Techné: Research in Philosophy and Technology ISSN: 1091-8264
20:2 (2016): 153–167 DOI: 10.5840/techne20168356

Husserl's Missing Multistability

Robert Rosenberger

Abstract: The notion of "multistability" is a central fixture of the postphenomenological framework of thought, one of the central ideas that enables this perspective to avoid both shallow determinism and instrumentalism. While this notion has been put to use in numerous case studies and theoretical treatments, here I argue that the work of following out the philosophical implications of technological multistability has only just begun. Don Ihde's new book, *Husserl's Missing Technologies*, provides a helpful jumping off point as he provides a leading-edge formulation of this idea. I continue with an attempt to sketch out the vast philosophical ground opened up by this concept, and review the contemporary work by postphenomenologists that is just starting to explore this new terrain.

Key words: postphenomenology, multistability, materiality, pragmatism, interrelational ontology

The publication of Don Ihde's new book, *Husserl's Missing Technologies* (2016), presents a rich opportunity to reflect on the most central commitments of the "postphenomenological" school of thought. This international and interdisciplinary group builds on Ihde's body of work, and with this latest entry in Ihde's corpus we receive crucial clarifications and expansions on some of the most basic components of the postphenomenological framework. This is because part of what it means for postphenomenology to be "post" rests exactly on the distinctions that Ihde draws between Husserl's and his own perspective, and on the connections that Ihde forges between phenomenology and American pragmatism, all central themes in *Husserl's Missing Technologies*. In what follows, I consider the new contributions this book makes to our understanding of postphenomenology's "interrelational ontology" in general, and its notions of "variational analysis" and "multistability" in particular. Close inspection of these ideas reveals some of the

Robert Rosenberger, School of Public Policy, Georgia Institute of Technology,
685 Cherry St., Atlanta GA 30332, USA; robert.rosenberger@pubpolicy.gatech.edu.

paths that lie ahead for this school of thought. I conclude with a review of some of the cutting-edge efforts made by postphenomenologists to address the philosophical and methodological challenges left in the wake of Ihde's formulation of the notion of multistability.

Variational Analysis and Multistability

As many of the contributors to this special review issue have noted, *Husserl's Missing Technologies* is in many ways a successor to 2010's *Heidegger's Technologies*, since both review and expand on Ihde's interpretations and criticisms of a major figure of the phenomenological cannon. Like the new book, *Heidegger's Technologies* is helpful for the way it defines postphenomenology through a comparison with the positions of an important and long dead figure. But I instead think that if *Husserl's Missing Technologies* is a sequel, then it is actually the follow-up to 2009's *Postphenomenology and Technoscience: The Peking University Lectures*. In that work, just as in the new book, Ihde's central effort is to define postphenomenology through a critique of Husserl, and through an analysis of the work of John Dewey.

In a well cited passage in *Postphenomenology and Technoscience*, Ihde explains,

> In Husserl's earlier use, variations (originally derived from mathematical and variational theory) were needed to determine essential structures, or "essences." Variations could be used to determine what was variant and what invariant. I also have found this technique invaluable in any phenomenological analysis—but as I used this technique, I discovered something other than Husserlian "essences" as results. What emerged or "showed itself" was the complicated structure of *multistability*. (Ihde 2009, 12)

Let's unpack this. Husserl's claim is that by considering an object of investigation from multiple perspectives—by considering multiple imaginative "variations"—we can learn something essential about that object. That is, for Husserl the method of variational analysis enables us to consider what is contingent and perspectival about particular variations, and to discover an object's essence within whatever remains. Ihde eschews Husserl's essentialism. In his view, what variational analysis reveals is not anything essential, but instead the object's very status as multistable. To understand a technology to be multistable is to recognize that it can mean different things to different people in different contexts, and that it can always be put to work for different purposes. This understanding of technological

multistability is one of the keys to postphenomenology's pragmatism, that is, its pragmatic commitment to nonfoundationalism and anti-essentialism; rather than understanding humans to have access to some foundational essence of technology, postphenomenology instead understands technology to always be open to multiple uses and meanings.

This notion of multistability is a centerpiece of much of the concrete work performed by postphenomenologists. This idea has been put to use in any number of case studies, from the history of archery (Ihde 2009), to the evolution of cellular phones (Wellner 2015b), to the critique of technologies that discriminate against the homeless (Rosenberger 2014a; Rosenberger, n.d.). In the context of medicine and health care, scholars have considered the multistability of sonogram readouts (Verbeek 2011), organ donation protocols (Rosenfeld 2015), emotionally assistive robots in elderly care (Hasse 2015), and Pap smear samples in cancer screening (Forss 2012). An extensive amount of work has been put into the analysis of the multistability of images in scientific laboratories (Ihde 1998), with studies in Mars satellite imaging (Rosenberger 2011a), image reading training practices in physics (Hasse 2008), and the study of neurotransmission (Rosenberger 2011b). In a debate here in *Techné: Research in Philosophy and Technology*, a central point of contention was over the implications of the notion of multistability for the issue of the distraction of cell phones while driving (Wellner 2014; Rosenberger 2014b).

Ihde continues to develop this line of thinking in *Husserl's Missing Technologies*. He reiterates the idea above that where Husserl's use of variations sought essences, postphenomenology's instead discovers multistabilities. "These are multiple ways of seeing, of multiple arrangements, and variants on themes" (Ihde 2016, 85; see also 127, 129). In a section on how phenomenological insights have the potential to enrich pragmatism, the method of variational analysis and the notion of multistability are offered as case-in-point examples of useful ideas. He writes, "I place the phenomenological practice of using variations as my primary tool for analysis. Such a variational practice works well to establish both the richness of variety provided in lifeworld experience and to locate whatever structural features may be found" (ibid., 111). Further spelling out the pragmatic commitment of this perspective, he continues, "What variational practice often shows is a nonreductive and multistable pattern to various phenomena. In the more concrete areas of human anthropological and cultural variations, for example, one can show the multiple solutions humans have worked out with respect to a wide variety of problems" (ibid., 112). Ihde points to both his extensive analyses of multistable visual illusions first embarked upon in *Experimental Phenomenology* (Ihde 1986),

and his investigation in *Technology and the Lifeworld* (Ihde 1990) of the multistable culturally situated navigational practices of seafaring societies in Europe and Southeast Asia.

This multistable understanding extends not only to human-technology relations, but to scientific research. Many fields of science include their own understandings of multistable phenomena, from multi-stacking arrangements in microchemistry, to the multistable galaxy shapes found by telescopes like the Hubble. Ihde appreciates this association with scientific conceptions of multistability, noting that a Google search for multistability in science yields more than 12,000 results. And he claims that "when it comes to technologies, I would argue that multistability is virtually the norm" (Ihde 2016, 128).

This brings Ihde to a delineation of postphenomenology's "interrelational ontology" (which in some previous works has also been referred to as a "relational ontology"). He bases his account of this ontology on postphenomenology's understanding of one of classical phenomenology's most important concepts: intentionality. He writes, "Here I look at 'intentionality' in its classical and Husserlian form and in its modified postphenomenological form. Intentionality, I hold, is a form of *interrelational ontology*" (Ihde 2016, 129). Ihde claims that for Husserl,

> it is still the case that *ego* remains a subject and what is focal and forefront is *consciousness*. But pragmatism and—and closer to phenomenological home—both Heidegger and Merleau-Ponty note that there is more to experience than consciousness. . . . To put it simply, postphenomenology substitutes an embodied action for consciousness or subjectivity. Perception for postphenomenology is bodily and actional. (Ihde 2016, 130)

Postphenomenology's interrelational ontology, at least as Ihde has formulated it here, is thus based on an account of embodied human-technology relations.

Following this, I'd argue that postphenomenology's interrelational ontology places it together in an extended family with a number of related contemporary perspectives, including Donna Haraway's "cyborgs," Jane Bennett's "assemblages," Bruno Latour's "networks" and "hybrids," Andrew Feenberg's technological "ambivalence," and Karen Barad's "intra-actions," among many others who attempt to challenge pervasively assumed distinctions between subjects and objects, the social and the material, mind and matter, and construction and facticity (Barad 2007; Bennett 2010; Feenberg 1999; Latour 1993; Haraway 1997). Like postphenomenology, some of these kin perspectives also even refer to their own take on metaphysics as a "relational" or an "interrelational" ontology. Indeed, these days

within certain philosophy of technology and STS circles it has almost become a provocative move to defend more traditional conceptions of absolute reality and transcendental truth. (In my view, such provocateurs largely tend to pass off the attempt at bucking this trend for a genuine insight. It still remains, as far as I can see, a greatly unfinished and deeply difficult project to follow out the implications of postmodern ideas about technology, subjectivity, and materiality.) One clear next step is to continue to outline and explore the particular advantages and limitations that come from postphenomenology's unique contribution. If postphenomenology retains the distinct advantage of troubling traditional conceptions of subjects and objects, users and devices, and the social and the material, then what are the implications of this special advantage for other related perspectives? What are the implications of the insights coming from those kin perspectives for postphenomenology? And what special role might the notion of multistability play?

The Challenge of Multistability

What's funny is that, despite all the emphasis already placed on the notion of multistability in *Husserl's Missing Technologies*, I think that it could stand to be emphasized much more. This is because, at least in my view, it is exactly the notion of multistability that enables postphenomenology to adopt pragmatic commitments to nonfoundationalism and anti-essentialism. The notion of multistability is in part what allows postphenomenology to take up a postmodern stance on materiality. And it is exactly the notion of multistability that enables postphenomenology to conceive of technology in a way that is neither reductively deterministic, nor purely instrumental. Thus it is true in no small sense that the notion of multistability is a key factor that makes postphenomenology truly "post."

So why in this book that spends so much time expounding on postphenomenology is the notion of multistability not treated more extensively? Why isn't it treated more extensively in this book that so centrally distinguishes itself from Husserl by adopting Deweyan insights? Why in a book that so crucially abandons Husserlian essences for Ihdean multistabilities isn't the notion of multistability and the method of variational analysis developed further? I have my suspicions.

First the obvious and necessary caveat: of course one reason that Ihde does not dwell longer on multistability and variational analysis is that he is simply otherwise occupied. Space is not wasted in this book. If you are looking for a trenchant criticism of the modernist sentiments inextricably embedded in Husserl's thought, then look no further than *Husserl's Missing Technologies*. If you have any doubt that scientific advance occurs through human embodiment of instrumenta-

tion, then you won't after reading this book. If you are searching for an original cross analysis of Husserl and Dewey cut through with sparkling detail from the history of science and technology, then your search is over. One reason that the notion of multistability is not further emphasized in this book is simply that Ihde clearly has his sights on different goals.

But I think there is something more in Ihde's decision not to treat the notion of multistability with greater philosophical detail in *Husserl's Missing Technologies*: doing so would open a massive can of squiggling worms. By covering the notion of multistability to exactly the extent that he has, Ihde is able to make crucial distinctions with Husserl and the classical phenomenologists, and is at the same time able to demonstrate an element of postphenomenology's distinct usefulness to Dewey and the pragmatists. But if he were to go any further, then he would step immediately into a philosophical quagmire of difficult questions about methodology, epistemology, ontology, and politics.

For example, any further and Ihde risks introducing questions about exactly what it means for postphenomenology to investigate the multistable nature of things. Sure, compared to a foundational account of "essence" like Husserl's, a conception of multistability appears superior. *Husserl's Missing Technologies* makes this clear. But what next? If variational analysis reveals multistability rather than essence, then what are we to do with that multistability? Other than countering someone's essentializing account, and enlightening people to a target object's overlooked multistability, what is variational analysis good for? Is it always the same kind of multistability that is revealed by postphenomenological investigations, or are there different forms? Shouldn't more be said on postphenomenological methodology on this point? Aren't there implications for a postphenomenologist's own politically-situated subject position when conducting variational analysis? If as Ihde always holds, and as fellow postphenomenologist Peter-Paul Verbeek so strongly emphasizes, subjects and objects are formed through technological mediation, then how are we to understand the changing embodied subjects and multistable objects at issue in variational analysis?

There's more. We've seen that postphenomenology is defined in part by its interrelational ontology. This interrelation is spelled out by Ihde through a phenomenological conception of embodied technologies. It is not consciousness alone that is intentionally directed to the world. Intentionality is conceived as bodily, and as extended through our embodied technologies. But it remains at best unclear exactly how the multistability of those embodied technologies should play into this interrelational account. How should we understand this ontology when a user

engages a conventional, rather than alternative, usage? How should we understand this ontology with regard to a user's potential embodiment of alternative stabilities? Put as a question in Verbeekian terms, if subjects and objects are co-shaped through mediation, then how should we understand the multistability of technology within each co-shaping?

None of the questions brainstormed in this section constitute a refutation of any of Ihde's positions. They are not criticisms veiled as rhetorical questions. They are original potential lines of inquiry that are made possible by Ihde's framework.

I see these kinds of questions to point out the challenges set out for postphenomenology as a school of thought. To make a Kuhnian analogy, by putting together phenomenological and pragmatist philosophies of technology in exactly the way he has, Ihde has at once developed a useful workbench of investigative tools that can be taken up for further case studies, and at the same time he has generated a distinct philosophical problem set—if not a form of "mop-up work," to take Thomas Kuhn's vocabulary further—for the postphenomenological school going forward (Kuhn 2012).

And postphenomenologists are already taking up these challenges, considering different forms of multistability, developing postphenomenological methodologies, and cultivating a technical appreciation of the philosophical implications of multistability. Let's review some of these cutting edge ideas and projects below.

Cutting Edges

While the future of theorizing on multistability appears to me to be an important and wide open expanse, there is some helpful work already underway. As a concluding section, I review some of this contemporary work.

1. Positivity, Negativity, Imagination, and Practicality

I have suggested that a basic distinction can be drawn between what could be called "positive" and "negative" uses of multistability (e.g., Rosenberger 2010, forthcoming). In the negative usage, the notion of multistability is wielded against some other account of technology deemed essentializing, foundational, or otherwise overgeneralizing. That is, if some theory maintains that technology is always only one way, then variational analysis can be used to show that technology is actually multistable. Or if some discussion is stuck thinking of a technology in only one way, then it may be useful to engage in variational analysis purely to demonstrate the fact of technological multistability.

In its positive usage, a technology is investigated as multistable as part of an investigative study. The goal is to edify, to learn new things, to find productive new ways to think about a given case. Most of the examples of multistablity-centered investigations listed above—organ donation protocols, Pap smear screening, emotionally assistive robots, Mars imaging—are examples of positive uses of multistability in which productive contributions are made to ongoing concrete discussions.

An important thing to note about this distinction is that each usage maintains a different epistemic demand. If one really is waging a purely negative critique, then it is only necessary to come up with some alternative stability, any alternative stability, to prove that a technology is in fact multistable. (Be careful though. If the target of the critique is not actually making a totalizing claim, such as if it's making claims about "most" rather than "all" technology, then your critique might be making an implied positive counterclaim, and you'll have some proving to do.) In contrast, in the case of positive projects, it will indeed matter which stabilities happen to be identified, and what procedure was used to discover those stabilities. If you're doing more with your analysis than simply demonstrating that technology is multistable, then how you approach that multistability will be relevant to your results.

Kyle Powys Whyte has suggested a related, though not identical, distinction between what he calls "imaginative" and "practical" multistability. Imaginative multistability refers to the kind that is discovered within visual illusions, in which each different stability does not involve its own embedded world. In this way, imaginative multistability entails only a weak sense of embodiment. As Whyte puts it, when considering visual illusions, "There is a sense that I am sort of a hovering observer running these variations with no particular enduring linkage to the context of any lifeworld" (Whyte 2015, 71).

Most of the case studies engaged by postphenomenologists are instead examples of practical multistability. Such cases entail a strong sense of embodiment, one in which the researchers' own experience in the lifeworld, and her or his own investigative procedures, are crucially relevant. He writes, "strong embodiment suggests that someone researching the multistability of a practice is either doing so from the perspective of being competent in one or several of the stable practices or in none of them" (Whyte 2015, 74). Whyte follows out the implications of such more strongly embodied studies for postphenomenological methodology.

2. Structural Edification

In his "Response to Rorty, Or Is Phenomenology Edifying?," chapter 9 of his book *Expanding Hermeneutics* (Ihde 1998), Ihde explains what it means for phenomenology to be structural. He is concerned with Richard Rorty's pragmatic call for "edifying" philosophies that advance conversations without making claims to epistemological foundations. Ihde maintains that postphenomenology is indeed edifying in a Rortian sense "for it is not without 'edifice,' 'structure'" (ibid., 126). By structure, Ihde refers to relationships that can be found to bring order to the stabilities of a multistable technology. Ihde's claim is that postphenomenology has the potential to edify exactly because structural relationships can be uncovered through variational analysis. For example, if one is analyzing a technology in terms of a particular preferred purpose, then the various stabilities that have been identified can be ranked in terms of their potential to best fit that purpose. Of course "ranking" is not the only possible relationship; "other types of structural stability could be hierarchical, serial, independent-dependent, and so on" (ibid.).

Ihde is careful to note that, in contrast to Husserlian variational analysis, postphenomenological variational analysis is not built on any epistemological foundation; any structural features discovered remain context relative. He writes, "If this is vestigial 'foundationalism,' it is both oddly so, since the investigation and horizontalization of the field of structure is neither selective (all are context relative) nor reductive (there is no 'best' or 'only' structure)" (Ihde 1998, 126).

3. Whytian Pivots

Whyte also trenchantly points out that postphenomenological studies vary not only in their particular object of study, but also in terms of the kind of object investigated as multistable. That is, we can identify different ways in which multistability is used in different postphenomenological investigations. For example, he contrasts Ihde's study of the history of archery (in which archery as a broad practice is shown to vary in its particularities from culture to culture), with my own studies in which it is often a single object of study (such as an individual desktop computer) or set of objects (such as a series of contested laboratory images) that are analyzed as multistable. Whyte introduces the term "pivot" to describe, "that which allows the variation to make sense as a variation" (Whyte 2015, 75). He explains that, "Each pivot requires that we assume that something remains constant and that the reader will not question the identity" (ibid., 76). Where one study might pivot on a broad set of practices, another might pivot on a particular object or set of objects. Whyte notes as well that Verbeek's usage of multistability constitutes another

class of pivot, in which the multistability of technology enables the various possible co-shapings of subjects and objects through technological mediation. In her own recent effort to offer categories of multistability, Galit Wellner astutely notes that sometimes the pivot is upon contrasting historical trajectories of technological development (Wellner 2015a).

This recognition enables Whyte to offer some broad methodological suggestions for postphenomenological research going forward. These include, among other things, a call for postphenomenological projects to be explicit and thoughtful about their choice of pivot, and for the postphenomenological researchers to be reflective about their own expertise with regard to the lifeworlds associated with particular stabilities and to work to develop the interactional skills to engage with other people that inhabit different relevant lifeworlds.

4. Relational Strategies

While the notions of variational analysis and multistability stress the variability possible for our devices and our world, there are also corresponding changes that occur in user experience when a shift is made from one stability to another. Most often in postphenomenological investigations it is the augmented abilities, experiential transparency, and perhaps the tradeoffs and limitations that are considered. But we can also pay attention to the way that with each different stability possible for a given technology, there will be a different corresponding user experience. I have offered the notion of the "relational strategy" to refer to the particular bodily-perceptual approach and understanding that a user must adopt in order to take up a technology *in terms of a particular stability* (e.g., Rosenberger 2009). For example, the difference between a longbow and horse-mounted bow will of course not only be different in terms of their particular physical designs and different cultural histories. They will also be different in terms of the ways that the devices are used, what the user must know, what habits of usage must be developed, and how the body must be comported. This is the case as well for devices to which we share "hermeneutic" interpretive relations, such as laboratory readouts. In cases in which there is debate over an image's meaning, we can consider the relational strategies (or in this context what could be called the "hermeneutic strategies") that enable one side of the debate to see the image to mean one thing, and the other side to perceive something else (e.g., Rosenberger 2011a; Rosenberger 2011b).

The implications of the relational strategies of desktop computing were a centerpiece of the debate here in a special issue of *Techné* in 2011 over the ethics

and pedagogical value of computer-simulated frog dissections (see issue 15(3) of *Techné*).

5. Local Stabilization

Anthropologist Cathrine Hasse uses postphenomenology to develop methods for exploring how local communities come to settle on particular stabilities of multistable technologies. As she puts it, "Stability is hard work and it seems to be worth the labor not just because of the actual machines, but because of the fantasies tied to them—which again are more about social expectations than intelligence inside the machinery" (Hasse 2015, 178).

Hasse's research excels at demonstrating the cultural situatedness of technology, and how it can be helpful to conceive of a technology's different cultural situations as different stabilities. With an expanded postphenomenological methodology, one that works productively with cultural and historical learning theory, we can explore the learning processes through which communities come to interpret and use a technology through one particular stability rather than another. She writes,

> The relational multistability following the meeting between design and a local practice will, over time and in the course of learning with and working with the materials in the local practice, gradually stabilize the materials with new meanings. These meanings are tied to the local zones of development. (Hasse 2015, 281)

If we are to take seriously the notion of multistability and the fact that different stabilities become embedded differently in different local contexts, then it is incumbent upon us to develop the tools (or connect up with the other disciplinary perspectives and methodologies equipped with the tools) to address how communities engage in design, innovation, and cultural learning.

6. Variational Cross-Examination

One question sometimes asked of postphenomenology is: if variational analysis does not lead to the discovery of essences, but instead to multistability, then on what basis can it provide new insights into a particular case? That is, how can variational analysis be illuminating or edifying if it does not follow Husserl and understand variations to reveal essences? If its claims are neither based on some foundation, nor on special access to essences, then on what basis does postphe-

nomenology stake its clams? I have put considerable work into clarifying and addressing these issues (e.g., Rosenberger 2014a; Rosenberger, forthcoming).

I argue that after a postphenomenological investigation has identified multiple stabilities though variational analysis, useful new information can be revealed when these stabilities are *contrasted against one another* (Rosenberger, forthcoming). In such a process we don't learn anything about the device's essence, but we may learn something new about those *particular stabilities*. For example, a "dominant" stability may be identified, one that is strongly entrenched in local practice, possibly the stability for which the object was designed and mass produced, and possibly one that is so normal within one's lifeworld that its features and implications may not be readily obvious. In such a case, useful discoveries can be made about that dominant stability by contrasting it with alternative stabilities. That is, illuminative or edifying postphenomenological claims can find their basis in the contrasts that can be drawn between stabilities, enabling this perspective to maintain its pragmatic commitment to anti-essentialism and nonfoundationalism.

I have gone so far as to suggest that the work of critically contrasting stabilities against one another should be understood as a second step added to postphenomenological methodology. We can refer to this second step as "variational cross-examination" (Rosenberger 2014a). After variational analysis is performed and multiple stabilities have been identified, then we should move on to evaluate each stability against the other stabilities for the sake of what we may learn about those exact stabilities. We may learn something about the dominant stability instantiated commonly in the lifeworld by contrasting it against unrealized alternatives. We may learn something about a mainstream stability by comparing it to an alternative stability taken up by a marginalized group. We may even learn something about how a dominant stability has been designed specifically to incline users against alternatives. All of this can be done without appeals to transcendentalism, foundationalism, or essentialism.

7. Feminist Standpoint Theory

Although we have not published any full treatments on this yet, the potential for combining the methods of variational analysis and variational cross-examination with insights from feminist standpoint epistemology has been a discussion point among postphenomenologists for some time, especially with Kyle Powys Whyte, Lucie Dalibert, Cathrine Hasse, and myself (see also Rosenberger, n.d.). Standpoint theory, as it has been developed within science studies and the philosophy of science, teaches us that mainstream discussions can remain blind to systematic

biases (e.g., Collins 1986; Harding 1986; Haraway 1991; Hartsock 1998). To rout out these biases, perspectives from the margins of the community must be incorporated into the mainstream scientific discussion. The incorporation of marginal perspectives routs out bias not because marginalized people have special access to the unbiased truth, but because they have a special view of the biases of the mainstream, especially as people who are living through the disadvantages that result from those very biases.

The suggestion here is that the performance of variational analysis, in which various stabilities are brainstormed and otherwise uncovered, could benefit from the incorporation of a diversity of standpoints. The point is that each investigator's own life experiences will make it possible to know only some of the possible uses and meanings of any given device or technological practice. While an individual investigator may be able to brainstorm some further stabilities, and may be able to learn about some further stabilities through empirical investigation, it is still possible that other stabilities will remain hidden from view, occluded by the limitations of her or his own epistemological standpoint. By incorporating additional standpoints into the investigation, by interacting with others from different backgrounds, and by including those actual people in the investigative process not simply as objects of investigation but as investigators themselves, postphenomenological explorations can exceed the epistemological limitations of individual standpoints and the large-scale biases of mainstream discourse.

In the end, this list of contemporary ideas about the notion of multistability serves most to point out the fact that there is much work to do. There are some exciting first attempts at devising postphenomenological methodologies underway. But, at least in my view, these projects are just getting started.

References

Barad, Karen. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press. http://dx.doi.org/10.1215/9780822388128

Bennett, Jane. 2010. *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press.

Collins, Patricia H. 1986. "Learning From the Outsider Within: The Sociological Significance of Black Feminist Thought." *Social Problems* 33(6): S14–S32. http://dx.doi.org/10.2307/800672

Feenberg, Andrew. 1999. *Questioning Technology*. New York: Routledge.

Forss, Anette. 2012. "Cells and the (Imaginary) Patient: The Multistable Practitioner-Technology-Cell Interface in the Cytology Laboratory." *Medicine, Health Care and Philosophy* 15: 295–308. http://dx.doi.org/10.1007/s11019-011-9325-0

Haraway, Donna. 1991. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." In *Simians, Cyborgs and Women*, chap. 9. New York: Routledge.

Haraway, Donna. 1997. *Modest_Witness@Second_Millenium*. London: Routledge.

Harding, Sandra. 1986. *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.

Hartsock, Nancy C. M. 1998. *The Feminist Standpoint Revisited and Other Essays*. Boulder, CO: Westview Press.

Hasse, Cathrine. 2008. "Postphenomenology: Learning Cultural Perception in Science." *Human Studies* 31(1): 43–61. http://dx.doi.org/10.1007/s10746-007-9075-4

Hasse, Cathrine. 2015. *An Anthropology of Learning: On Nested Frictions in Cultural Ecologies*. Dordrecht: Springer. http://dx.doi.org/10.1007/978-94-017-9606-4

Ihde, Don. 1986. *Experimental Phenomenology*. Albany: State University of New York Press.

Ihde, Don. 1990. *Technology and the Lifeworld*. Bloomington: Indiana University Press.

Ihde, Don. 1998. *Expanding Hermeneutics: Visualism in Science*. Evanston, IL: Northwestern University Press.

Ihde, Don. 2009. *Postphenomenology and Technoscience: The Peking University Lectures*. Albany: SUNY Press.

Ihde, Don. 2010. *Heidegger's Technologies: Postphenomenological Reflections*. New York: Fordham University Press.

Ihde, Don. 2016. *Husserl's Missing Technologies*. New York: Fordham University Press.

Kuhn, Thomas S. 2012. *The Structure of Scientific Revolutions*, 4th ed. Chicago: University of Chicago Press. http://dx.doi.org/10.7208/chicago/9780226458144.001.0001

Latour, Bruno. 1993. *We Have Never Been Modern*. London: Prentice Hall.

Rosenberger, Robert. 2009. "The Sudden Experience of the Computer." *AI & Society* 24: 173–80. http://dx.doi.org/10.1007/s00146-009-0190-9

Rosenberger, Robert. 2010. "Deflating the Overblown Accounts of Technology: A Review of Ihde's *Ironic Technics*." *AI and Society* 25: 133–36. http://dx.doi.org/10.1007/s00146-009-0222-5

Rosenberger, Robert. 2011a. "A Case Study in the Applied Philosophy of Imaging: The Synaptic Vesicle Debate." *Science, Technology & Human Values* 36(6): 6–32. http://dx.doi.org/10.1177/0162243909337117

Rosenberger, Robert. 2011b. "A Phenomenology of Image Use in Science: Multistability and the Debate Over Martian Gully Deposits." *Techné: Research in Philosophy and Technology* 15(2): 156–69. http://dx.doi.org/10.5840/techne201115214

Rosenberger, Robert. 2014a. "Multistability and the Agency of Mundane Artifacts: From Speed Bumps to Subway Benches." *Human Studies* 37: 369–92. http://dx.doi.org/10.1007/s10746-014-9317-1

Rosenberger, Robert. 2014b. "The Phenomenological Case for Stricter Regulation of Cell Phones and Driving." *Techné: Research in Philosophy and Technology* 18(1–2): 20–47. http://dx.doi.org/10.5840/techne201461717

Rosenberger, Robert. Forthcoming. "Notes on a Nonfoundational Phenomenology of Technology." *Foundations of Science*. http://dx.doi.org/10.1007/s10699-015-9480-5

Rosenberger, Robert. n.d. "Guilty Technology." Unpublished manuscript.

Rosenfeld, Adam. 2015. "Mediating Multiplicity: Brain Dead Bodies and Organ Donation Protocols." In *Postphenomenological Investigations: Essays on Human-Technology Relations*, ed. Robert Rosenberger and Peter-Paul Verbeek, 203–14. Lanham, MD: Lexington Books.

Verbeek, Peter-Paul. 2011. *Moralizing Technology*. Chicago: University of Chicago Press. http://dx.doi.org/10.7208/chicago/9780226852904.001.0001

Wellner, Galit. 2014. "Multi-Attention and the Horcrux Logic: Justifications for Talking on the Phone While Driving. *Techné: Research in Philosophy and Technology* 18(1–2): 48–73. http://dx.doi.org/10.5840/techne201432712

Wellner, Galit. 2015a. "Multi Multi-stabilities." Annual Meeting of the Society for the Social Studies of Science, Denver, CO, 11–14 November.

Wellner, Galit. 2015b. *A Postphenomenological Inquiry of Cell Phones: Genealogies, Meaning and Becoming*. New York: Lexington Books.

Whyte, Kyle P. 2015. "What Is Multistability? A Theory of the Keystone Concept of Postphenomenological Research." In *Technoscience and Postphenomenology: The Manhattan Papers*, ed. Jan K. B O. Friis and Robert P. Crease, 69–81. Lanham, MD: Lexington Books.