From AI with Love: Reading Big Data Poetry through Gilbert Simondon's Theory of Transduction

Computation initiated a far-reaching re-imagination of language, not just as an information tool, but as a social, bio-physical activity in general. Modern lexicology provides an important overview of the ongoing development of textual documentation and its applications in relation to language and linguistics. At the same time, the evolution of lexical tools from the first dictionaries and graphs to algorithmically generated scatter plots of live online interaction patterns has been surprisingly swift. Modern communication and information studies from Norbert Weiner to the present-day support direct parallels between coding and linguistic systems. However, most theories of computation as a model of language use remain highly indefinite and open-ended, at times purposefully ambiguous. Comparing the use of computation and semantic technologies ranging from Christopher Strachey's early love letter templates to David Jhave Johnson's more recent experiments with artificial neural networks (ANNs), this paper proposes the philosopher Gilbert Simondon's theory of transduction and metastable systems as a suitable framework for understanding various ontological and epistemological ramifications in our increasingly complex and intimate interactions with machine learning. Such developments are especially clear, I argue, in the poetic reimagining of language as a space of cybernetic hybridity.

Keywords: Artificial Intelligence, Poetics, Neural Networks, Information Studies, Computation, Linguistics, Transduction, Philosophy

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Few critics consider the well-known "Love Letters" Christopher Strachey generated and printed with the Manchester University Computer in 1952 to mark much of a literary or even salutatory achievement. Nevertheless, the simple print outs Strachey distributed to his colleagues' letter boxes one spring morning that year confirm the importance of computer programming as a linguistic accomplishment as much as a triumph in automated calculation. Strachey's template-based application, the "M.U.C. Love Letter Generator," was certainly novel for its time, especially since the program's host machine, the newly implemented Manchester Ferranti or simply the U.C., was one of the first commercially available computers in the world. Its model type was an upgrade of Manchester's very own Mark 1, A UK version of the original IBM machine, the Automatic Sequence Controlled Calculator (ASCC) developed at Harvard during the mid-1940s for the Manhattan Project. John von Neumann helped bring the model to Manchester when he returned there from Boston in June of 1948. Strachey joined the lab at the invite of the M.U.C. Lab's assistant director, Alan Turing, just four years later and almost immediately set upon compiling his letter generating apparatus while waiting for his first assignments.

Turing remains, of course, something of a founding figure in the cultural history of digital communication, especially in relation to artificial intelligence. He had determined even before Strachey joined the lab many key issues that continue to drive science and industry's ongoing interweaving of computation, programming, and linguistic study. Techniques for computationally mimicking human conversation are still evaluated for authenticity via his self-titled "Turing Test." Strachey's M.U.C. "Love Letters" would have certainly failed Turing's test, yet they still constitute an inaugural moment in the development of natural language process (NLP) tools by applying recombinatory patterns in linguistics to mimic the form and format of a generic love letter.

As this paper argues, computation initiated a far-reaching re-envisioning of language as an information-based, knowledge tool in relation to bio-physical activity in general. Modern lexicology provides an important overview of the ongoing development of textual and diagrammatic formats and their myriad applications in relation to linguistic communication. Yet the evolution of lexical tools from the first dictionaries and graphs to today's algorithmically generated scatter plots of live interaction patterns across the web has been surprisingly swift. With these advances, increasingly distinct models of linguistic processing have become equally applicable to bio-physical cognition as to any information technology. The very concept of a "thinking machine," as Turing laid out as early as 1950 in his well-known essay for *Mind*, "Computing Machinery and Intelligence," did not so much elevate programming to levels of human intelligence, as it reconsidered the latter to be at a fundamental level a mode of computation (1950).

Close to Turing's time with the Manchester Mark 1, mathematician Norbert Weiner also considered computability to be very much inseparable from broader epistemological searches for what he called a universal symbolic language, where reasoning and decision making could be augmented by textual configurations based in logical systems. For Weiner, determining a method for such mechanisms would be a core focus of the then-nascent discourse of cybernetics with its corresponding study of self-regulating or "servo" systems (1948). Andy Clark a half century later similarly emphasized the cyborg as a powerful model for understanding the increasingly intricate connections humans tend to forge with their technical environments. In his influential analysis of cognition and computation, *Natural Born Cyborgs* (2003), he declares “the cyborg” to be “a potent cultural icon of the late twentieth century. … For what is special about human brains, and what best explains the distinctive features of human intelligence, is precisely their ability to enter deep and complex relationships with non-biological constructs, props, and aids” (loc. 51). To look at texts as cybernetic apparatuses where, as we see in coding, language’s symbolic use to arrange and program tasks logically is prioritized over its semantic function is not to displace one linguistic form by the other. Language’s programming capacity should not be somehow gauged as its culminating cognitive role, implicitly re-assessing verbal semantics as a flawed mode of reasoning; yet neither can these functions be accurately isolated from each other. John Cayley makes a similar point just prior to Clark’s popular study. For Cayley what’s significant in a cybernetic sense of language is the emphatic interactivity between the two applications: “both code and language are practices of the symbolic,” he notes, while at the same time “code shares language’s strange but henceforth ... less singular relationship with materiality and embodiment” (2002). Cayley clearly differentiates code from language at a fundamental level, but at the same time reminds us that the latter’s bio-physical associations with human communication are not distinct. Humans code as a way of communicating person to person and within wider cultural contexts. We instruct each other, determine and assess actions through orders, laws, and even principles. Fundamentally, the cybernetic evolution of programming languages represents the ongoing refinement of textual logic as a symbolic apparatus. At the same time, textual logic, regardless of its sophistication, seems innately inadequate serving as the primary parameters for human cognition, never mind agency.

Modern communication and information studies from Weiner to the present-day support similar parallels between coding and linguistic systems. At the same time, current theories of computation as a model of language use can seem almost purposefully open-ended and ambiguous in terms of their approach. Schools in formal linguistics, for example, typically view language's role in cognition to be distinct from all other cognitive behaviors, operating according to its own structuring principles. However, cybernetics with its introduction of various advanced linguistic apparatuses continues to provide key insights into language's possible reconfiguration as a mode of computation. Contemporary neuroscience research into Natural Language Processing (NLP) and AI, in fact, remains comparably divided into theories that model intelligence according to the statistical, algorithmic configuration of language use across different media formats and those approaches that seek to match computational linguistics more literally with activity in the human brain. This latter perspective, commonly described as the "top down" model, seems especially eager to determine how computers might best mimic organic, human thinking. The "bottom up" model, by contrast, holds that the key to better computational systems depends upon the constant refinement of their internal logic programs with little direct interest in replicating human biology. Both models of computation yield algorithms that successfully augment, if not surpass, human information processing, especially when limited to specific fields of study. Yet, their respective core concepts of learning and even cognition, itself, differ substantially. Where the top down model aims to develop something akin to an artificial human brain, casting aside its organic mysteries while enhancing its capacities, the bottom up method argues that computation can enrich brain activity without necessarily becoming one. Here, parallel to Turing's views, trial and error calculations set against any number of random cause and effect sequences at superhuman speeds, pivoting either marginally closer to or further away from targeted outcomes, will achieve aims just as effectively as pre-formulated procedures. In fact, regardless of data field, trial and error computation remains at the moment more productive than most alternative, top-down approaches once levels of programming begin to reach a certain degree of complexity. More precise methods for coding physiological networks continue to yield impressive developments in artificial neural networks (ANNs); at the same time, trial and error methods in AI (with their origin in the logical engineering of efficient systems) still surpass any system trying to strictly model and thus replicate the many complexities of biological processes.

Language, understood bio-physically, perhaps even as unique to the brain, presents a persistent set of programming challenges, often leading to especially intricate models of digital computation. Even a brief overview of the complex relationship between digital computation and other linguistic operations tends to emphasize how human language use rarely conforms to textual formats, especially those featuring more rigid, algorithmically informed grammars. Computation as a practice, in fact, starkly outlines this very dichotomy by highlighting the technical limits of algorithms and programs as information tools regardless of their structural sophistication. At the same time, all bio-physical language activity appears in consistent need of algorithmic, textual augmentation, whether it simply be through improved lexicons and rule-based grammars, or lightning fast NLP tools employed broadly via ANNs across the entire internet. Digital writing technologies continue to be developed, in this way, as a specific means to address, if not solve, the inherent difficulties of aligning language as a bio-physical process with any mode of programming.

Perhaps nowhere does this challenge seem better exemplified than in IBM's recent experiment with AI and rhetorical argument the company brands "Project Debater." IBM declares Project Debater to be the first "AI system that can debate humans on complex topics," autonomously developing and delivering its own speeches on prescribed issues with the added capacity to “rebut” any counter claims or propositions for an extended parley ("AI Learns the Art of Debate," 2020). The arrival of Project Debater in effect asks us to consider the very art of argument, long presumed key evidence of reasoned cognition and free will, simply another function of information technology. Just as significant, of course, is the corresponding need to address newly apparent human cognitive deficits in such processes. Project Debater is designed to augment argumentation by pushing it beyond current human limitations. Cybernetic argumentation functions, in other words, as a way forward to improve analysis and decision-making, much as Christopher Strachey’s original experiments with M.U.C. implied significant social and cognitive interest in enhancing written correspondence through the technologies and logic of mass production. Both projects can be considered failures in the sense that the end results proved to be inferior to human efforts with language. M.U.C.’s letters proved to be less than convincing. The great debate was won by a human. At the same time, each technology provided useful technical advances for different linguistic practices. Strachey’s template may have been primitive, but the lexicons it drew from, if prepared and collected properly, suggest that such resources can easily be rendered to surpass conventional human capacities. Countless different adjectives, nouns, adverbs, and verbs, then as now, can randomly be placed in the following fashion:

> “you are my [adjective] [noun]. my [adjective] [noun] [adverb]
> [verbs] your [adjective] [noun].” (Roberts, 2017)

Similarly, Project Debater appears in any argument process to have access to countless examples and contexts it can instantaneously bring to the table. We see here how each project advances information production for the first time on the level of content. Bio-physical language processing can be critically substantiated with functional prototypes or models for information production regardless of field, format, or even genre. Hence, Strachey's templates, in terms of linguistic aims, compares well to the impressive power of today's artificial neural networks. The technical devices may have changed, but their approach to language use remains highly consistent. Since the late 1990s, machine learning language models continue to be in rapid development and are now running applications and services for some of the largest tech industries in the world, including Google (TensorFlow), Facebook (PyTorch) and SalesForce (AWSD). These advanced networks can be understood much as any grammar in that they generate text by determining a rule-based probability for how different linguistic units should sequence each other in a given body of work. Units can be words or even sentences depending how the text is meant to be read. Each of these models features what's known in neural programming as Long Short-Term Memory (LSTM) architecture, where the timing and frequency of human language use across the internet are continuously calibrated to improve the tool's predictive capability.

Some of the more sophisticated literary experiments using these very same devices can be seen in the work of David "Jhave" Johnson, who regularly combines neural network programming with his own linguistic responses he defines as "Big-Data Poetry." His "ReRites" project, conceived formally in 2011, for example, enabled him to produce 12 volumes of poetry in just 12 months. The set edition was published by Anteism Books in 2019. Each volume made use of the OpenAI GPT-2 algorithm as developed by the San Francisco non-profit research group OpenAI for generating complete paragraphs of coherent text. The GPT-2, the second model in OpenAI's experiments with Artificial General Intelligence (AGI) programming, operates similarly compared to other LSTM architectures. Jhave provides an even broader comparison between language models like GPT-2 and all prior attempts within modern culture to conceptualize linguistic practices from a technological, information-driven perspective. On one level, reading, itself, as a cognitive modality, can be understood according to the terms of an LSTM architecture.

> In the eras of the printing press, poets (writers and intellectuals) aspired to be well-read. Some aspired to breadth, others to depth, yet all recognized the cognitive benefits of reading: through the osmosis of many words, patterns and process and modes of communication became clear. Now the amount written exceeds the capacity to read, a brain beyond the brain is needed to analyze and interpret the results. Big data can digest the literary torrent. ("FQA: Frequently Questioned Answers," *BDP: Big-Data Poetry*)

Jhave's comparison of the activity of reading to modes of cognitive osmosis easily recalls Strachey's earlier project, save with better, more responsive tools. Cognitive augmentation through LSTM language models is constantly evolving, enabling artificial neural networks to predict with better accuracy both the context and content of any text being processed. At the same time, as "Big-Data Poetry" makes clear, language's increasingly complex relationship to the technical devices of algorithmic programming yields an astonishing assortment of new literary resources, while enhancing the creative capacity of poetics to pry into the role linguistic structure and pattern generally play in determining verbal meaning. Jhave considers his project to provide a critical site of "poetic intervention to demonstrate a cultural, altruistic, playful use of A.I." ("FQA: Frequently Questioned Answers," *BDP: Big-Data Poetry*).

Jhave's call for an "intervention" implies a need for active involvement, possibly dissent. AI presents a formidable challenge to how we use language, whether as speech or script; certainly, the antagonism permeating experiments like Project Debate is meant, in part, to threaten human cognitive primacy. Yet the altruism Jhave also conveys may infer a more complex tactic of mediation or mitigation. To play or toy with AI, even when directed by poesis, requires a conceptual framework that simultaneously recognizes language's dual function as both a programming device and a core component of human social interaction. Such a framework must support the cultural value of linguistic programming, especially as demonstrated in neural networks, while maintaining a critical interest in language’s bio-physical, social origins. It might be tempting at this point to arrange this dualism into a more traditional dialectical relationship, pitting human language use as a necessary and evolving antithesis to neural processing. Beyond dialectics, artists and theorists alike continue to struggle to re-imagine the very terms of literacy itself in the digital era.

Important insights into this question also appear in Gilbert Simondon’s philosophical consideration of transduction in natural systems, as first laid out in his 1958 thesis *On the Mode of Existence in Technical Objects* (2017). At base, transduction provides a possible system for differentiating symbolic, algorithm-based linguistic functions from language embodied as a material, bio-physical event, while emphasizing their interdependence. Simondon uses the term to describe the relationship between technical prototypes developed through research and their concrete realization as material events and processes. The procedure derives from thermodynamics to explain the conversion of potential energy into some kinetic form in the physical world, such as we see when an electric circuit discharges stored energy into a light bulb to produce visible light. While the electric circuit connected to the light supplies a source of ready electric current as potential energy, very little of it (only 5%) actually converts to light with the rest transforming into heat. Transduction accounts for the dual dispersal, where one kinetic event, the light, is expected and thus prioritized over the other, the heat. Eventually the secondary, regressive mode of dispersal overcomes the prioritized one, and the bulb will burn out. Any device within the circuit used to resist this process can be called a transducer, mediating between the preferred outcome and the regressive one. In the case of electric circuits, these devices would include various sustainers, filaments, etc. Simondon uses examples of circuit diagrams in his own original study to illustrate the process of transduction as key feature in all technical systems, where potential forms of energy inevitably disperse into specified concrete events, one set being determinable, and a secondary one radical, often unaccountable.

This relationship between potential and kinetic or dispersed forms of energy emerges in Simondon's work as a useful epistemological model, outlining an interdependent dualism in nature between the determinable and multitudinous. Evidence of this dualism occurs throughout Jhave's poetic interventions in A.I., where he actively – i.e., kinetically – engages linguistic prototypes to bring into being, not just a determinable, expected set of readings, but a host of other radical possibilities. In fact, to work with "Big-Data Poetry" is to witness an ongoing struggle in language between any preferred semantic expectations and a seemingly torrential wave of multiple regressive outcomes. Writers, accordingly, take on the role of transducers in order to mitigate and possibly prolong the prototype's linguistic usefulness. The composer and music theorist Paulo de Assis emphasizes similar processes in Simondon's theory to help explain its general significance in epistemology; a defining feature remains temporality. Transduction, he notes, "happens in time, it is a process, an operation with a temporal and energetic direction (even if not precisely determinable). And this temporal dimension unfolds from one point to the next, in closest vicinity from one another, but not in a full continuum" (700). AI effectively provides prototypes that help codify and therefore simplify real-time language use. At the same time, they appear to sponsor a natural degradation in form and format through ongoing individuated, concrete occurrences in time. While A.I. modeling helps us understand language use as information, using grammatical prototypes to invoke states of potential meaning, semantic processes remain the direct result of bio-physical (organic and inorganic), individuated linguistic dispersal.

Natural Language Processing seems to follow closely specific principles of transductive behavior, where information is concretely dispersed in time, expressing remnants of its modeling to varying degrees of determinability. One might even further qualify the temporal flow of this process as a kind of semantic discharge, encapsulated on one level as a programmable execution, and on another, once again, as bio-physical ambiguity. Here, language acquires a possible structure that encompasses computation as easily as human interaction; for both environments invoke states of potential meaning within an arranged, grammatical model, a programmability independent of its execution, as well as numerous concrete states realized upon said execution, some expected, others regressive. In Simondon's words, such prototypes provided a kind of "resistance module," allowing us to differentiate objects concurrently as integral, homogenous forms as well as individual, one-of-a-kind experiences or events.

Simondon intended his study of transduction to cover a wide variety of different modalities and contexts, extending beyond electro-magnetism to include the arts, economics, and the biosciences. In an early collection of essays taken from his 1958 thesis, published in France in 2005 as *L'individuation à la lumière des notions de forme et d'information*, we see transduction presented more broadly as a theory of form, designed to counter more traditional approaches, such as Gestalt Theory, by including explicit references to energy as a vital component. Whether in its potential or concrete state, form, Simondon argues, invokes specific energetic conditions as part of its very constitution (2005). When information is carried in any system, regardless of context, we see the real-time transformation of a pre-assembled constitution of forces, intensities and energies into countless new signals, each of them expressed in a single instant of time.

The application of energetic conditions to linguistic systems reveals a similarly intense interdependence between language as programmability and language as execution. Though fraught with conflict, degradation, and constant reconfiguration, the ongoing creation of multifarious linked states within just about any technical structure helped Simondon conceptualize the concrete world around us as naturally heterogeneous, and therefore never reliably derived from uniform, law-based appropriations. Transduction shows instead a sense of experiential reality where the models informing our worldviews appear ever locked in a continuous, interactive flow between arrangement and dispersal. This cycle can be further qualified as negentropic, as various states and objects simultaneously degrade and re-stabilize into new structures only to repeat the process again. The recurrent nature of any such sequence bears out, for Simondon, what he terms an especial "metastability," the nature of which can be traced to three factors originating, once again, in thermodynamics: 1. the potential energy of a system; 2. that same system's formal magnitude ("ordres de grandeur"); and 3. its ongoing entropy, or energetic degradation (2017). Linguistic processes, especially when considered in the context of computation, seem well served by Simondon's theories, especially when we conceive the computer at a basic level as an assembled state of potential computational executions ready for dispersal. Even if some linguistic systems like code appear to rely more heavily on fixed grammars, holding their potential meanings more regularly than other language practices like community-driven slang use, linguistic sense in general seems to follow transductive shifts in meaning between experiential communication and its grammatical modeling.

Transduction, with its metastable systems, gives us a unique paradigm for language practices after the dawn of programming. Computation, as innovators like Strachey and more recently David "Jhave" Johnson have shown in their respective experiments this past half-century, has significantly transformed how we perceive and engage language at both an ontological as well as epistemological level. Procedures for writing and reading, reimagined as digital, computational modalities, might usefully take into consideration Simondon’s theory of metastable, transductive behaviors to provide better insights into these new, more complex linguistic systems.

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