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**On the Relational Autonomy of Materials: Entanglements in  
Maker Literacies Research**

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Keywords:	posthuman approaches, maker literacies, classroom-sited research
Abstract:	<p>This article addresses key components of posthumanism and maker literacies by reporting on empirical data from two makerspace research sites. Using posthuman methodologies, we suggest practical considerations the relational autonomy of materials through entanglements between humans, non-humans, and more-than-humans in makerspace classroom settings. We propose answers to the following research questions: How do materials manifest their relational autonomy in makerspaces? How could the relational autonomy of materials impact maker literacies pedagogy? With this article, our contribution warrants researchers to think about the unpredictability of maker work through posthuman methodologies, and how maker projects can help speak against the failing student rhetoric in literacy education.</p>

## On the Relational Autonomy of Materials: Entanglements in Maker Literacies Research

**Abstract:** This article addresses key components of posthumanism and maker literacies by reporting on empirical data from two makerspace research sites. Using posthuman methodologies, we suggest practical considerations the relational autonomy of materials through entanglements between humans, non-humans, and more-than-humans in makerspace classroom settings. We propose answers to the following research questions: How do materials manifest their relational autonomy in makerspaces? How could the relational autonomy of materials impact maker literacies pedagogy? With this article, our contribution warrants researchers to think about the unpredictability of maker work through posthuman methodologies, and how maker projects can help speak against the failing student rhetoric in literacy education.

**Keywords:** maker literacies, posthumanism, makerspace, materials

## On the Relational Autonomy of Materials: Entanglements in Maker Literacies Research

### Introduction

Since early 2010, maker education has generated much attention in early childhood research and makerspace development at the pre-primary, primary, and secondary levels, from research on DIY (Knobel and Lankshear, 2010), connected play (Marsh, 2017), toy hacks (Scott and Wohlwend, 2018), circuitry (Peppler et al., 2018) and coding (Kafai and Burke, 2014). Some of the epistemologies underpinning these maker-oriented studies are new materialism (Barad, 2007) and posthumanism (Braidotti, 2018). These theories are helpful in illustrating makers' affective intensities in classroom contexts (Rowse and Shillitoe, 2019), agential cuts in documentary film-making (Lemieux and Rowse, 2020), preschoolers' playdough play and collaborative practices with a focus on intra-actions (Wohlwend et al., 2017), adolescents' digital composing (Dernikos, 2018; Kuby, Spector and Thiel, 2019), and children's compositions as posthuman 'becomings' when they use GoPros in the forest or the classroom (Harwood and Collier, 2019; Wargo, 2018). Drawing on posthumanism, Scott and Bird (2019) established that flexible, mosaic-like methodologies (Clark, 2003) allowed them to see how research 'tools' shape—and are shaped by—research contexts, humans, non-humans, and more-than-humans, highlighting tensions and possibilities in postqualitative research. There is much to consider in these tensions and possibilities, and both posthumanism and new materialism are valuable in considering the autonomy of materials as spaces of convergence where bodies↔concepts↔feelings↔shapes↔moves↔hesitations↔convictions collide. This superposition of emulsions as affective dynamisms—moving between the tangible and the ephemeral—create relational conditions where materials are part of entanglements. Within these, materials express both their rigid formality and their open flexibility as a bendable meshing of

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3 particles (Keune and Peppler, 2019). In other words, humans can work with materials and materials  
4 can work with humans to form dynamic becomings (Sheridan et al., 2020). More studies need to  
5 attend to these features of materiality, with more concern toward the impact and affects they  
6 generate. Drawing on empirical data from two research sites, we ask: How do materials express  
7 their relational autonomy in makerspaces? How could the relational autonomy of materials impact  
8 maker literacies pedagogy? Research on teachers' maker literacy practices (Woodard, 2019) and  
9 students' maker literacies (Rowse and Shillitoe, 2019; Rowse et al., 2018; Wohlwend et al.,  
10 2018) pushes us to address the possibilities and tensions of posthumanism in makerspace research.  
11 We exemplify this research by attending to posthuman methodologies and by being receptive to  
12 how data glows in relationality (MacLure, 2013). This investigation is made possible by using  
13 such posthuman methodologies as a playful diffraction of the transcription of intra-actions (Kuby,  
14 2017a), as well as attuning to intra-activity with materials as “the entangled intra-actions of people,  
15 writing tools, technologies, time, space, environment, and so forth” (Kuby, 2017b, p. 885).  
16 Presenting entanglements with data allows us to attend to the relationality of materiality, language,  
17 affective moments, space, place, and objects—with an acute understanding that these dimensions  
18 are weaved in together and are, therefore, inseparable (Zapata et al., 2018).

### 40 **Definitions and Research Sites**

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42  
43 In this article, we engage with the entanglements between materials, humans, and non-  
44 humans in two makerspace research sites<sup>1</sup>. Examples from these studies are organized under  
45 assemblages and ‘becomings’ (Deleuze and Guattari, 1980). We use the Deleuzoguattarian

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53  
54 <sup>1</sup> These research projects have received external funding through the Social Sciences and  
55 Humanities Research Council and internal institutional funding from Mount Saint Vincent  
56 University.  
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3 concept of becomings i.e., the movements within assemblages that deterritorialize elements and  
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5 reterritorialize them in new dynamic realms without organisational, hierarchical structures. An  
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7 assemblage is an unorganized constellation of elements that brings about effects in the material  
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9 world (Deleuze and Guattari, 1980).  
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13 The first research site was an elementary school in Southern Ontario, Canada. The study  
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15 took place in spring 2018 with twenty 4<sup>th</sup>-grade students who storyboarded short stories, coded  
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17 them with MIT's open-access *Scratch* software, and built circuits with MakeyMakeys, bananas,  
18  
19 pins, rings, clips, and other everyday objects. The second site was a graduate class of a Canadian  
20  
21 university where in-service teachers, some more experienced with technology and craft than  
22  
23 others, designed a student-oriented maker activity and created an artefactual composition as a  
24  
25 result of that process. These maker productions involved material, digital, and hybrid making,  
26  
27 following teachers' level of comfort and expertise with making. On the one hand, we define craft  
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29 as a form of material making where technology does not necessarily impose its presence. Hybrid  
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31 making, on the other hand, channels tenets of craft and digital making, and these features are  
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33 determined both by the crafter and the material's level of flexibility. Finally, technology-oriented  
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35 making presupposes the use of computer or app-based software to program digital artefacts. Both  
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37 research sites required one or more of the types of making as part of the making phase.  
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### 43 **On the Relational Autonomy of Materials**

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46 It has been argued, in the new materialist turn, that entanglements enact agency in their  
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48 relationality with the world (Barad, 2007; Jones and Boivin, 2010; Tilley, 2011). While materials,  
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50 as entities and elements, do not exert agency in new materialist terms, they perform agential cuts  
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52 (Lemieux and Rowsell, 2020), which in turn create ripple effects—on humans, non-humans, and  
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54 more-than-humans—that nurture their relational autonomy. From a Baradian new materialist  
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3 perspective, we argue that that the relational autonomy of materials is performed in webs of intra-  
4 actions and relationality. The relational autonomy of materials presents mutual relationships—a  
5 sense of entangled relationality—between humans and objects: it is not a localised entity residing  
6 in something or someone (Jones and Boivin, 2010; Niccolini et al., 2018) nor does it consider  
7 separate entities and their interactions in the world (Sheridan et al., 2020). The rigid formality of  
8 objects propels us as researchers to think beyond the concept of human-driven agency to consider  
9 material autonomy as a space where affective forces collide in relationality. These forces are  
10 channelled by humans through perception, reason, and intuition (Grosz, 2017). Drawing on  
11 Spinozian ethics, Grosz (2017) argues that reason results from rationalising perception, and that  
12 intuition echoes what we often call “gut feelings”. Apprehending materials, whether digital,  
13 hybrid, or physically tangible, falls into the realm of human perception, which regulates  
14 experiences of the world. Ruminating on the selection of materials and moving between options  
15 for craft are actions that pertain to reason. Reason is not a fixed process but rather one that  
16 modulates—and is modulated by—time, context, and situated objectives. Finally, intuition is as  
17 important as reason, insofar as it drives “a knowledge of the order of connection and necessity that  
18 binds even the smallest and most apparently trivial things, extended or conceptual, to the entire  
19 order of substance” (Grosz, 2017, p. 69). Humans, Grosz explains, rationalise their perceptions of  
20 materials through reason, metacognition, and reflection. By reflecting, rereading, problematising  
21 concepts, thinking is a rationalisation that refines perceptions about the relational autonomy of  
22 materials. An emphasis on process—or what cognitive psychology dubs “procedural  
23 knowledge”—directs attention to engagement with materials, and that attention is necessary as a  
24 first step in identifying the concept of relational autonomy. A second step presupposes an  
25 acknowledgement that humans are not superior entities and are simply a part of entanglements  
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3 with materials. By making with materials, the concept of authorship becomes dynamically  
4 territorialized and deterritorialized. Meaning becomes secondary to matter as it is provisional  
5 within the universe.  
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10 For the field of literacies, working with the emergence of material combinations, adjusting  
11 to the friction between surfaces, and apprehending textual play, are all human actions that speak  
12 to the relational autonomy of materials and frame tinkering as an assemblage—a dynamic  
13 construction and deconstruction of literacy events. Materials push humans to make relational  
14 decisions in the world, and these decisions would not take place independently without being  
15 entangled in contexts, places, and time. Reality and imagination are intertwined in materials and  
16 this is where they exert their relational autonomy. Materials exist in the world whether or not they  
17 are found or used, and they demonstrate their autonomy in the planes of immanence (Deleuze and  
18 Guattari, 1980), between idea↔object, intentionality↔product, immaterial↔material. Those  
19 spectral materialities echo such literacies aspects as the mobile and the moving (Nordquist, 2017),  
20 the ephemeral and the relational (Burnett and Merchant, 2018), as well as the felt and the affective  
21 (Ehret, 2018).  
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39 Recent acknowledgements of the relational, rhizomatic, and ephemeral qualities of  
40 mattering, as opposed to the humanist, structured, permanent aspects of literacy, lead us to believe  
41 that there is much space to recognise the relational autonomy of materials in maker research. Taken  
42 widely as a cross-disciplinary field, literacy has much to gain in that area to inform other ways of  
43 meaning-making. Humanistic concepts such as “giving voice,” or “granting agency,” seem futile  
44 to us if we think with posthumanism and the affective turn (Rowell and Shillitoe, 2019) as opening  
45 up possibilities to listen more, attune to our senses, amplify our research perspectives, and reject  
46 rational objectification in the fashion that traditional qualitative research pulls us to do (St. Pierre,  
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3 2011). Engaging in such awareness of the senses and response-ability (Haraway, 2016) calls for  
4  
5 ‘sticky’ work (Ahmed, 2014; Rowsell et al., 2018; MacRae et al., 2018) and literacy researchers  
6  
7 must resist the urge to always make research and literacies clean, proper, and orderly. What then  
8  
9 does the relational autonomy of materials look like in entanglements between matter, humans, and  
10  
11 non-humans?  
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### 14 15 **Methodology: Diffracting with Materials and Sites** 16 17

18 Theory acts as an assemblage of human, non-human, and more-than-human ‘bodies’—  
19  
20 participants, researchers’ bodies, backgrounds and identities, perceptions, time, environment,  
21  
22 materials and settings (Jackson and Mazzei, 2012). Reading data as a collision of forces with/in  
23  
24 theory and adopting diffraction as a lens for analysis (Lenz Taguchi, 2012; Jackson and Mazzei,  
25  
26 2012), we build on recent work (Lemieux and Rowsell, 2020) to consider entanglements between  
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28 materials↔research sites as we think diffractively with data. Thinking diffractively requires  
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30 acknowledging overlaps and interferences, while diffractive analysis “requires us to engage in an  
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32 event of reading and becoming-with the data, rather than reading it from a distance and as separate  
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34 and apart from it” (Lenz Taguchi, 2012, p. 272). This onto-ethico-epistemology allows the “effect  
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36 of being affected, where thinking and imagining exceed data and ourselves as researchers” (Lenz  
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38 Taguchi, 2012, pp. 276–277). Arts-based educational research methodologies, such as collage to  
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40 remix materials (Collier, 2018; Franklin-Phipps and Rath, 2019) and affective-material yarn work  
41  
42 (Niccollini, Zarabadi and Ringrose, 2018), fall under that realm insofar as data is diffracted by  
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44 creating something else through a transcorporeal intra-actions with the data. For example, when  
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46 using collage and remixing materials, such human concepts as peer plagiarism or imitation become  
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48 secondary to mattering, where “small ideas and images appeared to travel around the room”  
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50 (Collier, 2018, p. 125) and, consequently, where entangled webs of phenomena emerged. An  
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3 answer to the call to highlight entanglements between materials, humans, non-humans, and more-  
4 than-humans in literacies, the following vignettes from our two research sites will explore the  
5 “mutually constitutive relationship between people and materials” (Kuby, 2019, p. 130). Drawing  
6 on Lenz Taguchi’s (2012) diffractive methodology and Kuby’s (2019) posthuman vignettes as a  
7 way to think with theory and data (Mazzei and Jackson, 2012), we present assemblages of field  
8 notes (subsections identified), images from the two research sites (image captions are left off to  
9 not interfere with flow), and interview transcripts. To do so, we espouse the tenets of  
10 posthumanism in understanding that “posthumanism is not about getting rid of humans but rather  
11 seeing them as a part of relations with non-humans and more-than-humans” (Zapata et al., 2018,  
12 p. 481). These posthuman vignettes are research site specific. These data across the two research  
13 sites are woven in to think relationally with materials in literacy contexts. Thinking with  
14 posthumanism, our intent is to show, not tell, and leave out guided, structured interpretation.  
15 Below, Julia (or “J”) is an elementary mathematics school teacher, while “A” represents the  
16 researcher (Amélie).

### 35 36 **Paper↔Cans↔Julia↔World War II↔Enigma Machine**

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39 *Field notes:* Julia made an enigma box and showed me how it worked as she turned the  
40 rotors, and verbalised the mechanism the way she would if she was teaching a unit in the  
41 classroom.  
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### 45 46 **(Insert Figure 1: Julia-Rotor)**

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48 A: And how would you explain the project that you did—the Enigma Machine?

49  
50 J: I like to give a little bit of history like I did in class, so the fact that it was used in the  
51 Second World War to intercept high-level strategies. I tell them they will make a paper model  
52 of that, and I show them all the materials, and then we’d get into the building part and step  
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3 by step - I did some this week - it took a full three hours just to build it before I even show  
4 them how to use it.  
5

6 A: What's your overall observation on that?  
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8 J: The kids actually said to me, but Madame, is this science, is it maths - what is it? And I  
9 was able to tell them no, because this is – we're coding right now, we are learning about the  
10 Second World War, we're learning about famous mathematicians, we're using our hands to  
11 build things from scratch, we're re-using materials. We're using all these cans to build  
12 things, we're re-visiting concepts that you've learned in past years, how to create angles  
13 again, so we're using all these materials - so no, we're not just doing maths, we're not just  
14 doing – it's cross-curricular. I had one student say, Madame your rotors, they move so  
15 smoothly - I can't - mine it keeps getting stuck on tape, and they couldn't come up with  
16 solutions for that. And one boy actually had to see my end product, and then I started to think  
17 after class, maybe I shouldn't have had mine out at all, but I didn't know that until now.  
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29 *Field notes:* Julia expressed that she did not like how loose the rotors were at first, then she  
30 realised that they rotated easier that way, and the resistance is now how she wanted it. She told me  
31 the process made her think of Carr and Gibson's (2016) *Geographies of Making* and was reminded  
32 not to see the resistance as an obstacle but as something to work with, citing a quote that was  
33 important to her, in her words, "under section III, the paragraph on The Social Life of Making:  
34 'Following materials in this way calls for a more productive view . . . rather than obstacles to be  
35 overcome.' (p. 303)". I (Amélie) had recommended Carr and Gibson's (2016) article because, as  
36 Julia was tinkering and thinking about the materials she wanted to use for her rotor, she indicated  
37 her struggle with how the paper fit and the reading, in my view, normalized the sometimes tedious  
38 and complicated tinkering with materials. It was my hope that thinking with this article would  
39 spark new conversations about the meaning of mattering and how materials, sometimes, 'have  
40 things to say'. As a follow up to her maker activity, Julia made four additional enigma machines  
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3 for her class presentation and her peer teachers tinkered with them, following instructions to  
4 decrypt a message on the rotor. She provided a handout for everyone in the class, with detailed  
5 steps for her peers to follow if they wanted to replicate that activity in their classroom.  
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10 In her presentation, she said how “Let’s turn ‘MATH’ into a secret code” is the first prompt  
11 she usually gives her students. I heard lots of laughter as teachers played with the rotors, said letters  
12 aloud, and voiced things like ‘that’s really cool, I have kids who would love that’.  
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18 **(Insert Figure 2: Rotor)**

19  
20 (The codes below accompany the image)

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23 M→J message key of ABC

24  
25  
26 A→C message key of ABD

27  
28  
29 T→J message key of ABE

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31  
32 H→Q message key of ABF so the third rotor is the one that changes.  
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34

35 **(Un)sedimenting Entanglements**

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38 Posthumanism does not brush aside our response-ability to go back to our participants as  
39 we develop richer felt narratives of what happened in the classroom. Therefore, in fall 2019, I  
40 asked Julia to meet with me and gather her thoughts about how she felt about the first draft of this  
41 article. In a response-able effort to ethically account for her entanglements—a complex venture  
42 when working with postqualitative research—we discussed the field notes section in particular.  
43 We both remembered the conversation we had in my previous office (which physically changed  
44 over the summer), and we could reminisce being-there-in-the-moment. When reading the field  
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3 notes aloud, we situated them in the context of Julia's presentation when she explained to her peer  
4  
5 teachers how to use the rotor in a maker-oriented mathematics lesson.  
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8  
9 Julia read additional articles on posthumanism, mostly because of personal interest, but  
10 also because she demonstrated a disciplined sense of rigour and response-ability towards learning  
11 and education. As she expressed, it would not feel right to her to set those expectations for her  
12 students if she did not model this behaviour herself. She then shared with me how her students  
13 showed up to her class every day despite going through difficult events (e.g., illnesses, loss of pets,  
14 grandparents), and that if they came in ready to learn, then she should be ready to teach them. Her  
15 perspective is self-described as very open-minded, she was receptive to posthumanism herself, and  
16 that the more she read on the topic and reading this draft, the more she was receptive to those  
17 material, open, rhizomatic ideas. Julia explained that reading posthuman articles and engaging  
18 with mapping methodologies helped her understand that the materials she utilised did not always  
19 work the way she wanted them to. For example, the construction paper she wrapped around the  
20 rotor was too rigid for it to make it turn smoothly. Rather than seeing this as an obstacle, she  
21 expressed that this experience turned out to be useful in adapting to materials and testing what  
22 materials were most useful to make the rotor turn. This process was helpful in understanding the  
23 types of thoughts, struggles, and processes her own students would go through as they engaged in  
24 maker activities.  
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46 On more than one occasion, Julia told me that reading the first draft of this article made her  
47 think about this well-known adage "you don't know what you don't know," and that "thinking  
48 with theory" (Mazzei and Jackson, 2012) provided a new outlook on working with materials, an  
49 outlook that is not often privileged in schools. In class, we had discussed Harwood and Collier's  
50 (2019) chapter on new materialist frameworks in thinking about methodologies and using  
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3 wearables like GoPros, which reminded her of how teaching methods in cross-disciplinary  
4 literacies need to embrace flexibility when doing projects with children. Our conversation about  
5 the first draft and other articles we both read sedimented entanglements as they came-to-matter-  
6 through-the-moment. These are still dynamic as we write this—and they will be when readers will  
7 get to this piece. There is a sedimenting, crystallising force that comes with writing this vignette  
8 which ruptures the dynamism, but the reading dynamises it again. Reading is always a rhizomatic  
9 venture, so is making.

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20 As Julia read the article draft, an initial 4,300 words, she noted how a sentence that stuck  
21 with her was this one, from the original draft, now found in the conclusion: “can materials choose  
22 humans to channel their existence?” As an elementary mathematics teacher, Julia resonated with  
23 this question (or the question resonated with her) because, as she explained, when children engage  
24 in maker activities they go beyond problem-solving as they go through their making processes and  
25 think about materials and their relational autonomy. Our conversation lasted about 45 minutes,  
26 much longer than our original, semi-structured, qualitative interview, and this exchange made us  
27 think with new ways of looking at the data together, as it became  
28 researcher↔Julia↔paper↔rotor↔students↔maker↔education. This entanglement stretches the  
29 understanding of materials as units; rather it positions them as relational and central to learning.  
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What emerged at the conclusion of that dialogue was an appreciation for the materials, and how it  
sparked new conversations about their sustainable use in more extensive makerspace projects with  
her students. Julia tinkered with soda cans in her project because of their shape mimicking a rotor,  
not because of sustainable concerns, however this second conversation on sustainability led to a  
larger consideration to use recycled materials in future projects. This is an instance where the

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3 relational autonomy of materials is once again enacted, rhizomatically, through reading, talking,  
4 and making.  
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8 **MakeyMakeys↔Software↔Children↔Pins↔Posters↔Markers↔Us**  
9

10  
11 We now turn to our second research site in Southern Ontario, working with elementary  
12 school students. Like in Julia's case, we offer entanglements with field notes and notice how we  
13 attuned to 'sonic resonances' (Brownell, 2019) as we noted down moments of digital composition  
14 with children. While we could not go back to our participants as we moved cities since the end of  
15 this research project, we could retrace moments when we felt data glowed (MacLure, 2013), and  
16 we present these moments below through field notes that speak to the relational autonomy of  
17 materials. We pointed out those moments in bold, following Kuby's (2019) posthuman  
18 methodology to resonate with these forces in entangled data.  
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30 *Field notes:* This morning, elementary school students are given 15 minutes to finish their  
31 posters in relation to their *Scratch* project and the *MakeyMakey* kits. Then, they will present their  
32 posters to the classroom. **Billy and Jane are going around, colouring with markers, pasting**  
33 **animal shapes, tinkering with sound, using glue sticks to paste coloured images and printed**  
34 **text from their dialogues.** They are in groups of two looking at each others' stories, commenting  
35 on them, listening and interacting with each other.  
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45 **(Insert Figure 3: Children composing)**  
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47 We are hearing the following sounds and conversations:  
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50 "look at this person's speech, what is that?"  
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53 **"This thing! Dtititi"**  
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3 “How many holes do I need to punch? Well- how many things are you attaching to your  
4 MakeyMakey?”  
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7  
8 (LOUD duck sounds) Mrs. MacPherson (teacher): **“OK—thank you duck!”**  
9

10  
11 **“Mrs. MacPherson, can you print just a Scratch symbol? I want to paste it on my poster”**  
12

13  
14 “I got kit #1, cause I’m number one!!”  
15  
16

17 In a rush, **Mrs. MacPherson prints things** for students who want to paste last-minute elements  
18 on their posters.  
19

20  
21  
22 “Do you want to show me your project? Alright”  
23

24  
25 Students are really focused today as they finish up their projects and cutting and pasting. **Brittany**  
26 **printed an image of her character from Scratch and she pastes it on her bright green poster.**  
27

28  
29  
30 “Brittany, I got your Makeymakeymakeymakeymakey!”  
31

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33  
34 “Brittany, have you seen Jason to see if he can help you? – No not yet, – I might have found a  
35 solution myself”  
36  
37

38  
39 Billy and Jane are showing their projects to the student-teacher as well and they look proud to  
40 show their work to as many people as possible, especially adults, and walking them through their  
41 story.  
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45  
46 Jason: **“See this, every time you touch this and this, the power goes through”**  
47

48  
49 Lots of students are REALLY (my emphasis) excited to show us their completed stories, especially  
50 their posters. **Brittany is using alligator clips to attach elements of her story to her poster. I**  
51 **hear scissor sounds . . . “and they were happily ever after”**  
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3 Ethan selects all **the brown markers from different boxes** to colour his Scratch character, a grim  
4  
5 reaper.  
6  
7

8 **(Insert Figure 4: Markers being used)**  
9

10 Students who are done are scaffolding others.  
11  
12

13 “Do you want me to go get you something, **a coloured marker**” “**I brought you two**  
14 **browns**” Things on the coloured posters: **Speech from the Scratch narrative, shapes and forms,**  
15 **pictures of characters, key symbols found in the stories (e.g. a basketball or a key if these are**  
16 **important elements), flexible alligator clips linked to the MakeyMakeys, and holes to connect**  
17 **the wires and the MakeyMakeys.**  
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25 Leila is helping everybody in class, from colouring, broadcasting the projects, she looks  
26 organized and attentive. Out of 17 students today, I would say that 5 or 6 are scaffolding others  
27 with interest and care. Krista is finding a timer app on Mrs. MacPherson’s iPhone to monitor how  
28 much time is left. Most students have linked their posters to their *MakeyMakey* kits and the *Scratch*  
29 software using wires. They are playing their videos and they are fixing the last few glitches.  
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### 38 **Being with(in) Entanglements** 39

40 Thinking with posthumanism and literacy research, Kuby (2019) invites researchers to take  
41 risks and inspire others to do so by playing with posthuman methodologies. In the last  
42 entanglement between **MakeyMakeys↔software↔children↔pins↔posters↔markers↔us**, we  
43 highlighted in bold how materials came to be with humans, and how they exerted their relational  
44 autonomy by sparking human decisions, negotiations, sounds, and collaborative work. From the  
45 alligator clips to the brown-coloured markers to the MakeyMakeys, these materials—or  
46 combination of materials—not only generated wonderment and tinkering in students, but also  
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3 rhizomatically traced how materials come to matter in maker literacies research. Immaterial  
4 objects made their way onto a poster through a printer; such was the case of the *Scratch* logo that  
5  
6 Brittany asked her teacher to print. The relational autonomy of materials was also felt with Julia,  
7  
8 who wanted to get a more holistic picture of how paper and cans could work together in a maker  
9  
10 activity that she designed for her students. One way or another, humans were a part of those  
11  
12 entanglements, whether it was students, teachers, the two of us, or other adults, and materials  
13  
14 played a significant role in how decisions were being made and projects were designed.  
15  
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20         With this article, we consider how the discussions, transcriptions, materials, researchers'  
21  
22 interpretations, sounds, and ephemeral moments were part of entanglements that are “a knot of  
23  
24 forces and intensities that operate on a plane of immanence....an enactment among researcher-  
25  
26 data-participants-theory-analysis” (Mazzei, 2013, p. 736). It was not our goal to identify, or  
27  
28 pinpoint, the effects or benefits of a literacy practice over another—simply, it was to see literacy  
29  
30 events as relational and entangled in socio-material assemblages (Burnett and Merchant, 2018),  
31  
32 and we find examples from these research sites show the relational autonomy of materials.  
33  
34 Posthumanism helped us see how materials mesh with humans in makerspace contexts. This leaves  
35  
36 us questioning whether humans problem-solve, or if they simply adapt to materials. Our  
37  
38 postqualitative research seems to point to the latter. Another question then becomes: can materials  
39  
40 choose humans to channel their existence?  
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46         The latter question emerges as a diffraction of the initial research questions we asked at the  
47  
48 beginning of this article: How do materials manifest their relational autonomy in makerspaces?  
49  
50 How could the relational autonomy of materials impact maker literacies pedagogy? To the first  
51  
52 question, our posthuman inquiry brought us to think that if one hypothesizes that materials choose  
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54 humans as a result of forces colliding through posthuman methodologies (Mazzei, 2013), then  
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3 institutionalized spaces (schools, researchers, universities, disciplines) must acknowledge  
4  
5 malleability in maker literacies, embrace ludic play in maker activities, and account for the value  
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7 of process and becoming in maker work. To the second question, the posthuman methodologies  
8  
9 we used shed light on how bending materials and projects highlights the unpredictability of maker  
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11 trajectories, thereby allowing children and teachers to speak against the failing student rhetoric in  
12  
13 literacy education. We encourage researchers, practitioners, and their students to recognize that  
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15 potential by paying attention to the relational autonomy of materials in maker literacies research.  
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For Review Only

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## References

- AHMED, S. (2014) *The Cultural Politics of Emotion*, 2nd edn. Edinburgh: Edinburgh University Press.
- BARAD, K. (2007) *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Durham, NC: Duke University Press.
- BRAIDOTTI, R. (2018) *Posthuman Knowledge*. London: Polity.
- BROWNELL, C.J. (2019) Sound the alarm! Disrupting sonic resonances of an elementary English language arts classroom. *Curriculum Inquiry*, 49.5, pp. 551–572.
- BURNETT, C. and MERCHANT, G. (2018) Literacy-as-event: accounting for relationality in literacy research. *Discourse: Studies in the Cultural Politics of Education*, 41.1, pp. 45–56.
- CLARK, A. (2003) 'The Mosaic approach and research with young children', in V. Lewis, M. Kellet, C. Robinson, S. Fruser, S. Ding (Eds.) *The Reality of Research with Children and Young People*. London: Routledge, pp. 142–161.
- COLLIER, D.R. (2018) Doodling, borrowing, and remixing: students inquiring across digitized spaces. *The Reading Teacher*, 72.1, pp. 125–130.
- DELEUZE, G., and GUATTARI, F. (1980) *Mille plateaux: Capitalisme et Schizophrénie 2*. Paris: Les Éditions de Minuit.
- DERNIKOS, B.P. (2018) 'Reviving ghostly bodies: Student-teacher intimacies as affective hauntings', in T. Juvonen, M. Kolehmainen (Eds.), *Affective Inequalities in Intimate Relationships*. New York: Routledge, pp. 218–230.
- EHRET, C. (2019) 'Propositions from affect theory for feeling literacy through the event', in D.E. Alvermann, N.J. Unrau, M. Sailors (Eds.) *Theoretical Models and Processes of Literacy*, 7th edn. New York: Routledge, pp. 563–581.
- FRANKLIN-PHIPPS, A. and RATH, C.L. (2019) 'Collage pedagogy: toward a posthuman racial literacy', in C.R. Kuby, K. Spector, J.J. Thiel (Eds.) *Posthumanism and Literacy Education: Knowing/Becoming/Doing Literacies*. New York: Routledge, pp. 142–155.
- GIBSON, C. and CARR, C. (2016) Geographies of making: rethinking materials and skills for volatile futures. *Progress in Human Geography*, 40.3, pp. 297–315.
- GROSZ, E. (2017) *The Incorporeal: Ontology, Ethics, and the Limits of Materialism*. New York: Columbia University Press.
- HARAWAY, D.J. (2016) *Staying with the Trouble: Making Kin in the Chthulucene*. Durham, NC: Duke University Press.
- HARWOOD, D. and COLLIER, D.R. (2019) 'Talk into my GoPro, I'm making a movie! Using digital ethnographic methods to explore children's sociomaterial experiences in the woods', in N. Kucirkova, J. Rowsell, G. Falloon (Eds.) *The Routledge International Handbook of Learning with Technology in Early Childhood*. New York: Routledge, pp. 49–61.
- JACKSON, A.Y. and MAZZEI, L.A. (2012) *Thinking with Theory in Qualitative Research: Viewing Data across Multiple Perspectives*. New York: Routledge.

- 1  
2  
3 JONES, A.M. and BOIVIN, N. (2010) 'The malice of inanimate objects: material agency', in  
4 D. Hicks, M.C. Beaudry (Eds.) *The Oxford Handbook of Material Culture Studies*. Oxford:  
5 Oxford University Press, pp. 333–351.
- 6 KAFAI, Y.B. and BURKE, Q. (2014) *Connected Code: Why Children Need to Learn*  
7 *Programming*. Cambridge, MA: MIT Press.
- 8 KEUNE, A. and PEPPLER, K.A. (2019) Materials-to-develop-with: the making of a  
9 makerspace. *British Journal of Educational Technology*, 50.1, pp. 280–293.
- 10 KNOBEL, M. and LANKSHEAR, C. (Eds.) (2010) *DIY Media: Creating, Sharing and Learning*  
11 *New Technologies*. New York: Peter Lang.
- 12 KUBY, C.R. (2017a) 'Poststructural and posthuman theories', in R. Zaidi, J. Rowsell (Eds.)  
13 *Literacy Lives in Transcultural Times*. New York: Routledge, pp. 157–174.
- 14 KUBY, C.R. (2017b) Why a paradigm shift of 'more than human ontologies' is needed: putting  
15 to work poststructural and posthuman theories in writers' studio. *International Journal of*  
16 *Qualitative Studies in Education*, 30.9, pp. 877–896.
- 17 KUBY, C.R. (2019) 'Reimagining multiliteracies research practises with postqualitative  
18 inquiry', in N. Kucirkova, J. Rowsell, G. Falloon (Eds.) *The Routledge International Handbook*  
19 *of Learning with Technology in Early Childhood*. New York: Routledge, pp. 127–142.
- 20 KUBY, C.R., SPECTOR, K. and THIEL, J.J. (2019) (Eds.) *Posthumanism and Literacy*  
21 *Education. Knowing/Becoming/Doing Literacies*. New York: Routledge Expanding Literacies in  
22 Education Series.
- 23 LEMIEUX, A., and ROWSELL, J. (2020) 'This documentary actually makes Welland look  
24 good': exploring posthumanism in a high school documentary film project, in K. Toohey, S.  
25 Smythe, D. Dagenais, M. Forte (Eds.) *Transforming Language and Literacy Education: New*  
26 *Materialism, Posthumanism, and Ontoethics*. New York: Routledge.
- 27 LENZ TAGUCHI, H. (2012) A diffractive and Deleuzian approach to analysing interview data.  
28 *Feminist Theory*, 13.3, pp. 265–281.
- 29 MACLURE, M. (2013) Researching without representation? Language and materiality in post-  
30 qualitative methodology. *International Journal of Qualitative Studies in Education*, 26.6, pp.  
31 658–667.
- 32 MACRAE, C., HACKETT, A., HOLMES, R. and JONES, L. (2018) Vibrancy, repetition and  
33 movement: posthuman theories for reconceptualising young children in Museums. *Children's*  
34 *Geographies*, 16.5, pp. 503–515.
- 35 MARSH, J.A. (2017) The internet of toys: a posthuman and multimodal analysis of connected  
36 play. *Teachers College Record*, 119. 120305.
- 37 MAZZEI, L.A. (2013) A voice without organs: interviewing in posthumanist research.  
38 *International Journal of Qualitative Studies in Education*, 26.6, pp. 732–740.
- 39 MAZZEI, L.A. and JACKSON, A.Y. (2012) *Thinking with Theory in Qualitative Research:*  
40 *Viewing Data from Multiple Perspectives*. New York: Routledge.
- 41 NICCOLINI, A.D., ZARABADI, S. and RINGROSE, J. (2018) Spinning yarns: affective  
42 kinshipping as posthuman pedagogy. *Parallax*, 24.3, pp. 324–343.
- 43 NORDQUIST, B. (2017) *Literacy and Mobility: Complexity, Uncertainty, and Agency at the*  
44 *Nexus of High School and College*. New York: Routledge Expanding Literacies in Education  
45 Series.
- 46 PEPPLER, K.A., WOHLWEND, K.E., THOMPSON, N., TAN, V. and THOMAS, A. (2018)  
47 Squishing circuits: Circuitry learning with electronics and playdough in early childhood. *Journal*  
48 *of Science Education and Technology*, 28.2, pp. 118–132.
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3 ROWSELL, J., LEMIEUX, A., SWARTZ, L., BURKITT, J. and TURCOTTE, M. (2018) The  
4 stuff that heroes are made of: Elastic, sticky, messy literacies in children's transmedial cultures.  
5 *Language Arts*, 96.1, pp. 7–20.
- 6 ROWSELL, J. and SHILLITOE, M. (2019) The craftivists: Pushing for affective, materially  
7 informed pedagogy. *British Journal of Educational Technology*, 50.4, pp. 1544–1559.
- 8 SCOTT, J.A. and WOHLWEND, K.E. (2018) 'Bringing maker literacies to early childhood  
9 education', in I. Elea, L Mikos (Eds.) *Young & Creative: Digital Technologies Empowering  
10 Children in Everyday Life*. Sweden: Nordicom (University of Gothenburg), pp. 209–219.
- 11 SCOTT, F. and BIRD, J. (2019) 'Adults researching pre-schoolers in more-than-human contexts:  
12 rethinking ethnographer roles in the age of the anthropocene', in V. Reyes, J. Charteris, A. Nye,  
13 S. Mavropoulou (Eds.) *Educational Research in the Age of the Anthropocene*. Hershey, PA: IGI  
14 Advances in Educational Technologies and Instructional Design.
- 15 SHERIDAN, M.P., LEMIEUX, A., DO NASCIMENTO, A. and ARNSETH, H.C. (2020) Intra-  
16 active entanglements: What posthuman and new materialist frameworks can offer the learning  
17 sciences. *British Journal of Educational Technology* (online first). DOI: 10.1111/bjet.12928
- 18 TILLEY, C. (2011) Materializing identities: An introduction. *Journal of Material Culture*, 16.4,  
19 pp. 347–357.
- 20 WARGO, J.M. (2018) Writing with wearables? Young children's intra-active authoring and the  
21 sounds of emplaced invention. *Journal of Literacy Research*, 50.4, pp. 502–523.
- 22 WOODARD, R.L. (2019) Teacher-writer-crafter-maker: an exploration of how making mattered  
23 for one writing teacher. *Literacy*, 53.4, pp. 236–244.
- 24 WOHLWEND, K.E., PEPPLER, K.A., KEUNE, A. and THOMPSON, N. (2017) Making sense  
25 and nonsense: Comparing mediated discourse and agential realist approaches to materiality in a  
26 preschool makerspace. *Journal of Early Childhood Literacy*, 17.3, pp. 444–462.
- 27 WOHLWEND, K.E., SCOTT, J.A., YI, J.H., DELIMAN, A. and KARGIN, T. (2018) 'Hacking  
28 toys and remixing media: Integrating maker literacies into early childhood teacher education' in  
29 S. Danby, M. Fleer, C. Davidson, M. Hatzigianni (Eds.), *Digital Childhoods*. Sydney: Springer.
- 30 ZAPATA, A., KUBY, C.R. and THIEL, J.J. (2018) Encounters with writing: Becoming-with  
31 posthumanist ethics. *Journal of Literacy Research*, 50.4, pp. 478–501.
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Figure 1: Julia-Rotor

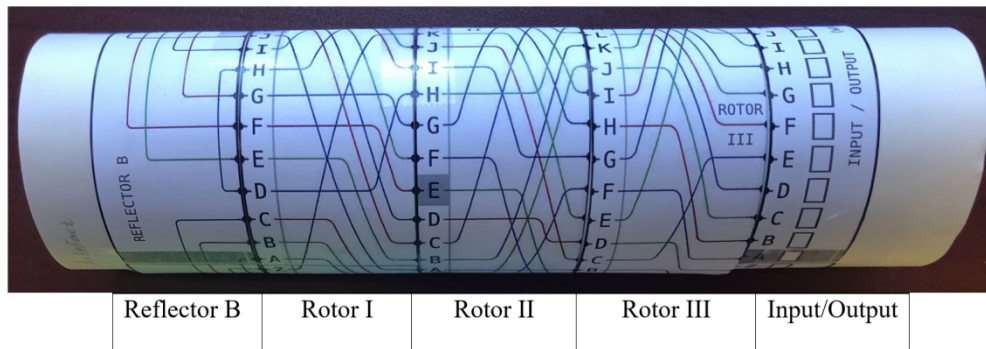


Figure 2: Rotor

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Figure 3: Children composing

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Figure 4: Markers being used

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