Book Collision. Computation, Infinity, and the Production of Subjects Beyond Representation

M. Beatrice Fazi. *Contingent Computation. Abstraction, Experience, and Indeterminacy in Computational Aesthetics*. London: Rowman & Littlefield, 2018.

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In *Contingent Computation: Abstraction, Experience and Indeterminacy in Computational Aesthetics*, M. Beatrice Fazi proposes that aesthetics is a legitimate means of inquiry into the ontology of computation. Fazi's aesthetics neither encompasses a philosophy of art nor raises traditional aesthetic questions regarding beauty, taste and judgment.[1] Instead, she draws from the Greek word *aisthesis*, meaning "perception from the senses or intellect"; "aesthetics" here denotes "a theory of knowledge that is predicated upon the immanence of thought and sensation."[2] Fazi's aesthetics-as-sensory-knowledge is not concerned with artworks made by computers, but rather with computation as a means of rendering the sensible world intelligible. As she puts it, "the computational aesthetics that I have proposed is, in essence, a philosophical study of what computation is and does."[3]

Fazi's main interlocutor is Gilles Deleuze. As she notes, Deleuze's aesthetics posits a relationship between creation, becoming, and sensory knowledge. In emphasizing process as fundamental to the nature of computation, and in affirming the immanence of thought and sensation, *Contingent Computation* rests on Deleuzian aesthetic precepts. Crucially, however, Fazi disputes one of Deleuze's most significant contributions, which is that computation can produce neither "the new" nor "the real" (which will be defined below). Throughout the book, Fazi revisits the premises on which Deleuze denies computation these essential functions. More specifically, she reads Deleuzian aesthetics through Alfred North Whitehead's philosophy of indeterminacy, Alan Turing's notion of computational incomputability, and Kurt Gödel's incompleteness theorem. In so doing, she demonstrates that Deleuze offers a productive avenue towards an ontology of computation.

I will not attempt to summarize the many detailed observations Fazi makes as she outlines a place for computation within aesthetics. Instead, I will suggest an avenue of departure by examining the role of infinity in her overarching argument. By reading Fazi's treatment of computational infinity alongside Alain Badiou's *Being and Event* and Alexander Galloway's essay "Mathification," which comments on *Being and Event*, I will attempt to show that *Contingent Computation* furnishes materials for a theory of "computational subjectivity" which is a mode of subjectivity particular to computational processes. Fazi's computational subjectivity, I will argue, resides within the logical and formal structures of cognition, but cannot be represented in perceptible or positivistic forms.

It will be useful to begin by exploring Fazi's and Deleuze's differing views on the relationship between continuity, discreteness, and the computational production of the "new" and "real." For Deleuze, novelty and reality both issue from "an unstable *flux* of change, micro-variations, modulations, and differentiations to be felt, not cognized."[4] This flux is mathematically continuous, or composed of infinitely reducible parts which cannot be stabilized in time or space. So, although reality manifests as concrete phenomena, its source is in perpetual flux. Because this flux resists finite reduction, attempts to enclose it within the discrete and finite functions of computation are futile. Deleuze also argues that computation forestalls the genesis of "the new," where the new is defined as "forces in thought which are not the forces of recognition."[5] Insofar as the limits of computational operability are determined in advance, he claims, computation cannot be said to produce anything wholly "new" or unrecognizable. Fazi elaborates:

> [For Deleuze,] the digital would seem to be excluded from the production of the new on the basis of its automated repetition of the preprogrammed. Working through possibilities and probabilities, the digital is a way of recognizing through prediction. Supposedly no new thought as well as no new being can be produced, because everything is already set up; in the digital machine, there is a lot of iteration and repetition, but no differentiation. For this reason, when seen from a Deleuzian perspective, the digital has no *potentiality*.[6]

Her argument that computation can, in fact, yield both the new and the real therefore deviates from the Deleuzian paradigm. To make such a radical move, she revisits Deleuze's belief that aesthetic flows do not manifest on the level of representation.[7] In his view, computational functions cannot sustain aesthetic continua, and the reason for this is that the functions operate on irreducibly discrete representative symbols.[8] Whereas thoughts and sensoria constitute an infinite flow, the motion of symbolic referents through digital networks is ultimately finite. These properties prevent computation from meeting Deleuze's criteria for *aisthesis*.

Fazi claims that Deleuze's exclusion of computation from aesthetic regard is based on a misapprehension of how computation operates. To revise Deleuze's error, she turns to Alan Turing's theory of the role of incomputability in computational functions. Reading Turing alongside

Deleuze allows her to argue that computational processes necessarily supersede representation, and as such, constitute a form of *aisthesis*.

Turing, Fazi writes, demonstrates that while computation imposes mathematical finitude on its inputs, it also always incorporates an incomputable element of infinity. The following provides an entry into Turing's work on this topic:

> The indeterminacy and infinity of computation are due to a central and constitutive characteristic of every computational processing: incomputability. The founding paradox of computer science is that it is a field that is defined by what it cannot do, rather than by what it can do. Alan Turing's 1936 foundational paper, "On Computable Numbers, with an Application to the Entscheidungsproblem," first formalized the notion of computability and demonstrated that some functions cannot be computed.[9]

As Fazi suggests, it matters that the earliest formalization of "computability" as a theoretical property of mathematical functions observed that not all mathematical functions hold this property. In other words, not all mathematical functions are computable. This barrier, as Turing showed, is not a *problem* for computability but rather *defines* it. And as it is a necessary component of computation, incomputability is also central to Fazi's aesthetic theory of computational ontology. To make the move towards Deleuzian aisthesis in particular, Fazi claims that Turing's incomputability places computation beyond representation:

> According to Turing's model of computation, to compute is to follow an *effective procedure* (in other words, an algorithm) in order to solve a problem in a finite number of sequential steps. Turing discovered, however, that some problems cannot be solved via algorithmic means, because the steps involved in their processing are not finite but infinite: these problems are incomputable . . . [B]ecause the incomputable is this element of undecidability, something in computation remains unknown, and ultimately, beyond representation. This unknown is a decisive element of the actual procedures of computation: it does not belong to life, the living, or the

> lived, but to computation itself. Although it is beyond representation, it is still within logos.[10]

Although the incomputable is beyond representation, it is nevertheless a "decisive" and necessary part of computational functions. Unrepresentability is therefore a quality of computation, which comports with Deleuzian aisthesis. Meanwhile, Fazi uses the concept of "logos"—understood as a rational and logical faculty—to connect aesthetics with ontology. To make this move, she invokes Alfred North Whitehead, for whom aesthetics and logic both stem from the problem of mental finitude in the face of the infinite. Whitehead, she writes,

> understood aesthetics and logic as "the two extremes of the dilemma of the finite mentality in its partial penetration of the infinite." Remarkably, he believed that "the analogy between aesthetics and logic is one of the undeveloped topics of philosophy." … In the context of computational practices and theories, this reconciliation is significant, because it shows that there is no need for computational formalism to be made more aesthetic via the injection of empirical variation. Computational logos is already aesthetic: aesthetics concerns the conditions of reality (in fact, of real experience, as Deleuze would have it), and these conditions—for computation as for everything else—are not only about the sensible, but the intelligible, too.[11]

In effect, computation surpasses representation but not intelligibility. Intelligibility, meanwhile, belongs to computation, which is a particular form of logos. The logical and rational structures of computation make intelligible the indeterminate and the infinite. For this reason, computation may be thought as a specific mode of "determining indeterminacy." The ontology of computation is constituted by the continual determining or becoming of the infinite–incomputable. This process unfolds over the dimension of time, and cannot be inscribed in either time or space. Computational aisthesis therefore does not yield representable outputs, such as "data" or "content."

The titular conceptualization of "contingent computation" points to the fact that computation is wholly contingent upon the infinite–incomputable which, although beyond representation, remains as yet capable of formalization in accordance with computational laws. Although computational aisthesis is beyond representation, it does not reduce the "real" or infinite by imposing finitude on it. Rather, it mobilizes the infinite as part of its determining operations. These operations constitute computation, and they produce novelty of a distinctly computational character. The infinite–incomputable is therefore both the substantive source for computational ontology and the material for its aesthetic production or *aisthesis*.

Fazi's Computational Ontology and Badiou's Infinity

Alain Badiou's consideration of infinity in *Being and Event* complicates Fazi's account of computational ontology. Here it must be stated unambiguously that both Fazi and Badiou conceive "infinity" as a state of indefinite magnitude. Infinity is a numerical and empirical condition. Badiou reads widely not only from the history of philosophy but contemporary mathematical theory—most significantly, Georg Cantor, Paul Cohen, Kurt Gödel, and William Bigelow Easton—to theorize a connection between numerical infinity and ontology. The relationship Badiou establishes between infinity and ontology permits him to declare that ontology emanates from mathematics.[12]

Drawing on Cantor's set theory, Badiou argues that no quantitative comparison is possible between the natural (or discrete) and real (or continuous) sets of numbers. Between these two, Badiou writes, lies an "impasse" or unbreachable divide from which comes ontology.[13] Key to this argument is the apparent paradox that the two sets are simultaneously infinite but incommensurate with one another. Badiou, again drawing on Cantor, argues that this is possible because their infinities are of two different types. This differentiation is unbreachable and renders it impossible to quantitatively compare the natural and real numbers.

In "Mathification," an essay on *Being and Event*, Alexander Galloway explores Badiou's fascination with the irreconcilable divide between the natural and real numbers. "Mathification" opens with a few seemingly simple questions:

> Is it always possible to compare things quantitatively? Is it always possible to say that there is something that is larger than something else? Is there a concept of "larger than" from which to construct quantity or numerosity, and, if so, is there a concept of "larger than" in thought

> overall? The path to the impasse begins just like that, because … the simple numerosity of being, the simple notion that everything is intrinsically quantifiable and therefore relatable via the operation of "larger than"—this simple reality collapsed under the weight of Cantor–Gödel–Cohen–Easton.[14]

Of the aforementioned figures, Cantor is perhaps most important to Badiou's schema: [15] Cantor provided the first demonstration of the difference between the natural and real number sets. This difference, he showed, is established by their respective cardinalities, where "cardinality" denotes the measure of the number of elements in a set. Cardinality is related to size, although, as Galloway notes, the notion of "size" loses meaning in the context of infinity. He expands upon "cardinality" as follows:

> [Cantor's] examination of the cardinality of the two sets, that is, the size of the real numbers versus the size of the natural numbers, produces a startling result. Based on Cantor's innovations and his explorations into the size of infinite sets, mathematicians refer to the "infinite" size of the set of all natural numbers. But, at the same time, the set of all real numbers is also infinite. Cantor's startling discovery was that these two infinities are different. Even more astounding, Cantor showed that the two infinities are not simply different, they have a different size, that is, there is no way to map a one-to-one relationship between each natural number and each real number. The cardinality of the natural numbers is of a different magnitude than that of the real numbers. [16]

For Badiou, Cantor's "astounding" discovery indicates that quantitative pursuits, if followed ad infinitum, necessarily resolve in a subjective choice between one or the other set. That is, as mathematical processes apprehend infinity, they must determine the set upon which they operate. Ontology, he argues, stems from this determination.

Badiou also observes that the determination cannot be calculated in advance of the action itself: the choice between natural and real numbers is made as part of mathematical production, although there is no determining rationale by which to decide. The absence of a rationale or criteria leads Galloway to describe the choice as "conceptless"; Badiou refers to it as a "wager." Galloway adds that this wager is "beyond the effectivity of known calculation [and] when calculation fails one is forced to gamble. One is obligated to make a choice, if not a leap of faith then a leap of faithfulness (*fidélité*)."[17] From this subjective leap of faithfulness, a subject—the product of a choice—appears. "The pursuit of quantity leads to subjectivity," Galloway writes. "In other words, *math makes subjects.*"[18]

Insofar as the term "choice" implies the existence of multiple options, computational functions cannot be said to "choose" between natural and real numbers. Because computation operates on discrete variables, they always use the natural rather than the real number line. Insofar as the term "choice" implies multiple options, their determination, I maintain, still "makes subjects" in the sense that it entails a continual process of "choosing" the natural numbers from infinity. Fazi does not explicate the production of subjects as a component of computational aisthesis. Nevertheless, she notes that Cantor's impasse between the two mathematical infinities bears upon computation. As she writes, the discipline of computer science is pragmatically "quite indifferent" to Cantor's mathematical "paradise":

> Such a "heavenly" status is not a shared destiny for the numbers crunched in and out by computing machines. Computational "virtues"—to keep the eschatological metaphor—are rather defined in terms of the capacity to break down infinitely many data into enumerable finite sets of processes, eliding anything that will not fit a universal correspondence between proof and execution … From this perspective, it can be said that computing machines are constructed upon the twentieth-century discovery of the logical deadlock between finitude and infinity.[19]

Fazi, in her capacity as a philosopher, articulates what computer science pragmatically does not: a synthesis of the finite but perpetually executed functions of computation and the existence of real infinity.

To be sure, Galloway's mathematics do not refer to the same object as Fazi's computation. Conventionally, computational procedures are understood to be contained within a formalized system, whereas the total purview of mathematics expands beyond formal systematization. In other words, computation always follows a predetermined set of rules, whereas mathematical procedures are not necessarily so restricted. Infinity is nevertheless critical to Fazi's ontology of computation because, as noted earlier, the preprogrammed rules of computation incorporate infinity as part of their operations. As Fazi says, "Such indeterminacy and infinity are not encountered at the level of sensation"; rather, they are mobilized "*from within* the logico-formal process itself."[20] The intelligible logico-formal process constitutes computational logos, which, according to Fazi (who is here drawing on Whitehead), exists on a continuum with aesthetics. Computational aisthesis is thus a continual process of translation into natural or discrete integers. This translation is Badiou's "conceptless choice" or "wager," and Fazi's "determination." Henceforth computation can be said to yield ontology, a subjective nature of being, as do mathematical processes.

There remains an important question. Does the fact that computation provides a rationale for its choice or determination prevent it from making subjects in the precise sense advanced by Badiou? Computational aisthesis, to reiterate, never "wagers" on natural numbers; it always selects them by virtue of what it is and does. I submit that computation makes subjects, albeit subjects delimited by a particular technical and instrumental logic. Computational ontology is, if not restricted by finitude, more systematic than ontology in general. This characteristic should not limit further inquiries into computational ontology and aisthesis, however. In fact, it provides a route towards more detailed specifications of computation as a mode of production beyond its conventional representational and instrumental applications.

Notes

1 M. Beatrice Fazi, *Contingent Computation: Abstraction, Experience and Indeterminacy in Computational Aesthetics* (London: Rowman & Littlefield, 2018), 8.

2 Ibid.

3 Ibid., 203.

4 Ibid., 32.

5 Ibid.

6 Ibid., 33.

7 Ibid., 62.

8 These symbols include, significantly, the zeros and ones of binary computer systems.

9 Ibid., 56.

10 Ibid., 56.

11 Ibid., 73.

12 Alain Badiou. *Being and Event*, trans. Oliver Feltham (London: Bloomsbury Academic, 2007), 279.

13 Ibid., 294–295.

14 Alexander R. Galloway, “Mathification,” April 2, 2017, Accessed June 11, 2019, http://cultureandcommunication.org/galloway/mathification.

15 Ibid.

16 Ibid.

17 Ibid. Emphasis original.

18 Galloway, “Mathification.” Emphasis original.

19 Fazi, *Contingent Computation*, 123.

20 Fazi, *Contingent Computation*, 56.

References

Badiou, Alain. *Being and Event.* Trans. Oliver Feltham. London: Bloomsbury Academic, 2007.

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