Talking Typewriters Talk Back

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During the 1960s and 1970s, a series of experiments involving Omar K. Moore and Richard Kobler's Edison Responsive Environment, a "talking typewriter," promised to improve literacy education for heretofore underserved student populations, including neurodivergent (mostly autistic) students (Moore 1966). While the ERE would give way to microprocessor-based tools and eventually personal computers, these experiments would continue and provide a corpus of lab reports, scholarly writing, press and government reports and other texts that describe the relationship between autistic people and computing machines. Taking into account recent developments at the intersection between disability studies and science and technology studies that focus primarily on the between autism or autists and technology, I posit that a reading of the ERE literature informed by crip and neuroqueer technoscience (Hamraie and Fritsch 2019; Rauchberg 2022) provides a view into the formative era of this now commonplace conceptual and discursive tether, and a generative origin for ways of thinking otherwise about that tether.

Theorizing the State of Autist-Machine Relations

Situating this work in crip technoscience means recognizing that "science and technology can be used to both produce and dismantle injustice," and in particular, that the means of production for access technologies "contribute to the uneven debilitation of human and non-human life" (Hamraie and Fritsch 2019). Discussing the development and use of teaching machines in the 20th century United States must include their deployment in Cold War domestic policy; William Lockett's discussion of the ERE acknowledges this very tension, discussing the interplay between government agencies and Moore's Hamden Hall laboratory (Lockett 2019, 9). In this vein, I attend to another such tension:

the relationship between the researchers who took up the ERE and similar tools, and the neurodivergent people with and upon whom they worked. Such attention is absent entirely in period discussions of this research, and only quietly present in contemporary critical work. Before this, we seek existing understandings of the relationship between the autist and the machine, and find our situation seen as either a vector of exploitation or a potential site of solidarity.

In literature about interventions on autism from a traditional disability technoscience perspective, the autistic-machine connection is taken largely for granted because of its presence as a trope in narratives about neurodivergent people (typically men) (Mauro, Ardissono, and Cena 2022). There have been recent critical interventions on this relationship that problematize this relationship, or at least some contemporary expressions of it. One of these is a reading of autistic-technological relations as exploitative; for our purposes, Os Keyes' discussion of Daivergent, an AI firm using autistic labor to classify ML model training data, represents this tendency. They pause to ask: "are autists, really, human? I raise this question because the answer that dominant frames of autism provide is "no." "(Keyes 2020, 14).

Recent interventions by J. Logan Smilges (2023) develop a long-needed "crip negativity" that, in making space for "bad crip feelings felt cripply," grants me a chance to ask Keyes' question again, but with a bit more venom: can the autist *be* dehumanized if those who have political and cultural hegemony (again, "dominant frames") over the meanings made from our lives have from the outset settled on our inhumanity? After all, Smilges asserts, "disability operates as a plasticizing ontology, infusing individuals and populations with varying degrees and qualities of humanness based on their proximity to normativity," and so far even our critical allies remain stubbornly attached to disability as the ground from which to stage our identification. One can assert, "as an autistic person — I am not a manifestation of stimuli and response. I am agential. I am Autonomously Autistic." (Williams 2018), knowing that "the concept of autonomous autists is as alien to a normative view of autism as autists allegedly are to themselves" (Keyes 2020, 15); the very need to assert that "in the end, autism is a co-occurring condition of being human" signals the reality that, outside (and even within!) our own discourses, we are not, at least not fully, human (Michael 2021). Any of us could affirm our humanity as a rhetorical

and political act, and less contested humans have every excuse not to reciprocate that assertion by changing their behavior toward us. Accepting their call to "consider the status we give to"personhood" in the first place" leads me to set aside Keyes' concerns regarding the presentation "of autists as asocial, unknowing and somewhat non-human creatures," as table stakes, and instead ask whether there is ground to be gained for the autist by rejecting the demand for acceptance into normative personhood?

Consider robots designed to help train autistic children to be more social, more communicative — in starker terms, more human. Rua Williams (2021) offers a vision of "robot-autistic solidarity" that transforms our existing pessimistic vision into something closer to an affirmative, liberatory posthumanity. After echoing some moments of "failure" from socially-assistive robotics research, Williams notes: "Perhaps autistics and robots are ready to forge collective understanding and mutual care despite substantial embodied, differences — a readiness that researchers have not extended to their objects of study" (Williams 2021, 469–70). Williams suggests that these acts of solidarity between autists and machines take place because of a more favorable set of power relations between the autist and the robot than that between the autist and a human therapist (Williams 2021, 470). I am inclined to accept this framing as a point of departure for an analysis of a much earlier series of experiments in machine-teaching that display similar moments of apparent failure. From these moments, my purpose is to explore not only the formation of autist-machine kinship, but how the perception of that kinship has developed toward a solidarity founded on autistic curiosity and its safe expression in a predictable responsive environment. Williams elsewhere employs "authors' own descriptions of participant actions to demonstrate how a participant voice has the power to puncture researcher containment via acts of microresistance" and it is these very moments of researchers, in effect, 'telling on themselves' that form the basis for the present study (Williams 2019). Before me are texts that display moments of "enacted resistance wich can be read as commentary on" the Talking Typewriter experiments, their aims and their means (Spiel et al. 2022). It is in these moments that the autist-machine relationship is brought to the foreground, and from which explorations of the nature of that relationship are possible.

On Understanding Misfits and Glitches

A theoretical foundation for understanding misfitting and glitching makes these moments of enacted resistance visible. "Misfit" is used here in the sense described by Rosemarie Garland-Thomson, as a noun for a kind of relationship of disjuncture, or flawed/"awkward" connection between "body and world" (Garland-Thomson 2011, 593). This relationship is material in nature, a "moment in spacetime where a particular embodiment encounters a disjunctive relation with the socio-material environment", per Williams (2021, 456), though I cannot follow their reasoning further and use "misfit" to describe the body under such relations. If I am to characterize the position of the autist vis-á-vis the machine, I will need to have means by which to describe both the character of that relationship and the range of possible moves it presents to the inhabitant of that position.

Thus, with "misfit" comes "glitch", a term that I come to primarily by way of Whit Pow's (2021) discussion of Jamie Fenton's work, and her role in the history of the discursive link between trans women and computing. While the history is important and of interest, what is vital to my work here is Pow's expansion of the glitch as a concept amenable to critical study, particularly their development of a kind of vocabulary of effects: "a momentary experience of undoing," "revelatory in terms of power structures," "operating outside [the machine]," a "possibility of different outcomes" for which the beholder might consider themselves "lucky" or "deserving" (Pow 2021). These effects can be seen throughout the literature, at work in the interplay between the autist and the machine, and coming from both participants, and are made visible here by this framework of glitching where a literal reading of talking typewriter research might only reveal straightforward reports of experimental failure.

Legacy Russell (2020) contributes exactly what is necessary to bridge between the embodiment of the misfit and the operation of the glitch. For her, "glitched bodies" are those that "cannot be programmed" and thus are "by the seizure of [their] uselessness" made illegible, imbued with a freedom to act afforded by the condition and process of failure (Russell 2020, 25, 75). Out of the synthesis between Pow and Russell's work on glitches as a concept comes a sense of both its embodiment and its effects; these are enhanced when glitching is understood as an action available to misfits, or an effect producible by misfits. Taken together, the misfit and the glitch offer a common language for interpreting the

moments of unexpected, spontaneous creative expression and un-programmed behavior spread throughout the ERE research literature and press coverage.

Moore's Theory, Kobler's Typewriter

Omar K. Moore (1961, 1966, 1971), Mary and Campbell Goodwin, (1969), Lassar Gotkin (1969) and others studying the Edison Responsive Environment leave behind a literature that represents some of the earliest non-behaviorist attempts at introducing machine-teaching to the classroom. There are other firsts it could claim, to be sure; Lockett (2019, 9) suggests that the relationship between the user of a talking typewriter and the apparatus itself can be read to prefigure the relationship between the home computer user and their machine. I am interested in how these experiments and their accompanying texts offer material to develop a history of the relationship between autistic subject formation and information technology writ large.

Both the mechanical and social elements of Moore's work must be understood in order to appreciate how Moore's environment creates space for experimentation. This understanding begins with Moore's sense of the "autotelic" (Anderson and Moore 1960). Moore and Anderson begin from the observation that because "we learn largely by practice" to solve problems, but that "failure to solve a problem [. . .]might have serious consequences," there must and do exist a set of "common activities" whose purpose is to permit such practice without its accessory risk to participants (Anderson and Moore 1960, 206). Autotelic activities are isolated from the larger society to a degree that prevents error from causing harm, are "intrinsically rewarding," and must replicate actual problems faced by society with enough fidelity that engaging in the activities would "help a child to learn the relevant techniques" for the simulated problem in question (Anderson and Moore 1960, 206–7). Moore and Anderson argue that "autotelic folk-models" of everyday life are universal features of human societies that constitute the means of transferring practical knowledge; with this in mind one can begin to make sense of certain material featurees of the ERE, such as the inclusion of a typewriter as the primary human interface, as attempts to transfer an element of mid-twentieth century white collar work culture into the autotelic domain Moore envisioned for his child users.

There are features of the ERE that enable its users to bring glitches into sharper relief,

something one might call, with apologies to both Babbage and Williams, a "metaresistance engine". Some of the traits by which Moore defines his concept of a "responsive environment" (such as free use and exploration, immediate feedback, "self-pacing" instruction, permitting the user to draw connections on their own that relate to the "physical, cultural or social world") appear designed to produce, or even encourage, unexpected behavior from the user (Moore 1966, 170). It is here that Moore, whether or not he ever fully realized, cast his lot against behaviorism, which in the intervening decades has become hegemonic in most methods of socializing neurodivergent children into adults. Writing during a period in which behaviorism has taken hold in many aspects of human endeavor, and as an autistic person whose childhood was marked by the use of behaviorism as a means to attempt to normalise my expression of self, I am satisfied that the approach of Moore and others who took up the ERE as both a tool and a method offers a counter-behaviorist intervention.

Two such early adopters of the ERE were Drs. Mary and Campbell Goodwin, a pair of pediatricians from the New York State Department of Mental Hygeine, who saw the potential of the talking typewriter as a therapeutic intervention for autistic patients during a period in which "care of the whole child [was] available to few" and the neurodivergent child could only look forward to an institutionalized life, "in a stone-floored, barren room with only a television blaring in the corner to tell him and his companions of another childhood outside the walls of the institution" (Goodwin and Goodwin 1969, 551). Starting from the assumption that, "in the child's eyes, success in reading [means] success as a person; failure in reading [means] total failure," and identifying Moore and Kobler's mechanical intervention as an emergent tool in reading pedagogy, the Goodwins made the ERE the centerpiece of a "year-round study of communication disorders" centered on a population of 65 autistic children (Goodwin and Goodwin 1969, 553, pp.556–7).

The behavior of the Goodwins' child test subjects is similar to that observed by Moore: "When Robbie went home 15 minutes later, he had left behind him a full page of random typing interspersed with many words," most of which were brand names of various detergents. (Goodwin and Goodwin 1969, 559). Others of the Goodwins' autistic typewriter users engaged in simiilarly echolalic writing, naming television programs, common household brands, or other text to which these children — presumed not to be

previously literate — would have been exposed through the mass media of the period (Goodwin and Goodwin 1969, 559–61). Clinical understandings of echolalia as a symptom have shifted during the lifespan of autism as a diagnosis, from a language development issue to being understood as " "restricted, repetitive patterns of behaviors, interests, or activities," along with "lining up toys or flipping objects" ", and ultimately as a communicative act — something the Goodwins were prepared to claim fifty years ago.(Gernsbacher, Morson, and Grace 2016).

Unfortunately, the citational history of "In a dark mirror" belies its authors' foresight; while at least one subsequent essay cites the Goodwins as prior work in facilitated communication (Biklen 1990, 304), others appear more interested in an aside in the essay about the possible link between autism and gluten sensitivity (Stevens et al. 1977; Croall, Hoggard, and Hadjivassiliou 2021 for example). Rather than wading further into etiological arguments about autism, however, I want to foreground one claim the Goodwins make about the ERE: that it "was less an agent for change than a focus for discovery," that it "was the instrument that showed us abilities not measured by conventional psychological tests"(Goodwin and Goodwin 1969, 562). Moore and Kobler's invention, to the Goodwins and to myself, emerges less as a machine-teaching device in any recognizable form, than as a communication technology with specific affordances for the neurodivergent user, making it a useful situation in which to tease out moments of autistic expression for its own sake.

So what happens when the ERE is used toward behaviorist aims, by researchers who "[focus] on reading behavior" and seek "maximum time dealing with reading behavior" through the use of the Talking Typewriter? Does the ERE render its stated benefits when those in charge of implementing it seek vastly different benefits, such as the machine's impatience with error or as "external feedback" in "correcting behavior" (Gotkin and McSweeney 1969, 27, 31)? Lassar Gotkin's work with the ERE displays a radically different set of priorities to Moore's, lamenting that"the controlling effects of a live teacher and group conformity are absent" in the typewriter cubicle, concerned more with "attentional problems" than with the ability of a child to choose whether to engage (Gotkin and McSweeney 1969, 38). Indeed, he goes so far as to reject the label "responsive environment" in favor of viewing the ERE as an "attentional environment"(Gotkin 1966, 237). Where Moore sees the ERE as a tool for enabling and observing the social development of children,

Gotkin envisions something much closer to the behaviorist roots of machine teaching, or to the then-common "programmed instruction" primers, something informed as much by corporate training materials as by literacy pedagogy. An example of what Gotkin has in mind for the ERE is a game in which the typewriter prints a character, then locks all keys except that character so that the pupil user can only actuate the correct key (Gotkin 1966, 236). There will be no typographical echolalia of the sort the Goodwins documented. So, will Gotkin be able to compensate for having seemingly missed the entire point of the ERE, and ensure that children use the machine as he intends them to?

Earlier work by Gotkin offers some moments of "idiosyncratic" behavior in the face of the ERE, which he calls "intermittently rewarding and frustrating" (Gotkin 1966). He presents two examples of such conduct:

> For example, on the same tape referred to above, the question is asked, 'Is the fireman's hat heavy or is it light?' One child answered, 'Be heavy for you but be light for Superman.'

> . . . a little girl appears juxtaposed against letters that dwarf her . . . we did not expect to hear what one little boy said on each of the two occasions he met her. Leaning down to the speaker where the girl's voice comes from, he announced, "Little girl, I love you." (Gotkin 1966, 234)

These moments signal a gulf between Gotkin's belief in the value of the ERE as a traditional machine-teaching tool and the manner which the children he experimented upon engaged with it. For the first child, it was clear that Gotkin's lessons were asking called for nuance where Gotkin offered binary choice. Thanks to the boy who became enamored with the girl in the machine, however, we are shown a glimpse of what solidarity with the mechanical might entail.

These are moments when the conventional behaviorist order under which Gotkin is laboring fails to account for the nature of the ERE as an instrument; Gotkin almost admits that there is something to these ruptures by acknowledging that they can be "intermittently rewarding," but quickly sets them aside to articulate that their emergence is counter to his view of what the ERE is for. Where Moore wants to study autotelic learning, Gotkin is interested in being able to mechanically reproduce lessons, in using the ERE to "increase

accuracy in the observation of learning" — to transform the subjective, even ineffable qualities of pedagogy into quantities (Gotkin 1966, 237). Refusing to accept a question on its own terms, developing affection with the machine — these are resistive acts, or at the very least, acts that so disrupted the order of Gotkin's laboratory that they merited discussion, while also being so alien to his method that the analysis they receive amounts to casual dismissal.

Conclusion (Provisional)

Others' work with the ERE and similar devices deserves brief mention. Richard Kobler, the engineer responsible for building Moore's contraption, worked with his wife Edith, used the Talking Typewriter in research intended to prove that "an autistic child is a 'reversed schizophrenic' because he lacks" an internal dialogue; in these experiments one child would repeatedly depress the space key as a form of self-stimulating behavior (the extinguishing of which becoming a major focus of this child's therapeutic program) (Kobler and Kobler 1971, 18–20). Kenneth Colby, whose other work on psychology and computing includes using early artificial intelligence systems to simulate the experiences of belief and paranoia, also focused on autistic language acquisition, and that focus lead him and his colleagues to develop a teaching machine that in many respects clones the ERE to a PDP-10 minicomputer; following his citational trail shows only one enagement with Moore's work, and a complete lack of engagement with other researchers working on this problem (Colby 1973; Smith, Newey, and Colby 1971). His work achieved similar results to the Goodwins' but is mostly notable for containing an explicit early statement of the perceived autist-machine connection (Colby 1973, 254). Analysis of these studies is the subject of my ongoing work.

What we are left with, though, is a provisional conclusion regarding two central questions: the historical question of how did the perceived relationship between the neurodivergent person (and particularly the neurodivergent child) and the computing machine become a trope in research concerning both subjects, and the political question of whether and how neurodivergent people can use this perceived affinity to live a freer, more satisfying life among our mechanical comrades. The ERE research on autistic children happened largely contemporaneously with the emergence of autism as a topic of public concern;

researchers who worked on the ERE also worked in circles dedicated to the formation of an expert class around autism (the Koblers and Goodwins speaking at NSAC, Colby citing Rimland) and as such, influenced both the definition of autism. What this presents the neurodivergent person of today is a choice of whether to accept the perception as it is or treat it as a stereotype to be rejected; what motivates my work is an interest in finding another path out of this question, a means of turning this presumption into a means of liberation by acknowledging how the neurodivergence-computing link came into being in part because of research that opposed the stifling behaviorist orthodoxy in whose name so much abuse has been wrought. In this history of resistance by child research subjects is a model of how to engage with the machines of our own moment.

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