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# The Forgotten Legacy of Schön: From Materials to “Mediums” in the Design Activity

Annie Gentes, Giulia Marcocchia

## Introduction

In the early 1980s, Donald Schön’s research on the activity of design practitioners and architects set forth some breakthrough ideas that have been discussed in the design research community since then. His founding texts on the “reflective practitioner” demonstrate that designing is a reflective conversation with the materials of a design situation.<sup>1</sup> Most concepts, such as “tacit knowledge,” “reflexivity in action,” and “seeing-moving-seeing,” focus on the cognitive activity of the designer. In addition, Schön introduced the role of materials in his dialogical model of design, specifying that “materials talk back.”<sup>2</sup> However, as Marcus Jahnke points out, “the subject-object duality remains intact. Reflective practitioners reflect on something by immersing themselves in reflection, but the subject is still positioned in a traditional distanced role in relation to the object.”<sup>3</sup>

In this article, we are primarily interested in the material “stuff”<sup>4</sup> that “talks back” and that designers work with. One of the reasons we focus on the *non-human* part of the dialog and its effect on design activity is the renewed interest in this conversation. The materials of the design activities take many forms in addition to the media system structured by sketches, drawings, or mockups.<sup>5</sup> Digital materials and digital tools certainly offer new channels and new formats for this conversation.<sup>6</sup> In addition, the value of certain materials (e.g., plastic<sup>7</sup>) is seriously reconsidered in view of sustainable design.<sup>8</sup> These discussions on the type and value of materials suggest that the concept of material itself, with its focus on physical properties, might be insufficient to address the many dimensions of what *material* actually means in design. We need a concept that not only addresses the physical and embodied characteristics of the tangible but also could capture social properties, ethics, aesthetics, and cultural and political traits. We suggest that the concept of medium, briefly mentioned in Schön and following Dewey, should be considered as an alternative to *materials* to better understand the designers’ work.<sup>9</sup>

- 1 Donald A. Schön, *The Reflective Practitioner: How Professionals Think In Action* (New York: Basic Books, 1983); and Donald A. Schön and Glenn Wiggins, “Kinds of Seeing and Their Functions in Designing,” *Design Studies* 13, no. 2 (1992): 135–56, [https://doi.org/10.1016/0142-694x\(92\)90268-f](https://doi.org/10.1016/0142-694x(92)90268-f).
- 2 Schön, *The Reflective Practitioner*, 175.
- 3 Marcus Jahnke, “Revisiting Design as a Hermeneutic Practice: An Investigation of Paul Ricoeur’s Critical Hermeneutics,” *Design Issues* 28, no. 2 (Spring 2012): 30–40.
- 4 Donald A. Schön, “Design as a Reflective Conversation with the Materials of a Design Situation,” *Research in Engineering Design*, no. 3 (1992): 131–47, <https://doi.org/10.1007/BF01580516>.
- 5 Nigel Cross, “The Nature and Nurture of Design Ability,” *Design Studies* 11, no. 3 (1990): 127–40, [https://doi.org/10.1016/0142-694x\(90\)90002-T](https://doi.org/10.1016/0142-694x(90)90002-T).
- 6 See, e.g., Lars Erik Holmquist, “Intelligence on Tap: Artificial Intelligence as a New Design Material,” *Interactions* 24, no. 4 (June 23, 2017): 28–33, <https://doi.org/10.1145/3085571>; Graham Dove et al., “UX Design Innovation: Challenges for Working with Machine Learning as a Design Material,” in *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (New York: ACM, 2017), 278–88, <https://doi.org/10.1145/3025453.3025739>; and Qian Yang et al., “Investigating How Experienced UX Designers Effectively Work with Machine Learning,” in *Proceedings of the 2018 Designing Interactive Systems Conference* (New York: ACM, 2018), 585–96, <https://doi.org/10.1145/3196709.3196730>. See also Rivka Oxman, “Digital Architecture as a Challenge for Design Pedagogy: Theory, Knowledge, Models and Medium,” *Design Studies* 29, no. 2

In this article, we therefore look closely at the literature discussing Schön's dialogic model of design. From this survey of the literature, we follow what researchers say about materials in design. We then juxtapose Schön's legacy with the theoretical origins of Schön's model. The "upstream" part of our journey leads us to reflect on the status of the medium in Schön's work—in particular, in its relation to Dewey's theory of the artifact. We then introduce more systematically the concept of medium and suggest that the concept of medium and its insertion in a general theory of *mediality* bring to light the multiple dimensions of the design material and its roles in culture.<sup>10</sup> In this article, we rely on the strategy of *borrowing* a theory from neighboring disciplines—here, the disciplines of media and art studies.<sup>11</sup> We explain phenomena in one theoretical domain using ideas borrowed from another.<sup>12</sup> In describing materials as media, we want to shed new light on how, in the design activity, the physical properties of the materials and the embodied activities of the designer are on par with the social and cultural values of the medium and meaning-making activity of the designer. We analyze the media of design from a semiotic perspective and consider the formatting dimension of media, looking at how they shape and are shaped by the design practice. From this perspective, designers may be able to envision and create a situation in which a desired practice is likely to unfold with and because of the "mediums" used.<sup>13</sup>

### Review of the Literature

Schön's analysis of the iterative practice and of the inquiry process of practitioners in action has been widely cited in different fields of research. Starting from his article on the effectiveness of professionals in 1974, to his seminal book on the reflective process in 1983 and on the education of the reflective practitioner in 1987, as well as more recent articles on the reflective conversation,<sup>14</sup> his work has been cited more than 140,000 times (based on Google Scholar citations). This analysis of reflexivity influenced education research, management, and science<sup>15</sup>; the literature also recognizes Schön's epistemological contribution to the grounding of a new definition of the design activity.

Schön's primary contribution was to show how a practitioner produces a frame of reference in response to "unique, uncertain and conflicted situations of practice."<sup>16</sup> *Framing* does not mean that the

(2008): 99–120, <https://doi.org/10.1016/j.destud.2007.12.003>; and Maliheh Ghajargar and Mikael Wiberg, "Thinking with Interactive Artifacts: Reflection as a Concept in Design Outcomes," *Design Issues* 34, no. 2 (Spring 2018): 48–63, [https://doi.org/10.1162/DESI\\_a\\_00485](https://doi.org/10.1162/DESI_a_00485).

- 7 Penny Sparke, *The Plastics Age: From Modernity to Post-Modernity* (Salisbury, BAS Printers, 1990); and Douglas Clemenshaw, *Design in Plastics* (Rockport, MA: North Light Books, 1989).
- 8 Tim Ingold, "Materials Against Materiality," *Archaeological Dialogues* 14, no. 1 (June 2007): 1–16, <https://doi.org/10.1017/S1380203807002127>; and Elvin Karana, "Characterization of 'Natural' and 'High-Quality' Materials to Improve Perception of Bio-Plastics," *Journal of Cleaner Production* 37 (December 2012): 316–25, <https://doi.org/10.1016/j.jclepro.2012.07.034>.
- 9 John Dewey, *Art as Experience* (London: Penguin, 2005).
- 10 W.J.T. Mitchell and Mark B. N. Hansen, eds., *Critical Terms for Media Studies*, Illustrated edition (Chicago: University of Chicago Press, 2010).
- 11 Katherine Hayles, "Print Is Flat, Code Is Deep: The Importance of Media-Specific Analysis," *Poetics Today* 25, no. 1 (2004): 67–90, <https://doi.org/10.1215/03335372-25-1-67>, and Rolsalynd Krauss, "Reinventing the Medium," *Critical Enquiry* 25, no. 2 (1999): 289–305.
- 12 Steven W. Floyd, "Borrowing Theory: What Does This Mean and When Does It Make Sense in Management Scholarship?," *Journal of Management Studies* 46, no. 6 (2009): 1057–58, <https://doi.org/10.1111/j.1467-6486.2009.00865.x>; and Livia Markóczy and David L. Deeds, "Theory Building at the Intersection: Recipe for Impact or Road to Nowhere?," *Journal of Management Studies* 46, no. 6 (2009): 1076–88, <https://doi.org/10.1111/j.1467-6486.2009.00849.x>.
- 13 In this article, we use "mediums" rather than the more common plural "media" so as to keep open the filiation with art studies and their discussion on mediums in artistic practices.
- 14 Schön, "Designing as Reflective Conversation," 3–14; and Schön and Wiggins, "Kinds of Seeing."

15 On education, see, e.g., Bruce R. Joyce and Beverly Showers, *Student Achievement Through Staff Development* vol. 3 (Alexandria, VA: Association for Supervision and Curriculum Development, 2002); Joseph D. Novak, *Learning, Creating, and Using Knowledge: Concept Maps as Facilitative Tools in Schools and Corporations* (London: Routledge, 2010); Chris Day, *Developing Teachers: The Challenges of Lifelong Learning* (London: Routledge, 2002); Punya Mishra and Matthew J. Koehler, "Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge," *Teachers College Record* 108, no. 6 (2006): 1017–105, <https://doi.org/10.1177%2F016146810610800610>; and Yrjö Engeström, *Learning By Expanding* (Cambridge: Cambridge University Press, 2015). For management, see, e.g., Ikujiro Nonaka, "A Dynamic Theory of Organizational Knowledge Creation," *Organization Science* 5, no. 1 (1994): 14–37, <https://doi.org/10.1287%2Forsc.5.1.14>; Karl E. Weick, "Sensemaking in Organizations" (Thousand Oaks: Sage, 1995); Sandy Kristin Piderit, "Rethinking Resistance and Recognizing Ambivalence: A Multidimensional View of Attitudes Toward an Organizational Change," *Academy of Management Review* 25, no. 4 (October 2000): 783–94, doi:10.5465/amr.2000.3707722; Lee G. Bolman and Terrence E. Deal, *Reframing Organizations: Artistry, Choice, and Leadership* (Hoboken: John Wiley & Sons, 2017), doi:10.1002/9781119281856; Edgar H. Schein, *Organizational Culture and Leadership*, vol. 2 (Hoboken: John Wiley & Sons, 2010). On science, see, e.g., Joseph Maxwell, "Understanding and Validity in Qualitative Research," *Harvard Educational Review* 62, no. 3 (September 1992): 279–301, doi:10.17763/haer.62.3.8323320856251826; Stephen Kemmis, "Participatory Action Research and the Public Sphere," *Educational Action Research* 14, no. 4 (December 2006): 459–76, doi:10.1080/09650790600975593; and Davydd J. Greenwood and Morten Levin, *Introduction to Action Research: Social Research for Social Change* (Sage, 2006).

16 Donald Schön, *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions* (San Francisco, CA: Jossey-Bass Publishers, 1987), 8–9.

practitioner's knowledge or expertise is applied to fix a known situation. Rather, it means that during the exploration, the practitioner's experience is applied to interpret and rephrase the "conflicted situation" of practice. This process of framing is iterative—in particular, because the framing changes the meaning of the situation, and as a result, the intervention changes, too. The practitioner's exploration is based on "seeing-moving-seeing" loops: the process of seeing (e.g., a situation, sketches, plans); moving (i.e., acting on the situation, adding, removing, composing); seeing (i.e., stepping back from the situation and considering the consequences of one's actions). These loops support the continuum of inquiry.<sup>17</sup> In particular, it allows the designer to explore the information space.<sup>18</sup> This whole process can be described as a dialogic structure—hence, Schön's metaphor of the "conversation" with materials. The evolution of the inquiry is considered a cognitive activity based on tests with materials, a cyclical process of re-interpretation, and a sensemaking path in situations not fully understood at first.<sup>19</sup> Designers are able to change their solutions through this reflective conversation with the materials.<sup>20</sup> This dialogic exchange between designers and the design situation—which changes the designers, as well as the framing of the problem—is what allows designers to engage with uncertain, disordered, and undetermined situations.<sup>21</sup> Conversation with materials also is defined as a complex and specific form of decision making involving a mix of individual elements, such as "*competences, intuition, experiences, and taste.*"<sup>22</sup> When designers act on materials, a materialization of affordances happens<sup>23</sup>; this process of affordance creation happens in a process of understanding "anchored to the material."<sup>24</sup>

Although the main actor in these developments is always the designer, the conversations with materials have been described in terms of performance in "*creating material space for critical thinking.*"<sup>25</sup> And when the materials are engaged during the sequences of experiments, they have been analyzed beyond the visual apprehension approach and toward their consideration as interactional resource.<sup>26</sup> Elaborating on the conversation metaphor, authors have used this dialogic model of design to develop a communication-based model of the design process.<sup>27</sup> This communicative trend of the research has led to seeing materials as a means for information, interaction, integration, and collaboration, through a rapid cycle of building, testing, scrutinizing, and redesigning.<sup>28</sup>

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- 17 Schön, *The Reflective Practitioner* (1983), 280.
- 18 Ernesto Arias et al., "Transcending the Individual Human Mind—Creating Shared Understanding through Collaborative Design," *ACM Transactions on Computer-Human Interaction* 7.1 (2000): 84–113, 5, doi:10.1145/344949.345015.
- 19 See, respectively Henrik Gedenryd, *How Designers Work: Making Sense of Authentic Cognitive Activities*, PhD dissertation (Lund: Lund University, 1998); Remko Van der Lugt, "How Sketching Can Affect the Idea Generation Process in Design Group Meetings," *Design Studies* 26, no. 2 (March 2005): 101–22, doi:10.1016/j.destud.2004.08.003; and Sigrun Lurås, "Systems Intertwined: A Systemic View on the Design Situation," *Design Issues* 32, no. 3 (Summer 2016): 30–41, doi:10.1162/desi\_a\_00397.
- 20 Nigel Cross, "Designerly Ways of Knowing," *Design Studies* 3, no. 4 (October 1982): 221–27, Doi:10.1016/0142-694x(82)90040-0.
- 21 Jahnke, "Revisiting Design": 31.
- 22 Daniel Fallman, "The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration," *Design Issues* 24, no. 3 (Summer 2008): 13, doi:10.1162/desi.2008.24.3.4.
- 23 Arseli Dokumaci, "Vital Affordances, Occupying Niches: An Ecological Approach to Disability and Performance," *Research in Drama Education: The Journal of Applied Theatre and Performance* 22, no. 3 (June 2017): 393–412, doi:10.1080/13569783.2017.1326808.
- 24 Bahareh Barati, et al., "The Making of Performativity in Designing [with] Smart Material Composites," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York: ACM, 2018), 8, doi:10.1145/3173574.3173579.
- 25 Josephine Moate et al., "Exploring the Material Mediation of Dialogic Space—A Qualitative Analysis of Professional Learning in Initial Teacher Education Based on Reflective Sketchbooks," *Thinking Skills and Creativity* 31 (March 2019): 177, doi:10.1016/j.tsc.2018.12.003.
- 26 Bo T. Christensen and Sille Julie J. Abildgaard, "Kinds of 'Moving' in Designing with Sticky Notes," *Design Studies* 76 (September 2021): 101036, doi:10.1016/j.destud.2021.101036.

The materials of this dialogical model have been addressed in diverse ways. For example, Kees Dorst and Judith Dijkhuis cited materials as "topics the designers deal with."<sup>29</sup> They are part of a negotiation process during which attributes are interpreted by the designer. Sketches present visual, tactile, and bi- or tri-dimensional qualities that diversely support cognitive inquiry.<sup>30</sup> They are generators of both new moves and new behaviors.<sup>31</sup> Sketches also include a certain level of ambiguity, which is needed to allow the fluidity of the design process.<sup>32</sup>

Researchers also emphasize the diversity of materials. First, non-verbal media for thinking and sharing the problem and its solution have been studied as central aspects of the design ability.<sup>33</sup> Thus, prototypes have been approached as "approximations of a product along some dimensions of interest," acting as the "pivotal media" for creativity, innovation, and collaboration in design.<sup>34</sup> Beyond the individual level of the designer's practice, interactions with materials have been shown to define the style of a company because such interactions are a way to structure representations of reality and the types of activity: "the media, methods, and styles that companies use to manage their multiple models of reality"; in addition, media, methods, and styles serve the development of innovation and creativity in an organization.<sup>35</sup> More generally, the media of design contribute to the tangibility of the idea. Second, the elements of the conversation have been defined as representations<sup>36</sup>—or as evolving elements and "complex assemblages of more or less articulated meanings, material artefacts, embodied experiences, and more."<sup>37</sup> Authors also have focused on the interconnection between physical action (e.g., sketching, or clay and foam forging) and cognition.<sup>38</sup> The words *media* and *materials* seem to be used interchangeably in this literature as "means."

As our review of the literature shows, the definition of what materials are can differ widely. First, they differ according to *types*: Elaborating on Schön, some authors consider materiality in reference to an activity that can be word-based but also sketch-based or prototype-based, and they compare the values of these different tools of expression. Second, definitions also differ in terms of *goals*: Authors focus on the goals of an activity of representation, where visual and linguistic materials are used, or they speak of "actual" materials as the purpose of the design activity—that is, as tangible elements around the designers that they can transform. Third, they refer to the role of materials in terms of *communication*. They may follow Schön's



- 27 Nathan Crilly et al., "Design as Communication: Exploring the Validity and Utility of Relating Intention to Interpretation," *Design Studies* 29, no. 5 (September 2008): 425–57, doi:10.1016/j.destud.2008.05.002.
- 28 Arias et al., "Transcending the Individual Human Mind."
- 29 Kees Dorst and Judith Dijkhuis, "Comparing Paradigms for Describing Design Activity," *Design Studies* 16, no. 2 (April 1995): 267, doi:10.1016/0142-694x(94)00012-3.
- 30 Gedenryd, How Designers Work.
- 31 See, respectively Nigel Cross, "From a Design Science to a Design Discipline: Understanding Designerly Ways of Knowing and Thinking," in *Design Research Now*, Ralf Michel (Bâle: Birkhäuser, 2007), 41–54, doi:10.1007/978-3-7643-8472-2\_3; and Ghajargar and Wiberg, "Thinking with Interactive Artifacts."
- 32 Margot Brereton and Ben McGarry, "An Observational Study of How Objects Support Engineering Design Thinking and Communication," in *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* (New York: ACM, 2000), 217–24, doi:10.1145/332040.332434.
- 33 Nigel Cross, "The Nature and Nurture of Design Ability," *Design Studies* 11, no. 3 (July 1990): 127–140, doi:10.1016/0142-694x(90)90002-t.
- 34 Björn Hartmann et al., "Reflective Physical Prototyping Through Integrated Design, Test, and Analysis," in *Proceedings of the 19th Annual ACM Symposium on User Interface Software and Technology* (New York: ACM, 2006), 299, doi:10.1145/1166253.1166300.
- 35 Michael Schrage, "Cultures of Prototyping," in *Bringing Design to Software*, ed. Terry Winograd (April 1996): 191–213, doi:10.1145/229868.230045.
- 36 Willemien Visser, "Schön: Design as a Reflective Practice," *Collection 2* (2010): 21–25; Willemien Visser, "Design as Construction of Representations, A Dynamic Viewpoint in Cognitive Design Research," *Human-Computer Interaction Special Issue Foundations of Design in HCI* 21, no. 1 (2010): 103–52.
- 37 Jahnke, "Revisiting Design as a Hermeneutic Practice": 36.

"conversation" metaphor, where the iterative use of tools of expression brings some unexpected productions that surprise the designer, or they may focus on the way that these materials support a collective activity of design between two or more designers and participants. Fourth, materials also have been described in *semiotic* terms as "changeable" and ambiguous, supporting a metaphorical appreciation that then allows for new values and new designs to emerge. Some materials are therefore more designable than others—not because they are physically flexible, but because they can be interpreted in multiple ways.

This diversity of definitions means that the question of materiality is not as clear-cut as it seems. First, we observed that authors make no clear distinctions between materials, tools, and means of expression. Second, we noted some confusion between presentation (i.e., the material and the embodied experience that is offered) and representation (i.e., a document and text that stands for something else). Rather than critique this apparent lack of distinction between materials of design, we hypothesized that the problem arises with the *concept* of materials. How could materials be both presenting and representing? We needed to explore this question to formulate a theoretically grounded solution for achieving the assemblage of new meanings proposed by Jahnke.<sup>39</sup> We needed a more precise description of the semiotic properties of these "tangibles" to better understand the meaning making and shaping activity of co-design practices in relation to materials.

### From Materials to Mediums in Design: A Discussion on the Semiotics of the Medium

As noted, the literature review led us to propose that the word *material* is limited and does not convey the different values of *matters* in design activity. Thus, what designers use can better be described as *media* (the plural of *mediums*). We suggest this change for several reasons. First, this change in terminology helps to reconcile the different values of materials in design and their agency. Second, it can lead to a better understanding of how designers choose one medium over another—how they balance between various values of these mediums but also how the different mediums challenge the designers' control and introduce elements of surprise. Our demonstration is based on Schön's use of the concept and also on the fact that his dialogical model of design follows Dewey's pragmatism in *Art as Experience*; here, the concept of *medium* supports the

demonstration of how artifacts signify.<sup>40</sup> In this discussion, we therefore propose a double journey: one that heads upstream as we go back to Schön's texts and Dewey's influence, and one that goes downstream, where we look at what media theorists can bring to a better understanding of the tangible and mediating elements of the design practice.

Going back to Schön's texts, note the amplitude of what he calls the "medium of reflection in action": "What does it matter that the *medium* of reflection-in-action is the architect's sketchpad, the relationship between patient and therapist, the drawings and experimental models of an engineering laboratory, the dialogue of planner and developer, or the interactive relations among managers in a corporation?"<sup>41</sup>

In Schön's examples of media, we see no actual *material* in Tim Ingold's sense.<sup>42</sup> No wood, metal, plastic, or any other matter is being used to build an actual product. Instead, Schön insists that discussions—for instance, between therapist and supervisor—are a medium that supports the reflexive activity of the practitioners. Questioning what Schön considers similar in this diversity of situations therefore seems necessary—and, in particular, looking at the properties of the mediums themselves. For example, Schön primarily describes scenarios that include drawings and conversations. Semiotically speaking, the common ground of drawings and words is that they are signs standing for something else. The designer plans the architecture or the object to be. Her drawings represent the buildings *in absentia*, in much the same way that the words used by the patient represent past experiences. The mediums of design are therefore what support representative activities using different semiotic systems: iconic for drawings and sketches and symbolic for language. From this standpoint, conception is akin to representation. And indeed, Schön's philosophy of design posits that conception is different from execution, according to Waks.<sup>43</sup> If we translate this distinction in semiotic terms rather than in chronological stages, mediums are used in their capacity to represent, as well as in their capacity to build.

However, Schön also offers another example in which the opposition between conception and execution is not so clear-cut. In *Educating the Reflective Practitioner*, Schön analyzes how a musician not only executes a piece but also reinterprets it and therefore gives it new meaning.<sup>44</sup> This example changes the definition of what a design process is, as well as the definition of what a design medium is.

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- 38 Scott R. Klemmer et al., "How Bodies Matter," in *Proceedings of the 6th ACM Conference on Designing Interactive Systems* (New York: ACM, 2006): 140–49, doi:10.1145/1142405.1142429.
- 39 See Jahnke, "Revisiting Design as a Hermeneutic Practice."
- 40 Dewey, *Art as Experience*, 106–33.
- 41 Schön, *The Reflective Practitioner*, 271.
- 42 Ingold, "Materials Against Materiality."
- 43 Leonard J. Waks, "Donald Schön's Philosophy of Design and Design Education," *International Journal of Technology and Design Education* 11, no. 1 (January 2001): 37–51, <https://doi.org/10.1023/A:1011251801044>.
- 44 Donald A. Schön, *Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions* (San Francisco, CA: Jossey-Bass Publishers, 1987), 46.

The medium is seen not as representing something but as something to be experienced for itself, including the physicality and agency of the medium and its emotional effect/affect. The performance redesigns the meaning of the music because, in this case, the medium is not a means to an end but the object to be experienced for itself.

This latter example supports a theory that the design medium is representative *and* expressive *and* valuable for the experience that it gives. From a semiotic perspective, this expansiveness is congruent with the idea that no sign is entirely transparent in its purpose. Even words are not transparent in their meanings. Their depth depends on the process of interpretation that they trigger (carefully described by Schön, Snowden and Coyne, and Jahnke<sup>45</sup>) and on their materiality: Words and, of course, sketches and drawings have auditory and plastic qualities that support their effect. Something of the presentation is always present in the representation.

The concept of medium, therefore, makes materiality meaningful by maintaining a plurality of semiotic processes as matter signifies both by itself and for something else. This view is consistent with Dewey's perspective on *Art as Experience*.<sup>46</sup> In this tradition, the medium articulates several semiotic levels. For Dewey, expressing something means that the material—gesture, sound, image, language, tangibles—is used in a special way and consequently becomes a medium:

The connection between a medium and the act of expression is intrinsic. An act of expression always employs natural material, though it may be natural in the sense of habitual as well as in that of primitive or native. *It becomes a medium when it is employed in view of its place, and role, in its relations, an inclusive situation* [italicized emphasis is the authors']—as tones become music when ordered in a melody. The same tones might be uttered in connection with an attitude of joy, surprise, or sadness, and be natural outlets of particular feelings. They are expressive of one of these emotions when other tones are the medium in which one of the tones occurs.<sup>47</sup>

For Dewey, material and medium can share the same plastic properties; however, the former supports a physical experience, while the latter is constructed to be interpreted as a text. The sound material becomes a medium when it is included in a phrase, in a composition,

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45 See, e.g., Schön, *The Reflective Practitioner*; Adrian Snodgrass and Richard Coyne, "Models, Metaphors and the Hermeneutics of Designing," *Design Issues* 9, no. 1 (Winter 1992): 56–74, <https://doi.org/10.2307/1511599>; Adrian Snodgrass and Richard Coyne, "Is Designing Hermeneutical?," *Architectural Theory Review* 2, no. 1 (November 1996): 65–97, <https://doi.org/10.1080/13264829609478304>; and Jahnke, "Revisiting Design as a Hermeneutic Practice."

46 Schön himself also makes this genealogical assertion explicit. See Schön, *The Reflective Practitioner*, 357 note 38; Schön, *Educating the Reflective Practitioner*, 16–17, 73, 168, 222, 312–313; Donald Schön, "The New Scholarship Requires a New Epistemology," *Change* 27, no. 6 (1995): 26–35; and Donald Schön, "The Theory of Inquiry; Dewey's Legacy to Education," *Curriculum Inquiry* 22, no. 2 (1992): 119–39. This last work will be cited as "Dewey's Legacy" in the text for all subsequent references.

47 Dewey, *Art as Experience*, 64. (italics added).



where the relation to other sounds is planned or interpreted as such. In Dewey's pragmatic phenomenology, a medium is both experienced as such, with its physical properties, and interpreted as a sign belonging to a larger text.

Switching from material to medium therefore helps us to understand what characterizes design activities: the dynamic change of semiotic focus. Elaborating on Katherine Hayles, we can say that the medium either tends to disappear and support the "text" or the use, or that the medium itself is foregrounded: "Materiality [is considered] as the interplay between a text's physical characteristics and its signifying strategies."<sup>48</sup> A mediatic theory of design takes into consideration this interplay between the physicality of the medium experienced as such and the fact that it can become "transparent" to better support a message or a use. Designing is simultaneously interpreting a text, experiencing an artifact, and using the artifact.

We think that this dynamic of change of semiotic focus sheds an interesting light on the design process because it addresses and solves the dichotomy between physicality and symbolism. Thus, we can address how the medium—whether words or drawings, or any other support of expression—signifies and how it frames the designer's production.

### **Mediums in Action: From a Semiotic Theory of Mediums to a Theory of Mediality**

In recent years, research in media studies has tried to answer the following question: "Do media transfer sense or do they create it?"<sup>49</sup> Elaborating on Marshal McLuhan and his catchphrase, "the media is the message," social and cultural studies have experienced a mediatic turn that has focused on the mediality of human activities. As W.J.T. Mitchell and Mark Hansen explain: "From McLuhan's standpoint, a medium impacts human experience and society not primarily through the content that it mediates but through its formal, technical properties as a medium."<sup>50</sup> Scholars therefore have looked not only at messages and contents of texts but also at how they came to be and how they organize the relationship between our private inner world and the external reality, as well as our communicative activities. The suggested answer to Krämer's question from media scholars changes the alternative contained in the question into a conjunction: "Media create sense by transferring it.... The transferring activity does not leave the transferred elements unchanged since it is carrying out a specific operation of embodiment by giving it a form or by creating a phenomenon."<sup>51</sup>

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48 Hayles, "Print Is Flat, Code Is Deep," 55.

49 Friedrich Balke and Leander Scholz, "The Medium as Form," in *Media, Culture, and Mediality*, ed. Ludwig Jäger et al., (Bielefeld: transcript Verlag, 2010), 40, <https://doi.org/10.14361/transcript.9783839413760.37>.

50 Mitchell and Hansen, eds., *Critical Terms for Media Studies*, X.

51 Friedrich Balke and Leander Scholz, "The Medium as Form," 40, <https://doi.org/10.14361/transcript.9783839413760.37>.

We can better understand Schön's dialogical model of design because with mediums comes a reflection on forms and formatting. In summarizing philosophical research on media, Balke and Scholz note that works

emerge from "media" which, however, are not only to be envisioned as abstract realms of possibilities for later creations of form but as fields that open up possibilities of saying, viewing or pointing out, possibilities of presentation or representation (in a broad sense) at the cost of definitively closing out "other possibilities." ... To define media in this sense as systems of formation means nothing less than being able to establish rules of a specific appearance, instead of relating this appearance to abundance expressing a special nature or to the supreme initiative of a creative subject.<sup>52</sup>

This analysis of media as a system of formation can shed new light on what Schön calls the "conversation with materials." An important aspect of this conversation is how the material "talks back"—in other words, how the medium seems to contribute to the conversation, surprising the designer and therefore reframing the situation. In Schön and Wiggins's Pedra and Quist example, the discovery of unintended consequences is a key turning point: "The "second 'seeing' involves recognition of *unintended* [italicized emphasis is the authors'], as well as intended consequences, and where *unintended* [italicized emphasis is the authors'] consequences fall into domains other than those in which the problem and its prospective solution are initially formulated."<sup>53</sup> By using the metaphor of a material response, Schön suggests not only that the use of drawings or language is not transparent to our thoughts but also that the medium does not dictate our construction. Schön further develops this conversational metaphor in *Educating the Reflective Practitioner*, where he uses the example of the student, Judith, and her professor, Norhovers, to explain that having an idea and imposing it on shapes is not enough. Judith seems to think that "a basic idea, once discovered, can be decided on once and for all, and it can always be made to work,"<sup>54</sup> But, following Waks' analysis, we suggest that Norhovers—representing Schön's perspective—defines design and design mediums as a milieu that supports "design moves, and discovering their consequences and implications."<sup>55</sup> Surprise is key to Schön's model: It is simultaneously an event in the design activity and part of the posture of the designer, who lets himself or herself be surprised. Schön's

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52 Ibid., 47.

53 Schön and Wiggins, "Kinds of Seeing and Their Functions in Designing," 143. (italics added).

54 Schön, *Educating the Reflective Practitioner*, 130.

55 Waks, "Donald Schön's Philosophy of Design and Design Education," 130.

notion of surprise is noted by Kees Dorst and Nigel Cross, as being the “impetus that leads to framing and reframing”<sup>56</sup> as well as by Klemmer and colleagues: “The epistemic production of concrete prototypes provides the crucial element of surprise, unexpected realizations that the designer could not have arrived at without producing a concrete manifestation of her ideas.”<sup>57</sup>

From a media studies perspective, the medium has its own properties that escape the intentionality of its producer or user and therefore brings unexpected results. As a “system of formation,” a medium shapes the production, but what is produced is not strictly determined either by the medium or by the intention of the designer. As Balke and Scholz conclude in their historical analysis of the philosophical concept, “[m]edia... do not only operate on phenomena; they provide the possibility of emergence for something that normally would remain below the threshold of perception or awareness by making it into a phenomenon, into an event that socio-culturally ‘counts.’”<sup>58</sup>

The medium supports the externalization of the ideas of the designer, who then can contemplate them and act on them. This interaction is consistent with what media scholars analyze when they define mediality as being an intermediate zone between the inner self of the person and her imagination and the outside world.<sup>59</sup> This phenomenology of mediation takes into consideration the fact that media are a meeting place between the subjective self and the outside world, where both can be redefined.<sup>60</sup> In the words of Peter-Paul Verbeek, “[m]ediation consists in a mutual constitution of subject and object.”<sup>61</sup>

## Conclusion

Elaborating on Schön’s burgeoning material anthropology of design practice, our focus has been on the material part of the conversation, and our goal has been to give it a more precise theoretical background. The concept of materiality as it appears in the review of literature is too limited to do justice to the complexity of its role in design practices. We investigated Dewey’s theory of expression and took into account contemporary research in media studies to suggest that the concepts of medium and media offer better ways to understand the role of materials in the design situation.

Our focus on mediums helps to critique a vision of design practice that would be idea-based and logocentric. With mediums, we can address the physical properties and the agency of materials, as well as the embodied dimension of the design activity. In

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56 Kees Dorst and Nigel Cross, “Creativity in the Design Process: Co-Evolution of Problem–Solution,” *Design Studies* 22, no. 5 (2001): 425–37. doi:10.1016/S0142-694X(01)00009-6. 436.

57 Klemmer et al., “How Bodies Matter,” 142.

58 Balke and Scholz, “The Medium as Form,” 38.

59 John Guillory, “Genesis of the Media Concept,” *Critical Inquiry* 36, no. 2 (January 2010): 321–62, <https://doi.org/10.1086/648528>.

60 Donald W. Winnicott, *Playing and Reality*, 2nd ed. (London: Routledge, 1971).

61 Peter-Paul Verbeek, *What Things Do: Philosophical Reflections on Technology, Agency, and Design* (University Park, PA: Penn State University Press, 2005).

addition, a media-centered perspective considers not only the sensitive experience of the material but also how the medium of design involves the support of representations. In other words, it includes the semiotic properties of media—the social and cultural meaning-making dimension of the design activity. Switching from a material to a medium-centered model of design allowed us to point out the dynamic change of semiotic focus that takes place in the design practice: The conversation described by Schön is more than a question of moving-seeing-moving. The semiotic qualities of media, versus conversation, are different: The former foregrounds the support and supporting of a bodily experience, while the latter foregrounds the message and supporting an interpreting experience.

This work led us to consider the question of the production of meaning and to argue that the medium defined as a “system of formation” offered an interesting angle into the intriguing notion that designers could be surprised by their own designs. A system of formation implies that the medium pre-exists and shapes the conception but does not entirely predetermine the results. In this milieu—both technical and semiotic—designers can materialize their intuitions, but the medium also offers its own framework for this materialization. The medium is therefore a milieu, with historical, social, political, physical, mechanical, and chemical characteristics that designers can partly harness but also that are going to surprise them. This research shows that we need a typology of mediums that addresses their various properties for designers.

Reversing the emphasis from researching people and their individual relationships with material artifacts to medium-based experience is a paradigmatic shift for research on design. It means analyzing the properties and experiential qualities of mediums as conditions for creative surprises without relating them to simple strokes of luck. Ultimately, we hope that our work helps to switch from a logocentric perspective of framing to a plastic and cultural understanding of shaping, which is crucial to understanding design.