capabilities, as well as learning methods.

To search for published academic materials about design drawing, the Google Scholar platform was used, where we searched for terms related to the topic, organizing the results by relevance. The first term researched was "drawing taxonomy" and, although the site presents hundreds of thousands of available results, very few results are, in fact, related to studies carried out on drawing in design. Sub-searches with the same term, meeting the platform's criteria to find results about the term in its entirety were also performed.

Following the same criteria, searches were also carried out with the following terms: "drawing typology", "design drawing" and "types of drawing". These terms were used because they named item classification processes. For each of the searched terms, the first ten pages available on the platform were analyzed, always sorted by relevance, due to the search for established and consolidated references in this area of study. The more citations and readings a publication is likely to have, the greater its importance and validity in the field, as well as its exposure on academic knowledge platforms.

After searching and collecting the publications that fulfilled the previously established criteria, inclusion and exclusion criteria of the materials were applied, considering the study focus of this research. In general, the elementary inclusion criterion for this critical review was that the publications refer to studies on the use and teaching of drawing in higher design courses, primarily focused on industrial design; and studies that presented original classifications, instead of classifying drawings through third-party quotations.

In a first selection among the materials that fulfilled the aforementioned requirement, 101 articles, books, theses, dissertations, or academic publications were found, which permeated definitions of theories and practices about drawing in design and/or congruent areas. The areas considered congruent are those that base their professional activity structured in the form of a project, and where the means of visual representation had similar uses and characteristics to those present in Human-Centered Design. In general, the congruent areas that presented studies included in this research were architecture, civil engineering, and mechanical engineering, in addition to other designerly courses.

When analyzing the collected materials, the need to establish specific inclusion and exclusion criteria was perceived, since many of the materials had their development too distant from the central theme of this research. Regarding inclusion, it was established that studies must be published through peer review, to ensure their academic validation. Some exclusion criteria were then established: studies that focused exclusively on certain historical styles, for example, “architectural drawing and Gothic design” would not be considered; and reinforced that studies in drawing that are not taught and learned at bachelor's or higher level, e.g. teaching drawing to children.

Finally, among the initially collected 101 publications, the scope of study of this critical review was reduced to twelve items. Even though the exclusion criteria are not numerous, one can notice another complicating aspect: the use of the term "design" in the English language presents a very wide use. Many studies that referred to different visual records, whether photos, graphics, etc., or any form of prior planning for a given study could use the term “design”. Despite these obstacles, the present study intended to collect as many references as possible that can be used to obtain a rich understanding of the types and uses of drawing in design.

4 Classification processes

Classification processes are usually developed to order a group of items, within a certain scope, using certain characteristics to group or not these items, according to their similarities or discrepancies. There are several methods of classifying an item, and these methods will vary according to the characteristics that are chosen to compare and group, or even the intention behind classifying itself. The same item can be classified in several different ways, considering the point of view of the one who classifies it. However, a common aspect of classification, in general, is that the process is developed to facilitate the administration of classified items. That is, we group similar items to understand behaviors and deal with their characteristics considering their specificities.

One benefit that can be immediately noticed when classifying and grouping similar items is that even if we do not know all the items in a certain category, we do know the basic characteristic of classification, and learning about the other items becomes an easier process. Classifying items suggests behavior prediction that, when associated with teaching and learning, can help in the investigation and self-learning process, for example.

If we presume it is advantageous to classify items, it is necessary to understand at least what these items are and what essential characteristics they are composed of. After outlining the basic items' structure, considering the point of view of the classifier, it is necessary to understand if there are any of these characteristics that permeate all the items so that it becomes the unit of measurement. Once the units of measurement are found, the gradation is established and a solid, measurable, and intelligible classification of a group of items can be established.

4.1 Classification of Design Drawings

4.1.1 *Adams, E. (2017)*

Adams (2017) divides the framework of the drawing into four broad purposes: Drawing as Perception, Drawing as Communication, Drawing as Invention, and Drawing as Action. The author used the Action Research method to establish the present taxonomy and states that she did so because "it is essentially a practical, problem-solving approach, which seeks to empower practitioners to research and reflect on their own practice" (p. 250); and she also stated that subcategories would be numerous, but did not introduce them in this study. For the first category named Perception, the author works with the idea of concepts regarding the perceived sensations that allow the designer to feel the need and/or desire to represent, in a solitary and introspective process, through observation and interpretive skills. For the second purpose, Adams describes Communication Drawing, as a category that serves to inform others about design ideas. In this instance, the author rationalizes the use of some conventions, suggesting a drawing practice that could be rigid to a certain degree, to ensure that others understand the message represented.

Drawing as Invention is defined by Adams as a medium used when the ideas to be represented are still in an embryonic stage and need to be summarily recorded on paper, or other surfaces, so that the designer experiences the "reflective oscillation". This oscillation refers to the impetus to have ideas, register them, and continue dialoguing with the scribbles to materialize the idea that was imagined. It can be done in series, in addition to being manipulated later, seeking improvement, or yet combining parts of a drawing. Drawing as Action is described to help in the realization of established ideas. In this category, Adams cites some types of commonly used representations, such as plans, patterns, and templates, as a way of illustrating the necessary formality for this purpose, in addition to using terms such as "test" and "effect" to describe them.

In general, Adams (2017) also reports on the decline in the teaching of drawing even in design schools, also addressing the importance of drawing as a delineator of material culture and everyday life. She further reported on the present importance of drawing as a learning strategy and as an intellectual activity, in contrast to an outdated concept of drawing only as a technique.

4.1.2 *Schenk, P. (2007)*

The study by Schenk (2007) was one of the few focusing on designerly drawings, plus the author presents an extensive collaboration in drawing studies within design. Schenk introduces the taxonomy of drawing that she developed as a result of research that she sought to understand how graphic designers draw. From this premise, the author perceived a broader need for understanding drawing within professional design activities. She states that the use of drawing on paper, during design processes, has shown a major decline since the beginning of her research, but designers still draw and the skill is still necessary for professional practice. Schenk

reports that the profile of students who currently attend design schools has also changed, but the author does not specify the perceived changes but points out that it influences a decrease in drawing analogically.

Schenk's drawing taxonomy has 27 types of drawings, which are directly related to correspondingly necessary activities in the drawing. By outlining many categories, the types of drawing presented by the author are quite specific, but she explains that design professionals rarely need to use drawings nomenclatures, only when they actually seek to communicate about a particular item with co-workers. She states that the constant technological evolution around the activities of drawing in design affects the practice. However, reinforced that drawing is still necessary for designers, as well as the improvement of the drawing skills of professionals who are currently trained. The research method used was not scrutinized, but the author presents that it was derived from previous research, and includes interviews with the designers, as well as an analysis of drawings produced during professional projects.

4.1.3 *Moroni, S., & Lorini, G. (2020)*

Moroni and Lorini (2020) develop a study of the classification of drawings considering their multiple functions as an analysis parameter. The authors do so because they believe that "the functions of drawings were studied less (...) due to a kind of 'verbal-centrism' that has dominated the general discussions on the mechanisms of interaction and communication" (p. 374). An important aspect of this study focuses on the differentiation established between 'functions of drawings', as per their research, 'forms of drawings', the platform where these drawings were made, whether manual or computerized or even two-dimensional or three-dimensional; and the 'elements of drawings', being lines, points, textures, among others. Established the basis, the authors then present the ten functions of drawing, a study based on theory in the visual representations in architecture, urban design, and planning. The ten functions are summarized in the following paragraphs.

The first is the Representational Function and are present in drawings that allow the description of a space or artifact, such as a map, example, while the Exploratory Function allows the search for options when the project is in its initial stages of development. The third function is called Constructional and is present in visual representations that provide evidence and allow calculations concerning the projected object. Conceptual Function characterizes drawings that use physical and visible elements of the project to establish a bridge in meaning with the use of a space or an artifact, relating to the user and his relationship with the designed product.

The Documentary Function is self-explanatory and deals with representations with official validity, used for registrations, patents, and other scenarios where technical rigor is essential. The Instructional Function is also consistently straightforward, as they are present in drawings that instruct and direct the user to a certain ideal behavior, in visual representations such as ‘assembly instructions for prefabricated houses’ or ‘furniture and graphical technical rules’. In Advisory Function, Moroni and Lorini present a slightly different function from the previous one. In Instructional Function aforementioned, the user needs to behave in a certain way to be able to perform an activity, and in Advisory Function the suggested behavior is ideal but not mandatory. Drawings with this function “recommend a specific behavior” (p. 380). The eighth function described still refers to behavioral suggestions, the Nudging Function appears to be “possible to 'regulate' behavior even without giving advice or imposing prescriptions” (p. 380), exemplified by paintings on the road of children playing around school districts, inducing the driver to pay extra attention in traffic. The ninth drawing function is Prescriptive and presents a legislative aspect, as it prohibits or commands behaviors, generally established with rigor. Finally, Constitutive Function consists of visual representations that constitute new orders or

social institutions, exemplified by declarative drawings. The authors also emphasize that some functions of drawings are privileged in comparison with others due to a historically description-centrist organization of knowledge "that dominated philosophical and theoretical investigations on language and logic until the mid-twentieth century" (p. 374).

4.1.4 *Pei, E., Campbell, I., & Evans, M. (2011)*

Describing drawings as "visual design representations", Pei et al. (2011) portray visual representations as means to "reproduce properties of a design proposal through physical or virtual means in the form of two-dimensional or three-dimensional media." (p. 65). The drawing taxonomy established by Pei et al. is based on the pretext that research data confirms that common misunderstandings about visual design representations affect collaboration between designers and engineers (p. 64) and there is disharmony between members of the same project team when these representations are perceived differently (p. 65).

Based on these issues, Pei et al. state that their study has two essential perspectives: identifying the types of drawings used by designers and engineers during the development of new products, considering the types of representation presented in the literature, and organizing them systematically, since these typologies commonly appear dispersed. Therefore, the developed taxonomy is based on a framework of four essential taxa: Sketches, Drawings, Models, and Prototypes. According to the study parameters, Sketches refer to rough representations, imprecise, but with depth, line weight, as well as being quickly executed and subdivided into Personal, Shared, Persuasive, and Handover Sketches, further subdivided into eight other subcategories.

The following taxon called Drawings refers to representations that consist of "more structured" visual representations when compared to Sketches. These serve as a way to "record to analyze details" and as a means of communication between the designer and the manufacturer. The author includes in the Drawings category, visual representations that are established by rules (i.e. ISO), representation tools (i.e. software), and CAD representation systems, and subdivided into two categories: Industrial Design Drawings, three-dimensional realistic representations, reproducing physical and aesthetic characteristics of the product, but not its functionality; and Engineering Design Drawings, which consist of visual representations with technical aspects of the product, such as functioning and assembly, showing little relation to its aesthetics. These two subdivisions are also split into 4 subcategories each.

The last taxon presented is called Prototypes, subdivided into Industrial Design Prototypes, responsible for demonstrating the final shape, ergonomic characteristics, and aspects related to product design, and Engineering Design Prototypes, which present the final technical aspects. This last section is divided into a category for Industrial Prototypes, called Appearance Prototypes, and seven subcategories for Engineering prototypes.

4.1.5 Hua, M., Huang, S., & Childs, P. (2018)

Hua et al. (2018) develop a taxonomy focused on the use of sketches in design, not drawings as a whole. This study focus has been presented frequently since the strong influence of sketch is perceived at the end of projects development as in the design activity as a whole. For this design sketch taxonomy, coding and clustering were used as the analysis method and three main categories: Thinking, Talking, and Non-working sketches. The categories were named intuitively, and the Thinking sketches refer to representations that help the designer's individual cognitive activity, to elucidate and define the artifact sub-categorized into Defining, Memory, Idea, and Development sketches. Talking sketches are the drawings used in collective processes,

becoming communication platforms between designers and other professionals, subdivided into three categories: Explanatory, Prescriptive, and Presentation sketches.

The authors highlight the need to develop a hierarchical taxonomy, since their references presented are fluid structures, in addition to pointing out classifications aged and did not encompass the presence of the computer as a support in the development of visual representations. Another problem presented by Hua et. al. is the lack of integrity in the existing taxonomies, saying that previous studies do not present a drawing category that was not professionally focused. These excluded types of drawings are the third category developed in this study, the Non-working Sketches. Sub-categorized into Storing, Practicing, Playing, Warming-up, and Fabulous sketches, they consist of representation modes occurring outside the space of professional activity, which support and prepare the designer to draw with fluency and speed during the design process.

4.1.6 Ashwin, C. (1984)

When the taxonomy is developed based on Semiotic strands, Ashwin (1984) is a commonly referred author. In his study, Ashwin establishes six communication modes, Referential, Emotive, Conative, Poetic, Phatic, and Metalinguistic, and explains them in three possible levels of specificity: Monosemic, Polysemic, and Pansemic systems.

According to the author's semiotic basis, images can be read in Monosemic systems, where the given image allows only one possible interpretation, with other understandings being considered a wrong interpretation; Polysemic, systems allow more than one way of interpreting the visual message; and the third system, named Pansemic, offers unlimited possibilities of interpretation, considering visual systems consisted of abstraction, and it becomes up to the reader to establish its meaning. The author also informs that the Pansemic system normally does not apply to the use of design drawings, since they are elaborated based on a real problem or product, seeking clear communication between the parties involved in the project.

Taking into account two of the three possible levels of specificity in understanding and interpreting drawings made within the design spectrum, Ashwin then establishes six possible communication functions for drawings. The first of these functions is the Referential, characterized by being a coded drawing, established on the grounds of absolute understanding by all parties involved in the process of development, reproduction, and reading of these drawings.

Another function is the Emotive function, characterized by the presence of elements such as lights and perspectives that suggest the understanding of the product through visual characteristics that establish the idea of a lifestyle associated with the product or project represented there, or other convenient narratives. The Emotive function is exemplified by its use in fashion design, where the postures of the mannequin drawings do not respect the real proportions of the human body but are established to emphasize the communicative intention.

The third function named Conative or Injunctive is a type of communication present in different sectors of design, “its purpose is to persuade the interpreter of some desired course of action” (p. 48), exemplified by illustrations for advertising. At this point, it is possible to believe that the references in this study are somewhat dated, aimed at the time when this study was published, but as the author scrutinizes the communicative intentions of the Conative function, it becomes possible to understand that the Conative function persuades the viewer to behave in a certain way, even if he or she has other options available.

The Poetic Esthetic is addressed by the author as “it could be argued that the designer qua designer never creates a drawing for purely poetic or esthetic reasons” (p. 49), but today the

use of such a function in design is fully understandable since marketing and advertising are responsible for presenting artifacts to the public in a way that creates lifestyle concepts, rather than focusing exclusively on the direct functions of the product. When reporting on this function, it can be seen that the scholar is not concerned with characterizing it, but with bringing historical examples of designers and architects producing works that use the Poetic function. Nowadays it became trivial to use unrealistic circumstances for product placement, or even advertisements that portray a situation that does not correspond to the use of the product, such as: when drinking a beverage and, as a reaction, the character starts to float to address a possible feeling not measurable by the characteristics or components of the artifact being marketed.

The Phatic function, when present in the drawing, Ashwin (1984) states that “phatic communications play an important role in many areas of drawing for design” (p. 50), then the author refers to frames, construction lines, arrows, or other visual elements that direct the reader's gaze, even if it does not add any specific meaning to the overall representation.

The last communicational category presented by Ashwin is the Metalinguistic function, characterizing representations with the function “to comment upon, explain, clarify, or qualify other communications” (p. 51). This communicative function is characterized by the information added to the representations to clarify and explain in detail, reducing any margin of doubt in the establishment of understanding between the one who draws and the one who reads the drawing.

The author introduces his classification of types of drawing by establishing that, at that moment, no matter how much there were studies and understandings about drawing, the greatest record of this knowledge was given by the drawing itself.

4.1.7 Biddulph, M. (2014)

Biddulph (2014) presents his perspective on the activity of representing and how much learning about the place or object can be done during this process, clarifying his point of view by comparing how "we would not question the extent to which learning mathematics helps us see mathematical relationships in the world", so why do we remain in this cyclical process of not valuing visual representations as a form of knowledge? In contrast to the invalidation of this knowledge, the author states that we do take the "role of representation for granted" (p. 278).

The scholar develops the present study from the architectural perspective on visual representations and uses the Sociosemiotic theory as a method of analysis. Biddulph’s perspective on the study of drawings in design goes beyond the practice itself, and he points out that “we should understand the link between the way that a place has been understood through how it is represented, and the resulting process of design for places” (p. 293).

The study then proceeds by presenting several benefits related to the activity of representation, and the last two have a growth perspective and are acutely suited to design processes: becoming a container or archive of references, considering that with consistency in the study and repetitions in representing famous design or architectural pieces, drawing practice enables the designer to retain references about shapes, styles, and others. Also, the "control design practice and establish a division of labour" (p. 286), refers to this control that comes from the full capacity of visual representation, and the division of labor that ramifies when we understand the intricacies necessary to produce a project.

The author structures his study as a table, called a typology of representation, presenting cumulative levels of classification, and others that are excluding: “each line represents a characteristic of an image which shapes how it might be interpreted. These, in combination, become the affordances of the image” (p. 287). In the first instance, visual representations are

classified as Indexical, Iconic, or Symbolic. In the following levels, a series of characteristics grouped in pairs are presented, concerning the level of complexity, means of production, and so on, followed by commonly known nomenclatures in the universe of visual representations, such as Sketch, Plan/Map, Elevation, Perspective, Axonometric, Section, Physical Model, Virtual Model, and Diagram.

Despite the presentation of items and classifications considering the levels of complexity required by the design process, Biddulph's study does not present delimitations to the types of representation. The author focuses on dynamics such as given meanings and derived meanings, as well as representation and power, where he points out the influence of the visual representation process in the imposition of forms of rationality, controls, and concepts that may or may not be absorbed or appropriated by the built environment or by the users of this environment.

4.1.8 Bovelet, J. (2010)

From an architectural background, Bovelet (2010) presents the classification of characteristics of design drawings as “the tentative heuristic”. The author indicates that he analyzes from a symbolic-theoretical perspective, in addition, to establishing that “drawings also must follow rules that can be described in terms of symbol theory" (p. 77).

Bovolet's classification consists of six items, characterized through the architectural design episteme. The first, called Two-dimensional flatness, consists of a design drawing feature of presenting spatial relationships and order between the design elements, even if represented on a two-dimensional surface. The second, Directionality, known as the characteristic of the drawing that demonstrates the ability of this type of representation to establish the direction of the visual representation through its elements, bringing freedom and control to the one it represents, unlike writing, which has its culturally predefined direction. Graphism, the third feature similarly focuses on the versatility of the drawing, which has its forms defined by the establishment of the line, and not in rigid elements and pre-established meanings.

The fourth characterization is Syntacticity, a feature that enables the drawing to reprocess knowledge through figurative elements, which appropriates meanings related to their use. Referentiality, the fifth characteristic, is described as the ability to provide an operational framework where ideas and forms can be debated, and the ability to establish visual references to arguments that could remain at the level of ideas. And finally, Operationality, the author reflects on how the drawing is bigger than just the representation because once we represent something, a space for debate or knowledge construction is opened since the drawing needs “to be regarded as epistemic instruments that always also generate what they represent” (p. 78).

4.1.9 Farthing, S. (2013)

Also using metalanguage, Farthing (2013) presents his studies with textual information and drawing, and the author is described at the end of the study as an artist, but he does not make it clear from which point of view he develops the present study. Farthing begins his study by stating that he places drawing on the same level of grandeur as Writing, Mathematics, and Musical Notation, since they are "a domain concerned with recording, sharing and discovering" (pp. 424-425). In sequence, the author divides his categorization into levels that present two gradations each, until the intention of that visual representation is refined, finally presenting specific drawing nomenclatures. First, Farthing presents the Divisions, which are separated by Conceptual and Pictorial Drawings and they differ by the intensity of abstractions used in a representation. Second, we are introduced to Classes, Systemic and Improvised, which differ according to the volume of conventions used, and later, he presents the Orders, which differ

from the categories previously presented because drawings can be defined as Measured, Estimated, or both. The last instance of analysis is the Families, and this level of evaluation presents two options with a gray zone in between, so the drawings can be analyzed for being made through a mechanical interface, or freehand, or in a hybrid process.

In the end, the author presents Genera and Species, and "the Genera is the point in the taxonomy where the reasons why and how a drawing was made meet" (p. 428). In conclusion, Farthing presents the evaluation levels as pictorial information, as well as drawing nomenclatures that go far beyond the representations used in design or even in related areas, approaching visual records used by music, biology, and mathematics, among others.

4.1.10 Graves, M. (2005)

Graves (2005) is another scholar who presents his typification of drawings from the architectural background. Although his study was originally published in 1977, the design drawings classification process does not present great contrast with contemporary reality, appearing to have aged without major obsolescence. Graves establishes three structural categories: Referential Sketch, Preparatory Study, and Definitive Drawing. According to the author, Referential Sketch "is generally fragmentary in nature, and yet has the power to develop into a more fully elaborated composition" (p. 236), while the Preparatory Study refers to visual representations of experimental essence, as they record the process of questions that arise during the creation of an artifact. These representations also serve as history or documentation of the cognitive process of developing a design project, as they are developed in series. The last category, according to Graves, is the Definitive Drawings. These types of representation have the function of answering questions made in the previous step, and the author uses terms such as "quantifiable" and "compositional configuration" to present it, adding a realistic, measurable perspective. In general, Graves does not present any methodology used to define the typology of drawings.

4.1.11 Norp, B., & van Hoek, E. (2019)

Norp and Van Hoek (2019) present a classification of types of sketches used in the process of visual representation in Industrial Design. The research is structured by comparing the activity of sketching in a professional environment, in contrast to the theoretical aspects taught during the training in Bachelor of Design. This article is written through images and sketches and, at first, it looks appealing due to the metalinguistic approach. However, when the information is presented solely through drawings and there is no translation between what has been seen to words, there could be room for different understandings of the study itself.

Among the few information recorded in text, the authors present nomenclatures: Technical, Architecture, Design, and Useflow Sketches, however, specific descriptions were not outlined. Finally, the authors point out there are still significant gaps between teaching and sketching in Industrial Design, such as the use of sketches also during the analysis stage during professional practice, but uncommon in the learning stage, along with the development of sketches in groups also being common in professional practice, but little privileged during learning. The overestimation of sketches with a realistic aspect during the academic training period is also criticized, and these sketches are not presented as important during professional practice, since the use of software completes the need for final representation.

4.1.12 Steinø, N. (2018)

Steinø (2018) begins his study by presenting a recurrent concern common among design scholars: the state of neglect of drawing. The author states that having a physical outcome is what configures drawing as an activity and making final representations is the sole purpose of

this activity. Drawing is an important prerequisite in the design because it allows the designer to know shapes, details, and objects, helping to develop a specific technical vocabulary (p. 129), which is why Steinø argues that drawing skills influence the perception of creativity since it is not possible to register good ideas if the designer has not mastered the ability to register, to draw.

Highlighting the lack of consensus on the nomenclature of drawing types, Steinø presents his classification of drawing types in four categories: Notation Drawing, which refers to visual representations that generate records to build a visual repertoire; Reflection Drawing, drawings reproduced quickly, commonly in cycles, which record objects that have not yet been conceived, establishing the bridge between ideas and reality, also referred to, by the author, as sketch; Communication Drawings are the visual representations that are responsible for presenting ideas to other co-workers, carried out in an organic and immediate way, as they support explanations and brainstorming; and the last is the Presentation Drawing, final drawings, without ambiguities nor spoken or written explanations, delineating the final characteristics of the projected artifact. Finally, the author addresses the constant duality postulated between hand-drawn and visual representation software, stating that different representation techniques are complementary rather than meant to replace each other.

The classifications presented above were organized in the form of a table in order to allow a global understanding of the studies presented:

Figure 1 – Compilation of the previously presented drawing typologies

Method	Author	Categorization	Second Level Categorization
Action Research; Taxonomy	Adams (2017)	Drawing as Perception Drawing as Communication Drawing as Invention Drawing as Action	--
Field Research	Schenk (2007)	Visual note, Instruction, Schematic, Projection, Plan, Imposition, Storyboard, Sketch, Copy, Trace, Doodle, Scribble, Visualization, Indication, Layout, Keyline [Outline], Rendering, Trial illustration, Trial lettering, Dummy, Specification, Demonstration, Draft, Refinement, Resolution	--
Typology; Literature Review	Moroni And Lorini (2020)	Representational Function Exploratory Function Constructional Function Conceptual Function Documentary Function Instructional Function Nudging Function Advisory Function Prescriptive Function Constitutive Function	--

Literature Review	Pei et al. (2011)	2D Visual Design Representation	Sketches	Personal Sketches; Shared Sketches Persuasive Sketches Handover Sketches
			Drawings	Industrial Design Drawings Engineering Design Drawings
		3D Visual Design Representation	Models	Industrial Design Models Engineering Design Models
			Prototypes	Industrial Design Prototypes Engineering Design Prototypes
Coding and Clustering	Hua et al. (2018)	Thinking Sketch		Defining Sketch Memory Sketch Idea Sketch Development Sketch
		Talking Sketch		Explanatory Sketch Prescriptive Sketch Presentation Sketch
		Non-working Sketch		Storing Sketch Practicing Sketch Playing Sketch Warming-up Sketch Fabulous Sketch
Semiotic	Ashwin (1984)	Referential Emotive Conative Poetic Phatic Metalinguistic		Monosemic Systems Polysemic Systems Pansemic Systems
Sociosemiotic	Biddulph (2014)	Indexical	Analytical Subjective Conceptual Abstract Existing Thematically Generic Expressed Process/Input/Means Fuzzy Large Scale	Representative Objective Representative Place Specific Future Thematically Specific Recorded Product/Out-put/End Firm Small Scale
		Iconic		
		Symbolic		
Heuristic	Bovelet (2010)	Two-Dimensional Flatness Directionality Graphism Syntacticity Referentiality Operationality	--	
Taxonomy	Farthing (2013)	Conceptual or Pictorial	Systematic or Improvised	Measured or Estimated	Mechanical or Free-hand or Hybrid	Mapping Genus Scoring Genus Tracing Genus Diagrammatic Genus Technical Genus Sketching Genus

(Not Specified)	Graves (2005)	Referential Sketch, Preparatory Study Definitive Drawing	--
(Not Specified)	Norp and van Hoek (2019)	Technical Sketch	Principles How It Works Section View Morphological
		Architecture Sketch	Configuration Exploded Views Interaction of Component Space Budget
		Design Sketch	Shape Detailing Colour Look & Feel
		Useflow Sketch	Use Interaction Steps During Life Cycle Use Issues & Opportunities Intended Ideal Use
(Not Specified)	Steinø (2018)	Notation Drawing Reflection Drawing Communication Drawing Presentation Drawing	--

Source: Elaborated by the authors.

5 Discussion

Altogether, twelve design classifications were presented, coming from authors who discuss it from different backgrounds, but even so, the discussions seem to be quite correlated. As much as the authors use different methods, and intentions and develop their studies at substantially different historical moments, when it comes to hand drawing, there is a feeling that most scholars debate about the same topics, without any greater sense of novelty. Some focus on more specific explanations while others present broad theoretical perspectives.

Daily, it is possible to perceive the change in the scope of design, whether in processes, philosophies, theories, professional practice, or means of representation. However, drawing, a skill so valued by so many scholars, does not seem to have followed the evolution of design as a form of knowledge. Once again, it is worth emphasizing that we are not talking about evolution in the dichotomy of drawing by hand or the use of software, but in relation to understanding drawing no longer as a simple visual reproduction tool nor focusing on representations that are solely aesthetic pleasing to the eye. The expected evolution in the understanding, teaching, and learning of drawing takes place in perceiving it no longer as a visual reproduction tool but as a process, a method that helps thinking, a language that anchors the designers' work while they investigate solutions to presented problems.

Another aspect commonly perceived in the typologies was that most authors present three major categorizations in which the drawings differ: the first instance is private, for investigation, discovery, and visual education; a second slice is described by the appeal of the sketch, quick drawings that flow with the iteration or oscillation of the creative process, testing solutions and

communicating to the group about the development of the project; and finally, the third is consolidated in the presence of technical aspects and in the need for unambiguity in the representation, which is the drawing that precedes the use of the software.

6 Conclusions

The universe of visual representations is vast, culturally distinct, and increasingly necessary in a visually oriented society, however, it is common sense that teaching drawing does not occupy a privileged position in education chains, from the literacy process to higher levels of education. During the development of this study, many authors discuss how the classification of drawings can guide teaching drawings, but none of them develops how one could indeed affect the other. Another latent aspect is the discrepancy between teaching drawing and its professional use, highlighting the distance between formal education and design practice. These aspects alert us to how drawing used in design needs further studies focusing on what is expected from the use of this knowledge in professional practice, so that new modes and techniques of teaching and learning can be established, teaching the ability to draw as a language that supports creative thinking, memory development, and anchor continuous technique improvement.

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