



Playing toward multiplicity: Disorienting intra-actions with materials & learning in an escape room

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PLAYING TOWARD MULTIPLICITY: DISORIENTING INTRA-ACTIONS WITH MATERIALS & LEARNING IN AN ESCAPE ROOM

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Abstract: *In this paper, we follow the co-constitutive material-participant relationships that propel action in escape room play, particularly how they open and close paths for learning. We focus on how learning is organized in one escape room game, The Author's Enigma, as intertwined with conversations on play and learning to consider the relational values and ideologies that appear through more-than-human encounters. We contribute a critical (new) materialist draw toward material-participant intra-actions to notice the production of narrowed messages, as well as openings that lead toward multiplicity. Thinking-with-theory; we take up Ahmed's (2006) concepts of orientation and disorientation to consider objects' arrivals and their not-yet-presence. We also move with Barad's (2003) concept of intra-action, perceiving more-than-human actors as 'matter-in-the-process-of-becoming'. Following a conch shell as a vibrant material in the ecology of escape, we trace participants and the shell through moments of intra-action across escape play. We detail the communicative forms produced through material intra-actions as both open and closed, while producing resonant logics with players in the room. We discuss implications for: 1) game-based approaches to education; 2) disruption to assimilative lenses for sensing and supporting learning; and 3) valuing particular relational arrangements with materials.*

Keywords: *orientation; disorientation; intra-action; thinking-with-theory, escape rooms; play; games; posthumanism; materiality*

Introduction

A door opens, welcoming five participants into an underwater world, one in a series of connected spaces in the escape room 'The Author's Enigma,' each with distinct features and feels. Watery projections on the wall provide soft flickering light where nooks filled with shells, treasure boxes, and draped kelp converge to write this room as a deep-sea environment. Upon entering, Sam notices a small red and beige fish trapped in a net hanging from above. He moves toward the fish and removes it from the net. "I found a fish, too!" he says, holding it up. A few seconds later, he repeats "I have a fish!" Escape room participants are scattered throughout the room, testing, prying, pushing, and calling out what they see. It seems the fish does not have an immediate instrumental purpose, but Sam keeps it in his hand as he continues moving throughout the underwater environment.

A group of five participants is welcomed into play through an underwater world where they collaborated with materials to solve an escape room – a series of thematic, immersive puzzles that, when solved, culminate in narrative resolution and 'escape' from the room(s). As detailed in the vignette, Sam was drawn to a small red plastic fish, bringing it from room to room to find out how the fish might play a part in escape. Possibilities in the fish-Sam connection were held open in suspension of prescribed object purpose. In this study, we join others in the Special Issue who extend methodological conversations by attuning to material relations in contexts of teaching and learning to study a particular form of play while simultaneously engaging in methodological play. Through a critical feminist (new) materialist theoretical lens we decenter human talk, gesture, and movement, to consider the ethical implications for learning. We analyze how the co-constitutive material-participant relationships that propel action in escape open and close paths for learning, while disrupting settled, assimilative lenses for sensing and supporting learning.

Although games have increasingly received attention in research on teaching and learning, such studies rarely focus on materiality. As such, we attune to the material-discursive realities of learners in one escape room, *The Author's Enigma*, as an ecology where designers, participants, and materials cooperate in processes of learning in gameplay. To do so, we complexify a posthumanist methodological approach through a critical feminist (new) materialist lens to trace the trajectory of materials, such as a conch shell, that unfolds in material-participant encounters throughout escape play. We think-with-theory (Jackson & Mazzei, 2012) to read escape room play through the lens of intra-action (Barad, 2003; 2007) and concepts of orientation and disorientation (Ahmed, 2006; 2010). We take up this theoretical process to notice (a) expansive possibilities in material relationships and (b) how attention to materials replicates or reimagines what is possible and valued in learning. We look to escape room play in its original context given that designers of learning environments are looking at escape rooms for inspiration for game-based approaches to education (Nicholson & Cable 2021). We attune to materials as central actors in play by asking:

What might the concepts of (dis)orientation and intra-action illuminate about material-participant joint action in escape?

What possibilities emerge through these material relations, and how do they implicate valued trajectories of learning?

Literature review: learning, play, games, and escape

In this review we focus on games and escape rooms as intertwined with conversations on play and learning. We share what brings us pause in the gamification of learning, including escape rooms, and calls for further theoretical attention.

Play and learning

Some who take a sociocultural or cultural-historical approach to studying play in learning expand from Vygotsky's (1966; 1978) vision of play as a rigorous activity in children's development. Yet they do so in ways that further solidify linear and hierarchical conceptualizations of development (Matusov & Hayes, 2000). When framed as a moment in a linear trajectory, play supports movement from everyday contexts toward supposedly higher-order thinking, being, and acting in schools. In formal education, this articulation often fuels a dichotomy between play and academic learning, reinforcing a vertical value hierarchy wherein 'higher' 'academic' learning is distinct from and superior to the work of play. This results in the uptake of narrowly defined 'rigorous' versions of play that tightly align with academic directives (Bodrova, 2008; Fler & Peers, 2012; Wohlwend & Pepler, 2015; Lewis, 2013). It also suggests play is primarily valuable in early years of education. We instead join those committed to recognizing play as valuable throughout our lives (e.g., Gutiérrez, Higgs et al., 2019; Paré et al., 2019).

More-expansive efforts have highlighted various relational dimensions of play-based learning across the lifespan, including negotiating relationships, rules, and possible futures. Waermö (2016), for instance, discussed how relational negotiation in play can produce a collective embedding of agency, or *negotiagency*, produced "through individual action related to the actions of others and the transformation of the activity" (p. 27). Gutiérrez, Becker, et al. (2019) highlighted how youth collectively experimented with rules to circumvent normative play and co-author experiences. Spaces of play can be rich sites for collaboratively creating imagined futures (Paré et al., 2019) and attuning to ingenuity in everyday activities (Gutiérrez et al., 2017). Citing Leander & Boldt (2018) and Massumi (2002), Paré and colleagues (2019) attuned to a group of adult friends playfully imagining possible futures, illuminating how:

in play, the meanings and imaginations of, rather than the mere *physicality* of objects shape the experience of the participants. The context of play thus brings into the picture learners' desires, which goes beyond both the notions of designing learning environments and the teachers' and designers' intentionalities. (p. 309)

Yet, we cannot assume that *negotiagency*, co-authoring, and attuning to ingenuity are supported in robust ways through *all* play activities. Recognizing complex, relational, and more-than-human meaning-making practices in play across the lifespan is necessary for articulating ways of valuing such practices.

Games and learning

In recent years, conversations on the learning potentials of gameplay have appeared most prominently within game-based learning and *gamification* discourses. Plass et al. (2015) synthesized the most prominent arguments for game-based learning as grounded in motivation, player

engagement, adaptivity, and graceful failure. Importantly, however, Plass et al. (2015) argued, there cannot be a single theory of game-based learning as designers with heterogeneous concerns design games with various implicit and explicit theories of learning. Instead, it is necessary to understand how learning is organized by its designers, players, and materials in any given game (Squire, 2006).

Gamification is a powerful trend within the instrumentalization of play (Ruberg, 2019), and has been framed as a central inroad into leveraging affordances of gaming and learning (Plass et al., 2015). Plass et al. (2015) clarified gamification in education— or “adding game elements to an existing task that may be unengaging, tedious, or boring” (p. 278)— as distinct from playful and game-based learning. We argue that the gamification trend in education is too often representative of understandings of learning, play, and games that are, at best, shallow and, at worst, deeply harmful. While games *may* create rich learning environments, they do not transform learning as profoundly as gamification discourses suggest (Squire, 2005).

Escape rooms as immersive, game-based play and learning.

Escape rooms offer immersive gameplay grounded in collaborative, hands-on engagement with puzzles and clues aimed to support participants working to escape. Typically constrained by time, some have encouraged their use for building teamwork and communication (Nicholson & Cable, 2021; Veldkamp et al., 2020). An escape room’s organization and logics can be open-structured (puzzles can be done in any order), sequential (one puzzle follows another), or path-based (multiple puzzles pursued at once that converge in the final ‘meta-puzzle’) (Nicholson, 2015; Wargo et al., 2022). As ecologies, the culture(s) of each escape room is developed through design (prescribed actions) and play (emerging between players and design) (Erickson, 1995; Goodwin, 2010).

Escape room play has become increasingly popular as a resource for learning academic content in both youth and adult contexts (Danhoff, 2022), such as in computer science (Borrego et al., 2017), computer programming (López-Pernas et al., 2019), and health science (Gomex-Urquiza et al., 2019; Hermanns et al., 2017) classrooms. Researchers suggest benefits such as active learning opportunities that increase motivation and engagement while making learning accessible and thinking visible. Yet, games designed for learning, like any activity, are part of many-dimensional, interconnected systems. Arguments concerning the relationship between education and technology are value-laden (Selwyn, 2016), and arguments for games and learning have political implications (Squire, 2006; 2008). We cannot ignore that much of the uptake of games for learning has grown from their use in business and military sectors (Squire, 2008); companies and groups stand to profit, financially and ideologically, from their development and proliferation (Bogost, 2014). Games are designed with and serve particular values and ideologies (Squire, 2008; Bogost, 2007; Flanagan, 2009; Ruberg, 2019). It is necessary to explicate underlying values and ask: “whose ideologies [and cultural practices] will be served (and whose will be left behind)” (Squire, 2008, p. 17) through games for learning?

Escape from What?

Those who bring escape gaming into school-based learning often frame it as a pedagogical disruption (Nicholson & Cable, 2021). We join those who view learning as an inherently value-laden political and cultural process (Freire, 2010; McKinney de Royston and Sengupta-Irving, 2019; Philip et al., 2018; Nasir et al., 2020; Warren et al., 2020). We view learning as fundamentally

about transformation (Gutiérrez and Vossoughi, 2010), a dynamic becoming and unbecoming (Patel, 2016) rather than a linear path of acquisition. In escape, as in many environments, achievement is narrowly constrained by design (e.g., object associations, time); only those who align or comply with the logics of escape are rendered successful, while those who do not are deemed failures.

Thinking with theories through (dis)orienting intra-actions: materials, participants, and escape

In the following section, we put queer feminist and new materialist theories in conversation with posthuman studies of learning, and highlight tensions that influenced our thinking-with-theory analytic approach. Education scholars have considered what theories within new materialist, and, more broadly, posthumanist thought can offer studies of learning (Peppler et al., 2020; Sheridan et al., 2020; Rosiek et al., 2020; Wargo, 2018). Posthumanist research proposes a relational shift to flatten hierarchies between human and more-than-human life, decentering human supremacy in the analysis of learning. A posthumanist methodology challenges sociocultural and constructivist research, which relegates material to a mediational tool purposefully manipulated by and for the (human) learner's meaning-making (Sheridan et al., 2020). Instead, posthumanism emphasizes the 'world as connected' and learning as an ongoing series of relational encounters *with* materials that spark insight, growth, and change (Wargo, 2018). In this inquiry, we think with Ahmed's (2006; 2010) theoretical concepts of orientation and disorientation, and Barad's (2003) intra-action to follow materials and participants as actors in escape and heed the call by Eglash et al. (2020) that new materialist scholars take seriously "the responsibility to be accountable for its implications" (p. 1347). For us, this means that we take up posthuman methodologies, and this specific constellation of theoretical concepts as intertwined, for the specific purpose of understanding how we might build futures that do not reinscribe oppressive systems of the present.

Thinking with Ahmed: objects and (dis)orientations

With Ahmed (2006; 2010) we see how objects *arrive* with varied histories of associated actions and allow for particular further activity. For example, a table may arrive with a history of allowing for writing, preparing food, or another action, each of which represents a social construction of particular object-activity relations. Co-produced histories are integral to how someone orients toward an object. As Ahmed (2006) states, "forms of social orientation affect how bodies arrive at the table" (p. 31-32). For Ahmed (2006; 2010), people orient toward objects through relational alignment, where bodies, with their own social histories, arrive and construct meaning with objects, and objects arrive and construct meaning through bodies. Hence, "[w]e touch things, and are touched by things" (Ahmed, 2010, p.245). From this perspective, objects do not have an inherent identity apart from relational contact.

Orientations to objects are the starting point. They involve both physical proximity of objects to bodies, as well as turning toward objects to face them. The way one faces regulates what is foregrounded with importance and what is pushed to the background, literally and figuratively. Orienting brings bodies into relation with objects, a place of situatedness that draws upon past histories. Ahmed highlights, "If orientations are an effect of what we tend toward, then they point

to the future, to what is not yet present.” (Ahmed, 2010, p. 247). Orientations are shaped through accumulating associations ‘behind’ us and our tendencies that direct us toward what is not yet present.

Ahmed proposes orientation alongside disorientation, where bodies and objects arrive in unintended or unfamiliar ways, opening a multiplicity of paths for political work that reshapes bodies and worlds. Disorientation is a dislodging of objects from their established associations, a destabilization of order presenting opportunities for change and unknowing (O’Donoghue, 2020). Connecting dis/orientations to the root word “orient” as a verb, as well as a geospatial location, Ahmed (2006) writes, “the concept of orientation “points” toward some directions more than others, even as it evokes the general logic of “directionality” (p. 112-113). As she writes, ““What is east (of me/us)” becomes “the East” by taking some points of view as given” (p. 113), (i.e., a Western point of view), thus normalizing some starting points, and some bodies as given and some as queer and “oblique.” Together, orientation and disorientation highlight how worlds are extended, reorganized, and foreclosed based on gendered, sexualized, and racialized actions and their associated histories. We think with orientation and disorientation to consider the object’s arrival, the not-yet-presence, and possible implications.

Thinking with Barad: Intra-action.

We also consider the relations created by people and materials through the lens of intra-action. For Barad (2003; 2007) intra-action:

signifies the mutual constitution of entangled agencies. That is, in contrast to the usual "interaction," which assumes that there are separate individual agencies that precede the interaction, the notion of intra-action recognizes that distinct agencies do not precede, but rather emerge through, their intra-action. (p. 33)

Barad extends this definition to emphasize how, in intra-action, both the discursive and the human are inextricable from the materiality of the environment; human and more-than-human actors (including objects) are not separate (such as in interaction) but are joined and co-produced through their encounter. In their entangled state, human and more-than-human matter are transformed.

Thinking of more-than-human actors as ‘matter-in-the-process-of-becoming’ (Barad, 2003) further enables us to think with possibility, both designed for and unintended, of material discourse(s) in learning. Barad (2003) offers:

material conditions matter, not because they “support” particular discourses that are the actual generative factors in the formation of bodies but rather because *matter comes to matter* through the iterative intra-activity of the world in its becoming. (p. 823)

Positioning human-material relations as *dynamic* supports thinking with possibility by unfixing objects from a predefined valuing. Matter is not simply a resource made operational in discourse. It is critical to the ‘enfolding’ of events of knowing as “a distributed practice that includes the larger material arrangement” (Barad, 2007, p. 379). We extend the practice of knowing as critical to learning wherein learning events are also entangled with what is made possible through human-material relations.

Intra-action and feminist new materialist theories broadly are taken up in many ways in and beyond posthuman education research. In this analysis, we follow work that reconsiders who and what is

agentive as a social, cultural and, political act, understanding power as intertwined through the interdependent human and more-than-human relationships (Hood & Krahae, 2017; Thiel, 2015). What is rendered as possible to do and be in the escape room is constructed by the co-produced human-material relationship.

Recognizing tensions in queer, feminist, and new(?) materialist theories

Ahmed and Barad's theoretical perspectives follow lineages of queer theories that help us to sense, critique, disrupt, and desire beyond normalized and often binary relations. Queer theories and sociocultural theories of learning share "an interest in how norms and practices are reproduced or resisted as people interact with cultural artifacts and each other" (McWilliams and Penuel, 2017, p. 95). Alongside Ahmed (2006), we follow a queer commitment "not to presume that lives [and for us, learning] have to follow certain lines in order to count as lives [learning]" (Ahmed, 2006, p. 178). In discourse surrounding games and learning in education, attempts to try out possible solutions toward 'success' (i.e., winning or beating a game) are often emphasized as moments of productive failure. Instead, we join endeavors to re-conceptualize failure in queer studies (see: Halberstam, 2011; Muñoz, 2009), in queer game studies (Ruberg, 2019), and in queer approaches to learning (Britzman, 1998; McWilliams, 2016). We approach moments that might be seen as necessary 'failures' *along the way* to viable solutions instead as lively moments of disorientation that open more paths.

While energized by the interconnections of these materialist, feminist, and queer theories we also want to name their tensions, which we believe can be generative. For Barad (2003), the *new* in new materialism is an attention to physical matter, one they state is absent in prior feminist work. Ahmed (2010), alternatively, refuses the '*new*' in 'new materialism,' instead framing her work within ongoing feminist theory that emphasizes the politics of material conditions, or '*critical materialisms*'¹.

Another tension we engage with is how new materialist theories, as part of posthumanist literature, often fail to engage with Indigenous and African diasporic onto-epistemologies. As Jackson (2013) states, "perhaps the "post" human is not a temporal location but a geographic one (p. 673)," meaning that hegemonic ideas of human/more-than-human interaction that posthumanism pushes back against assume a western-Eurocentric idea of the human as a starting point. Much posthumanist scholarship works at expanding what is included in the Western, Eurocentric definition of a 'rational' human, while doing little to disturb hierarchies and powered associations of othered onto-epistemologies, such as Indigenous material agency (Eglash et al., 2020; Bang & Marin, 2015). By placing Barad's conceptualization of intra-activity in conversation with Ahmed's focus on destabilizing settled ways bodies come to belong, we "strive to reach beyond (liberal) humanism in the posthumanist landscape" (Jackson, 2013, p. 682). Thinking with these ideas and

¹ Ahmed (2008; 2010) shares the ways that this view misrepresents feminist theoretical projects, including erasure of lesbian feminism of color contributions (Ahmed; 2017). As an ethical stance, Ahmed (2008) asserts that "when we consider how it is that we arrive at the grounds we inhabit, we need to appreciate the feminist work that comes before us, in all its complexity." (p. 36). We agree that such an oppositional foundation overlooks and suppresses what could be key alignments between Barad and Ahmed's ideas, conversations to be built from; we hope to embrace, with care, the complexities and possibilities in thinking with these theories together.

tensions supported our commitments to *reach beyond foreclosed* ways of seeing human-material relations to notice multiple possible valued learning trajectories.

Finding our way through thinking with theory

Data for this inquiry came from a larger project’s (Wargo & Garcia, 2021; Wargo et al., 2022) data corpus generated to examine learning in escape room interaction. Five undergraduate adults in their early 20s self-selected into the study from an open call for participation within the higher education institution where the authors worked at the time of data generation. The participants were classmates, teammates, and friends, and one had taken a course with authors two and three in a prior semester. However, the Learning to Escape project was not connected to this or any course. As part of the study, the group “learned to escape” a series of three multi-linear escape rooms over the course of a few weekends.

Sources of data in the larger study included observational notes, 1:1 participant interviews (before, between escape games, and after play), head-mounted GoPro video recordings of activity in the rooms, audio recordings of group talk, multiple forms of transcription (of verbal communication, movement, and sound), floor plans, and puzzle pathways. For an extended analysis of escape room mechanics, see Nicholson (2015). In this paper, we focus on first-person video data from one room, *The Author’s Enigma*, along with an accompanying multi-linear puzzle pathway (Figure 1), to follow how learning and meaning were co-produced (Koschmann, Stahl and Zemel, 2007) by participants and materials.

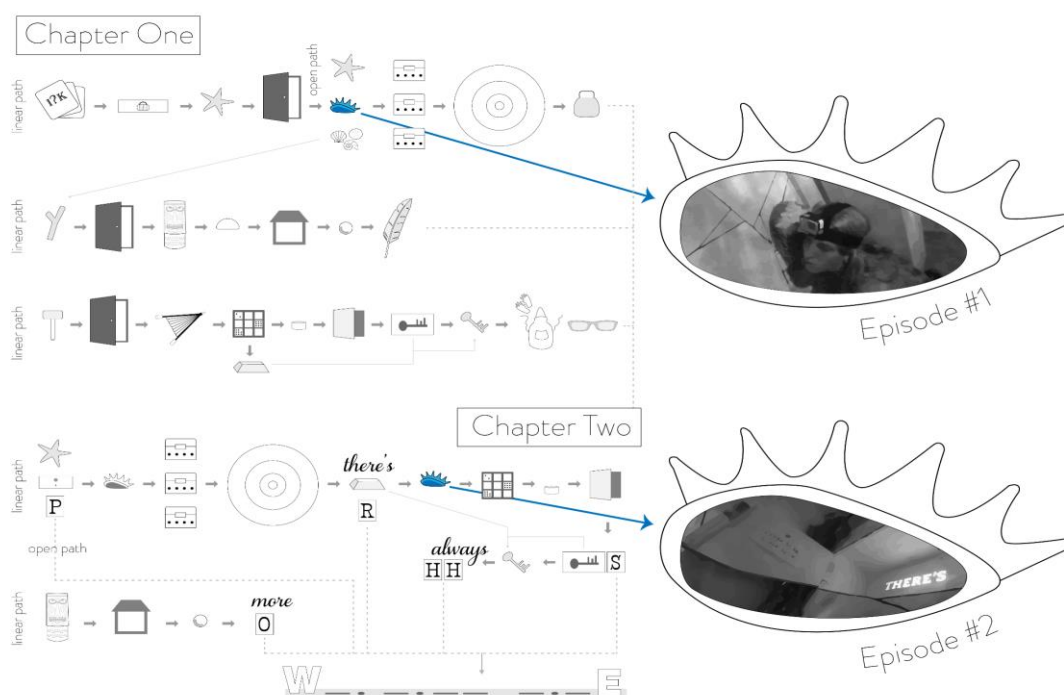


Figure 1. Multi-linear puzzle pathway of *The Author’s Enigma*. The icons and arrows above represent the puzzles and pathways players solved to pass through each phase of the escape room, leading toward eventual escape. The episodes highlighted in the shell call-out boxes are the focal episodes and scenes detailed in this paper.

Video data was generated by participants with GoPro cameras worn on their heads to record the unfolding escape. In the liveliness of play, three of the five cameras were accidentally paused at various points, resulting in partial recordings. From a methodological perspective, we gave no directive to participants about what to record. The quality and continuity of recording became part of the ways non-human objects joined participants in intra-action. We attend to the unfolding intra-action in the escape room as seen through the perspectives of two participant-cameras, Casey and Will, whose recordings captured the full length of escape.

While initial analysis across the research team consisted of sequentially generating transcripts of data, video memos, iterative coding specific to different theoretical approaches, analysis for this paper began as we moved toward a postqualitative thinking-with-theory (Jackson & Mazzei, 2012) approach. We, the first two authors, returned to the video and transcripts, writing analytic memos, noting points of interest and emerging questions with more detail. Importantly, as we undertook this process, we were simultaneously drawn toward the theoretical lenses of Barad's (2003; 2007) intra-action and Ahmed's (2006; 2010) orientation and disorientation. This brought us to recalibrate our analysis toward a postqualitative methodological approach of thinking-with-theory (Jackson & Mazzei, 2012). Thiel (2015) states:

thinking with theory asks researchers to take up or 'plug into' a particular theorist or theoretical concept (i.e., intra-activity, actant, and muchness), as they write and 'put that theory to work' on sets of data in order to gain deeper and multilayered understandings of social life. (p. 64).

The theoretical conversations between Ahmed, Barad, the project's data, and our questions seemed ripe for such multilayered understandings. In turning to postqualitative inquiry, Lather and St. Pierre (2013) offer that "[t]he ethical charge of our work as inquirers is surely to question our attachments that keep us from thinking and living differently." (p. 631). The theoretical concepts that Ahmed and Barad offer helped us tune our attention toward human and more-than-human (e.g., a starfish, a red herring, a conch shell) intra-actions of escape, opening us up to approach posthuman ideas of learning and living research differently.

Following our own (dis)orientations, we let ourselves be drawn toward *glows* in the data; MacLure (2013) describes glows as the agency of moments "that arrests our gaze and make us pause; the connections that start to fire up; the conversation that gets faster and more animated" (p. 662). Rather than approach research with, for example, reproducibility, a postqualitative approach such as thinking-with-theory, recognizes how the particular people doing the research shape what is produced. As one of many postqualitative approaches, posthumanism foregrounds human-more-than-human relationships. Critical new materialism is a lens with which to focus on human-material relationships in posthuman research. In our case we followed moments of glow that illuminated trajectories of focal objects. Such trajectories enabled us to see both how material-participant intra-action contributed to progression through escape (the assumed goal) and those that might be read as "off-track" or not valued in this specific escape. Rather than consider any actions as "off-track" from the game's linear logics, we were interested in possibilities associated with all material-participant actions.


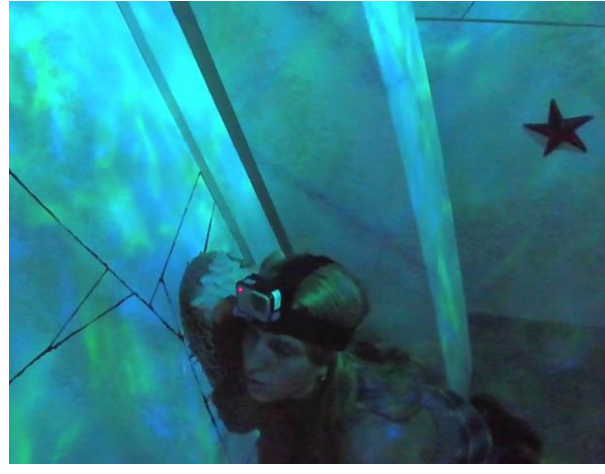


Findings: Shell as material in intra-action

Following the conch shell as a vibrant material in the ecology of escape, we highlight particular moments where participants and the shell intra-act and how these actions can be traced across *The Author's Enigma*. With the shell, participants sang, opened a locked box that held context for the decoder, and were invited to return to a puzzle in new ways.

What might the concepts of (dis)orientation and intra-action illuminate about material-participant joint action in escape?

Through this section we foreground the methodological work of thinking-with-theory, particularly what the concepts of materiality, (dis)orientation, intra-action, and entanglement illuminate in analysis. In order to understand human and more-than-human intra-action in the escape room, we look closely at play between physical and conceptual materials, which form the entanglement of matter and meaning in escape. We chose an episode from Casey's video to illustrate how one stage of escape is made possible. This episode zooms into Chapter One (figure 1, popout 1) in the Atlantis room, where participants must learn the secrets of an underwater world to continue. In this micro-moment, Casey's orientation leads her to an accomplishment of action that aligns with the designers' intentions in the puzzle pathways.

Thinking with Ahmed: through orienting to objects. In Casey's first-person GoPro footage, we see Casey's hands feeling the room. She runs her hands along the walls, touching a scallop shell to see if it moves, pressing an area on the wall that looks cut from the rest. Casey turns away from the group's turning of ideas with a spinning decoder. We see her reach toward and touch the edge of a conch shell (Figure 2), curling her fingers around the tip and pressing them against the smooth inside edge. Her hand stops moving in the camera view. She bends down. The compositional view shifts to face the wall, shimmering with blues and greens. We gather Casey has pressed her ear against the shell (Figure 3). There is no camera movement for 5 seconds. Emerging from this pause, we see her hand reach out to the nearby wall, resting it beneath a curtain of seagrass that falls from above (Figure 4). It's a long pause, another 10 seconds before she says out loud, "One day I was strolling along the beach...". Eight slow seconds later she alerts the other participants, "Hey guys, this speaks!" She relays the message from the shell aloud, repeating what she hears and pausing between phrases. In a space full of materials and possible action, Casey lingers *with* the shell. Meanwhile, her peers search the room to understand the message.

 A first-person perspective shot from Casey's GoPro camera. The scene is dimly lit with blue and green ambient lighting. Casey's hand is reaching out and touching a textured, shell-like surface.	 A shot from Will's GoPro camera showing Casey from a side profile. She is wearing a head-mounted display and has her ear pressed against the shell-like surface. A red star is visible on the wall behind her.
<p><i>Figure 2. 00:16:04. Casey leans in and touches the shell. From Casey's GoPro camera data.</i></p>	<p><i>Figure 3. 00:16:23. Casey puts ear up against the shell to listen. From Will's GoPro camera.</i></p>
 A shot from Casey's GoPro camera showing her hand resting against a blue, translucent wall. The lighting is predominantly blue.	 A shot from Casey's GoPro camera showing a white envelope or piece of paper. The text 'THERE'S' is printed in yellow on the right side. On the left side, there is handwritten text that reads 'Listen to the conch again...'. The background is blue.
<p><i>Figure 4. 00:16:31. Casey balances herself, resting her hand against the wall. From Casey's GoPro camera.</i></p>	<p><i>Figure 5. 00:49:13. "Listen to the conch again..." written on paper. From Casey's GoPro camera as she listens to the shell, again.</i></p>

What drove Casey to put her ear up against this shell? It is one of many shells of different shapes and sizes scattered about. Yet something calls her toward it, drawn in a way her peers had not been as they moved toward other objects. Thinking with Ahmed, we can understand Casey's pull to the shell in terms of her orientation *toward* the object, bringing it forward against the other objects and materials of the room. Methodological attunement with orientations reminds us that the conch shell arrives into the context of the room through the many hands that formed it and sold it, the designers that built it into the room and angled its open mouth out to the participants with close proximity to the treasure box. The shell has a history of purposes in the watery context of the Atlantis room. It possibly evokes an affective call to childhood, to the seaside, to the seafloor. We

see this particular set of orientations not as given, but as arising from particular histories and proximities. We ask again, what drove Casey to put her ear up against *this* shell? Casey responds to the shell's arrival with a familiar action, one often repeated in encounters with a conch shell. She leans in, pressing her ear against the opening to listen. This motion orients her body, crouched on the floor, chin turned toward her shoulder in familiar engagement with this object. Casey meets the object and the object meets Casey through associated actions and familiar histories (pressing one's ear to the shell). In her movement toward the object, Casey signals her hope for response, for a clue as to what is next.

Thinking with Barad: through the material-discursive.

Thinking with Barad, we see the material as holding the same potential for meaning-making as the discursive. Casey encounters the physical material of the shell, its smooth, open pinkness against a textured uneven exterior, and its placement with the mouth facing away from the wall and toward potential listeners. It is large and draped with seagrass. Casey uses multiple senses, or ways of listening – her gaze rests upon the shell, she reaches out to it, touches it, and ultimately leans in for another experience of the shell. After touching its surface, Casey and the conch shell meet each other in a momentary performance, the human and more-than-human matter as opening to emergent meaning. The conceptual attunement of intra-action brings to the fore many dimensions of physicality within meaning-making: her ears, shaped to transduce the vibrating communication; her knees, which bring her to the ground; her steady balance and pivot, make certain actions possible. The shell and Casey become entangled.

Beyond the physical aspects that draw Casey in, the shell also arrives with historically accumulated meanings. These are meanings that intersect with the ideas, memories, and experiences that participants bring into the space. The non-physical matter is already present—the ideas evoked by the atmosphere of the sea room, the mottled watery light projections against the walls, childhood fairytales. Casey's performance recalls a cultural script of the conch shell, such as a parent holding the shell up to a child at the beach, a physical motif that allows ideas and potential of the shell as a listening device to meet. It calls Casey back to a past, producing the possibility of joint action, an entanglement that renders the shell as a valuable clue and propels the performance of the conch shell as speaking matter.

What possibilities emerge through these material relations, and how do they implicate valued trajectories of learning?

In the sections that follow, we continue tracing the shell and share forms of intra-action that participants and materials joined in throughout *The Author's Enigma*. In the unfolding activities, material intra-actions took on communicative form to produce varying trajectories. Their forms emerged as open, closed and in resonance with other materials in the room.

Communicative forms: open and closed.

Each material in the puzzle pathway (Figure 1) has an underlying directive, or in some cases multiple directives. Yet, in play these are not always immediately apparent. Throughout *The Author's Enigma*, such ambiguity (what we refer to as open forms) invites playful response. In some moments, a clue was offered in closed form through a directive. In order to escape, however, the prescriptive puzzle pathways narrowly defined which forms of participation were valued.

Tracing actions through closed forms: In the second chapter of the escape, participants gathered around a wall-sized cipher decoder to solve a puzzle. With each turn, they work to align, with the intended meanings of the symbol system and with the trajectory of escape. Once they have, together, accomplished the expected alignment by matching clues from a nearby chest to wall symbols, a small panel pops opens on the wall, revealing a door and hidden chamber. The low door opens to offer the word ‘there’s,’ illuminated against the back of the once-hidden niche along with a block with an “R” on it, a gold bar, and a piece of paper with the words “Listen to the conch again” (Figure. 5). Crouched low already, Casey leans back into the shell and again listens for what it has to share.

As with multiple materials in the ecology of *The Author’s Enigma*, participants joined with the conch shell throughout the game through orientation and disorientation to accomplish joint action. The action that followed the clue, structured by the engineered puzzle pathway, was *closed* off from the many ways human and more-than-human might meet in these moments. At the time of the study, *The Author’s Enigma* was in beta-testing, where limited players offered feedback to the game engineers for further development. Designers were still working out this clue and the paper slip emphasized an in-process material, denoted by a piece of bright orange tape. Seeing this version enables us to consider the potential of materials that were not pre-determined and worked instead toward expansive pathways. Instead the written note taped into the chamber ushered activity along, *closing* the material form version with a directive to “Listen to the conch again.”

Tracing song language as open form: Returning to chapter one of *The Author’s Enigma*, open-form versions of materials allow for playful engagement with the environment. They create the potential for participants to ask, *what could this material offer?*, and respond in many ways as they attempt to continue through the puzzle. Whether and how the game enables this kind of playful activity is important. Hence, we’ve focused much of our analysis on the activity that unfolds within these moments. Going back to Casey’s first intra-action with and orientation to the conch shell, she voices what she hears after listening to the shell speak:

*One day, I was strolling along the beach
And in the distance I saw a mermaid
She was swimming with her friends
Until they met an octopus
She tried to sing a song for her new octopus friend*

Taking up the last line of the shell’s message, participants wonder what it might be offering as a clue. Following a possible trajectory from the end of the shell’s message, the matter of singing enters into the conceptual material of the room. As Casey first repeats the shell’s message out loud to the group, Will wonders, “Do we have to sing a song?”. Walter takes up the idea and responds in song, “ah-aahh-aaahhh”. Singing was accomplished in intra-action with the shell and hearing its message. As Casey was called by the shell, became oriented to its presence and the players acted together, the idea of singing, then song, and escape through song became meaningful.

Open forms can enable materials to act as orientation *and* disorientation devices (Ahmed, 2006; 2010). As disorientation devices, materials in intra-action expand possible lines to follow. The possibilities further shape “what it is that we ‘do do,’ and hence what we ‘can do.’” (Ahmed, 2006,

p. 176). These micro moments with open forms, we argue, are consequential both in the unfolding activity and for futures beyond the escape as a learning space. It matters, in physical and discursive senses of the word, what is enabled, allowed in a space and what is silenced, closed off, disciplined. Song emerges in this disorienting intra-action as a line of repeated action that becomes a vibrant material part of the escape ecology, regardless of its instrumental effects. Even open forms, however, preserve the underlying architecture of ‘correct’ solutions that lead to the goal of escape, which we further interrogate in our discussion.

Listening for resonant logics.

After Walter’s singing elicits no apparent response from the room, participants get busy trying more potential paths. Within the shell’s message that Casey hears, although initially unseen by participants, are clues that correspond to a locked box. With the proximity of the objects and language-object clues, participants seek what we call *resonant logics* (Figure 6), or where and what in the escape ecology might join in finding solutions within emergent meanings. When we use listening here, we are referring to ways that participants attune with many senses, highlighting sight, sound, touch, and more broadly feeling. In the escape room, designers have gathered and organized materials to encourage *particular* resonance and connections. Trails of logics that resonate with the room’s design made it possible for the group to continue along the puzzle pathway. Along the way, participants and materials created additional possible meanings in disorienting intra-actions, with materials arriving with various histories.

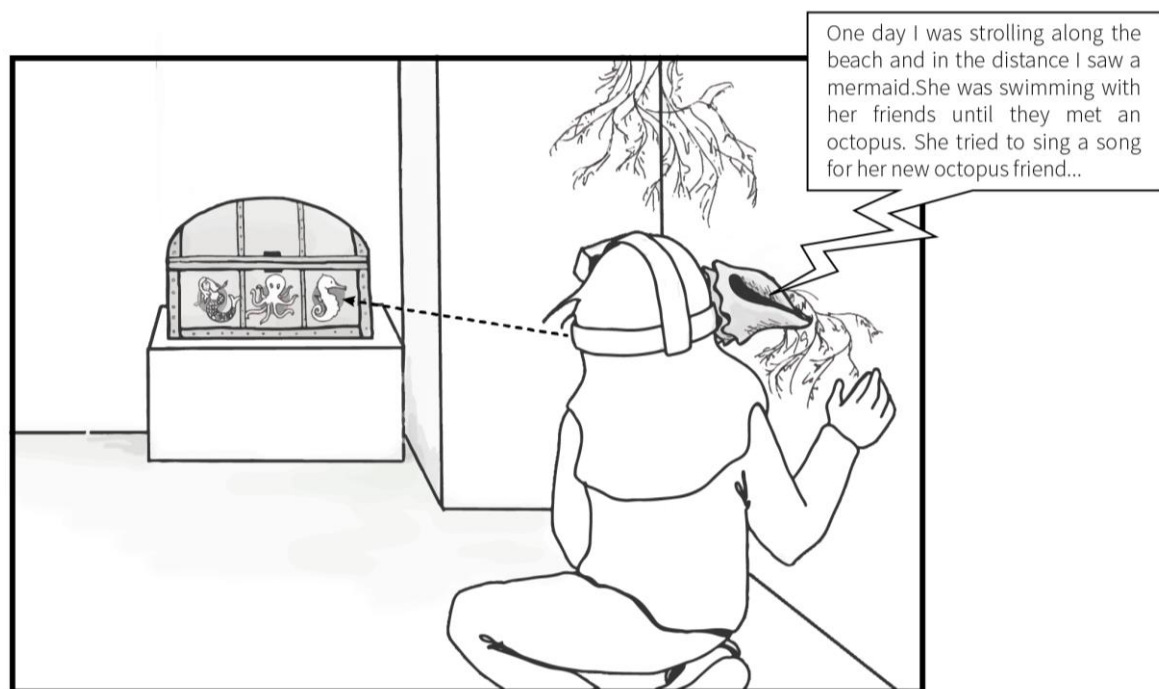


Figure 6. Resonant Logics

Back with the shell’s message, participants eventually make a connection with the materials of the room. Searching the room, Casey is drawn and directs the group toward the boxes, sharing “I’m pretty sure each of these are gonna open and then we’ll get the complete picture of that [pointing to wall cypher]. So let’s focus on these boxes.” Casey both listens to the shell and listens to the room, open to all sorts of perceptions and resonant logics with which to make connections.

Excitedly echoing an “O! Ooo! O! o! O!,” Casey realizes the mermaid in the story is also a button on the box. The seahorse and octopus characters in the shell’s story likewise make appearances in the box buttons. After physically close listening, Casey is able to crack the code on the box by vocalizing when each character appeared in Emily’s story, cueing Maddie to press the buttons in the sequence of their appearance. Yet before the box slowly clicks to unlock, and unsure of the success of their problem-solving, Casey prompts the room, “Oh, do we have to sing?,” responding to the open form with the group’s created logics. Walter again erupts in a disharmonic “ahhhahhhahh”. With the layering intra-actions of listening, button-pressing, and singing, the chest unlocks. Which of these triggered the chest opening is left unresolved, though song lingers as Maddie sings and laughs while they continue toward escape.

We noted resonant logics throughout game play in *The Author’s Enigma*. Casey noticing the resonance between the buttons on the box and the characters in the story were logics aligned with the designed puzzle pathway. Other moments demonstrated resonant logics that participants created in play, such as Walter carrying forward singing prompted by the conch shell’s message. This example highlights a moment where these lines are blurred, where the disorientation of materials arriving in unfamiliar ways occurred simultaneously with more orienting intra-action, leaving open the possibility that singing could have been the response necessary to continue with the puzzle. Logics that are resonant with the meanings created by the group as part of an entangled ecology did not always align with the meanings required for successful puzzle solving. Thus continuation through the room renders only some as valued. The persistent presence of singing shows us this held intra-active meaning for the group; we can’t help but wonder about all the possibilities that the room occludes. What message does the experience communicate when only some meanings and histories are valued? For whom might these dynamics generate what kinds of consequence(s)? In the discussion, we highlight the dynamic of valuing only some meaning-making across activities in educational spaces is familiar. We know that many structures are designed to enable only a small selection of people to thrive and to matter. When we attuned to disorientation, however, we saw spontaneous ingenuity and paths opening up possible future action. We’ll follow these openings into our discussion, where we share what this analysis suggests to us about designing for learning with materials.

Discussion - attuning to micro moments with materials as portals toward multiplicity

We began this paper with a story about a small red fish Sam found in a net. Bringing it from room to room, Sam announced “Hey guys, I still have the fish” each time the group came to an impasse, but it remained a prop. The fish ultimately did not unlock or decode. Upon completion of escape, Sam, still holding the fish, asked, “But what was the fish for?”. The designer responded, “Oh you didn’t notice? It’s the red herring!”². Even the fish ultimately fulfilled its singular intended purpose.

Through our methodological draw toward material-participant intra-actions, we are able to notice the production of both narrowed messages and potential openings. These can both be obscured

² A red herring is an object or idea that is intended to be misleading

when methods take the game logic for granted. Our analysis highlights how, in order to progress through the escape room, participants had to orient “properly,” solving puzzles by responding to objects as intended by the designers. Taking a materialist approach to analysis for this study meant that we worked to understand the relationship between materials, or objects, and the production of successful escape. Ahmed’s attention to specific body-object histories brought forward the idea of directionality in orientation as a geopolitical starting point, dictating from where and to where the body can move. Through the concept of (dis)orientation, we better understand how escapers were configured in the relationship between physical artifacts and social histories valued only through *particular* relational arrangements.

A critical/new materialist analysis of the data offers many moments where, in attempts to learn the logics of the room, participants are in relationships with materials toward other possible actions and logics. When we attune to disorienting intra-actions, we see a multiplicity of ways of approaching relationships with materials (e.g., singing together), and meaning-making (e.g., using singing to unlock a box) at work in intra-action, unfolding in ways the planned structure of escape does not detect or value. This methodological approach has “reorient[ed] us toward futures that are far less foreclosed, far less preplanned.” (Snaza & Weaver, 2015, p. 7). In looking to material intra-actions in learning, and particularly to disorienting intra-actions, we found participants’ ways of being with materials and each other in moment to moment activity might inform more expansive efforts of teaching and learning.

In an effort to move from singularity toward multiplicity, we noticed how possibilities for escape were organized in design and intra-action. Attuning to possibility calls us to notice how bodies are constrained such that we might consider relationships that could be, moving toward those that cultivate mutual flourishing. Escape is possible only when at least one player picks up on and orients with the designer’s intended semiotics at any given moment, simultaneously establishing value for their participation and knowledge. Casey orients to the shell as a signifier, an object whose message must be deciphered through grasping a shared meaning. If a player does not hold this same understanding, escape, as designed in these rooms, would be outside of their grasp. This required orientation to objects highlights that a shell is not simply a shell when placed as an intended resource in the escape room. The shell is meant to open further intra-actions yet it is also rigidly determining which are valued.

Attention to materials’ presence as actors in learning and material possibility can lead us to expand the relationships generated by how materials are valued and for what, for whom, and with whom (Philip et al., 2018). In disorienting intra-actions with materials, such as the conch shell, we see vibrant relationships form often momentary openings that *could* catalyze reorganizing activity, but instead are redirected toward alignment with the valued pathway. Some of these openings are sustained through multiple arrivals across the trajectory of escape, so much so that it is not clear to the group what relationships in action accomplished escape (as with singing). Incorporating Ahmed’s (2006; 2010) attention to orientation, we see that what participants “do do” with materials shapes what they “can do”. Ingold (2013) distinguishes, “the improvisatory creativity of labour that works things out as it goes along, from the attribution of creativity to the novelty of determinate ends conceived in advance” (p.20). By attuning to disorientation, we can see both improvisatory creativity and creativity for determinate ends in *The Author’s Enigma*. We argue that

this attention is necessary for understanding the conditions in which ingenuity can flourish, sustaining trajectories toward a multiplicity of valued futures. If we hope to render game play, “as a practice of the social imaginary of what is possible in the future for ourselves and others” (Gutiérrez et al, 2017, p.), including more-than-human futures, then we must consider more deeply how people are invited into relation with materials, as matter and what matters.

We seek structures that amplify and are responsive to the agencies enacted by all involved as they organize the conditions for and meaning of their actions and ensuing relationships. In educational environments taking up escape room play, this means agency co-constituted with learners, teachers (who are also learners), materials, and more-than-human life. How might we focus on the multiplicities of logics that emerge in the trajectories of learning in order to escape the settled ways that lives come to belong, to matter?

The methodological sensibilities of thinking with disorienting intra-actions offered us an entry point into seeing and valuing multiplicity with materiality. Recognizing that singular narratives imply a neutral, value-free way of knowing, Warren et al. (2020) offer a set of sensibilities required to engage with political and ethical forms of teaching and learning, one of which is a commitment to multiplicity. *Multiplicity* attunes to heterogeneity of knowledge and ways of knowing through analyzing relationships between people’s cultural histories and knowledge production (Warren et al., 2020). Ingold (2013) highlights Conneller (2011), stating, “it is clear that there is no such thing as “stone”; there are many different types of stones with different properties and these stones become different through particular modes of engagement” (Ingold, 2013, p30). Examining the material can lead from the singular to the multiple by moving beyond an essential nature of *things* to examine instead the *relationships* things generate. Hood and Kraehe (2017) suggest that getting lost with things in our surroundings in new materialist inquiry, “can engender new educational insights precisely because they are disorienting” (p.37). We see glimmers of this in multiple intra-actions in *The Author’s Enigma*, such as in Sam’s desire for the red fish to have a different role and in emergent singing.

Ahmed names that taking disorienting pathways – what she might describe as approaching lines with an oblique or queer angle – may need support. As paths become disorienting, new relations to ground and orient will be necessary. This critical new materialist analytic method offers an entry point toward finding where and how support is needed for recognizing, reorienting with, and designing for multiplicity. To be clear, support is not more scaffolding toward a pre-determined outcome, but a stance toward valuing, girding and steadying emergent disorientations being built from many histories, as an ongoing process of attunement. Instead of designing for disorientation that orients learners toward prescribed alignment (such as the red herring), we can seek and value the disorienting moves that offer insight to how we might reconfigure learning environments.

What histories and actions are we considering of the materials in learning environments? What histories and actions fail to come into our considerations? How are we, through methodological attunement, able to sense and be responsive to the histories that all involved bring to activity? In the escape room, the designer influenced valued orientations. Critical historicity (Bang and Vossoughi, 2016; Bang et al., 2016) is necessary for understanding the materiality of learning

particularly in efforts to nourish work on designing for many ways of being and knowing. Studying intra-action ultimately illuminates what ways people are dynamically produced as (un)successful, and what futures are rendered possible.

Conclusion

Expansive views regarding the conditions for learning will require expansive theoretical perspectives. Thinking-with-theory, including posthuman perspectives and ideas from beyond education research, is one methodological route for attending to the often overlooked material aspects of learning. For us it left us with lingering questions. What can we learn from moments of disorientation? How might such breaks in the structured material-participant discourse lead to new (or newly valued) interactional ways of being and epistemological pathways? If we go back to the tracing of the conch shell in *The Author's Enigma*, we see the group engage in song and laughter. What if this emergent expression had maintained a place of valued importance in the room?

It has been our focus throughout this paper to show how the organization of futures are narrowed and expanded in the micro-relational encounters of escape. By dwelling in and following material-participant intra-actions in *The Author's Enigma* through concepts of orientation and disorientation, we considered relational encounters with materials in learning as an invitation “to futurities worth having” (Rosiek, 2021, p. 4). In showing how micro-relational moments become consequential for the production of success, we also hope to show that there are everyday opportunities to disrupt the realities that render many unsuccessful. Attuning to learners’ disorientation is an opportunity to open, change, disrupt, and transform. These small moments, and how they echo out, matter.

References

- Ahmed, S. (2006) *Queer phenomenology: Orientations, objects, others*. Durham, NC: Duke University Press.
- Ahmed, S. (2008) ‘Open forum imaginary prohibitions: Some preliminary remarks on the founding gestures of ‘new materialism’’. *European Journal of Women's Studies*, 15(1), 23-39. doi: 10.1177/1350506807084854.
- Ahmed, S. (2010) ‘Orientations matter’. In: Cole, D. H. and Frost, S. (eds.) *New materialisms: Ontology, agency, and politics*. Durham, NC: Duke University Press.
- Ahmed, S. (2017) *Living a feminist life*. Durham, NC: Duke University Press.
- Bang, M., & Marin, A. (2015). Nature–culture constructs in science learning: Human/non-human agency and intentionality. *Journal of Research in Science Teaching*, 52(4), 530-544.
- Bang, M. and Vossoughi, S. (2016) ‘Participatory design research and educational justice: Studying learning and relations within social change making’. *Cognition and Instruction*, 34(3), 173-193. DOI: <http://dx.doi.org/10.1080/07370008.2016.1181879>
- Bang, M., Faber, L., Gunneau, J., Marin, A. and Soto, C. (2016) ‘Community-based design research: Learning across generations and strategic transformations of institutional relations toward axiological innovations’. *Mind, Culture, and Activity*, 23(1), 28-41. <https://doi.org/10.1080/10749039.2015.1087572>

- Barad, K. (2007) *Meeting the universe halfway: Quantum physics and the entanglement of matter and meaning*. Durham, NC: Duke University Press.
- Barad, K. (2003) 'Posthumanist performativity: Toward an understanding of how matter comes to matter'. *Signs: Journal of Women in Culture and Society*, 28, 801-831. <https://doi.org/10.1086/345321>
- Bennett, J. (2010) *Vibrant matter: A political ecology of things*. Durham, NC: Duke University Press.
- Bodrova, E. (2008). Make-believe play versus academic skills: a Vygotskian approach to today's dilemma of early childhood. *European Early Childhood Education Research Journal*, 16(3), 357-369.
- Bogost, I. (2007) *Persuasive games: The expressive power of videogames*. Cambridge, MA: MIT Press.
- Bogost, I. (2014) 'Why gamification is bullshit'. In Walz, S. P. & Deterding, S. (Eds.) *The gameful world: Approaches, issues, applications*. Cambridge, MA: MIT Press, pp. 65-78.
- Borrego, C., Fernández, C., Blanes, I., and Robles, S. (2017) 'Room escape at class: Escape games activities to facilitate the motivation and learning in computer science'. *Journal Of Technology and Science Education*, 7(2), 162-171. DOI: <http://dx.doi.org/10.3926/jotse.247>
- Britzman, D. P. (1998) 'Is there a queer pedagogy? Or stop reading straight?'. *Educational Theory*, 45(2), 151-165. <https://doi.org/10.1111/j.1741-5446.1995.00151.x>
- Conneller, C. (2011) *An archaeology of materials: Substantial transformations in early prehistoric europe*. London: Routledge.
- Danhoff, C., (April, 2022) 'Using digitalk escape rooms to make learning fun'. *Edutopia*. Downloaded from: https://www.edutopia.org/article/using-digital-escape-rooms-make-learning-fun?utm_medium=email&utm_source=rasa_io
- Eglash, R., Bennett, A., Babbitt, W., Lachney, M., Reinhardt, M., and Hammond-Sowah, D. (2020) 'Decolonizing posthumanism: Indigenous material agency in generative STEM'. *British Journal of Educational Technology*, 51(4), 1334-1353. <https://doi.org/10.1111/bjet.12963>
- Erickson, F. (1995) 'Ethnographic microanalysis'. In McKay, S. and Hornberger, N. (Eds.), *Sociolinguistics and Language Teaching*. Cambridge, UK: Cambridge University Press, pp. 283-306. doi:10.1017/CBO9780511551185.013.
- Flanagan, M. (2009) *Critical play: Radical game design*. Cambridge, MA: MIT Press.
- Fleer, M. & Peers, C. (2012). Beyond cognitivism: Creating collectively constructed imaginary situations for supporting learning and development. *The Australian Educational Researcher*, 39(4), 413-430.
- Freire, P. (2010) *Pedagogy of the oppressed*. 30th anniversary ed. New York, NY: Continuum.
- Gómez-Urquiza, J. .L., Gómez-Salgado, J., Albendín-García, L., Correa-Rodríguez, M., González-Jiménez, E., and Cañadas-De la Fuente, G. A. (2019) 'The impact on nursing students' opinions and motivation of using a "nursing escape room" as a teaching game: A descriptive study.' *Nurse Education Today*, 72, 73-76. <https://doi.org/10.1016/j.nedt.2018.10.018>
- Goodwin, C. (2010) 'Things and their embodied environments'. In Malafouris, L. and Renfrew, C. (Eds.) *The cognitive life of things: Recasting boundaries of the mind*. Oakville, CT: David Brown Book Co, pp. 103-120.
- Gutiérrez, K. D. and Vossoughi, S. (2010) 'Lifting off the ground to return anew: Mediated praxis, transformative learning, and social design experiments'. *Journal of Teacher Education*, 61(1-2), 100-117. <https://doi.org/10.1177%2F0022487109347877>

- Gutiérrez, K. D., Cortes, K., Cortez, A., DiGiacomo, D., Higgs, J., Johnson, P., Lizárraga, J. R., Mendoza, E., Tien, J., and Vakil, S. (2017) 'Replacing representation with imagination: Finding ingenuity in everyday practices'. *Review of Research in Education*, 41(1), 30–60. <https://doi.org/10.3102/0091732x16687523>
- Gutiérrez, K. D., Higgs, J., Lizárraga, J. R., and Rivero, E. (2019) 'Learning as movement in social design-based experiments: Play as a leading activity'. *Human Development*, 62, 66-82. <https://doi.org/10.1159/000496239>
- Gutiérrez, K. D., Becker, B. L. C., Espinoza, M. L., Cortes, K. L., Cortez, A., Lizárraga, J. R., Rivero, E., Villegas, K., and Yin, P. (2019) 'Youth as historical actors in the production of possible futures'. *Mind, Culture and Activity*, 26, 291-308. <https://doi.org/10.1080/10749039.2019.1652327>
- Halberstam, J. (2011) *The queer art of failure*. Durham, NC: Duke University Press.
- Hermanns, M. L., Deal, B. J., Campbell, A. M., Hillhouse, S., Opella, B., Faigle, C., and Campbell, R. H. (2017) 'Using an "escape room" toolbox approach to enhance pharmacology education'. *Journal of Nursing Education and Practice*, 8(4), 89–95. <http://hdl.handle.net/10950/632>
- Hickey-Moody, A., and Page, T. (2015) *Arts, Pedagogy and Cultural Resistance*. Retrieved from <http://www.rowmaninternational.com/books/arts-pedagogy-and-cultural-resistance>
- Hood, E.J. and Kraehe, A.M. (2017) 'Creative matter: New materialism in art education research,' *Teaching and Learning, Art Education*, 70(2), 32-38. <https://doi.org/10.1080/00043125.2017.1274196>
- Ingold, T. (2013) *Making: Anthropology, archaeology, art and architecture*. New York, NY: Routledge.
- Jackson, Z. (2013) 'Animal: New directions in the theorization of race and posthumanism?'. *Feminist Studies*, 39(3), 669-685. <http://www.jstor.org/stable/23719431>
- Jackson, A. Y., and Mazzei, L. A. (2012) *Thinking with theory in qualitative research: Viewing data across multiple perspectives*. New York, NY: Routledge.
- Koschmann, T., Stahl, G., and Zemel, A. (2007) 'The video analyst's manifesto (or the implications of Garfinkel's policies for studying instructional practice in design-based research)'. In Goldman, R. (Ed.). *Video research in the learning sciences*, 133-143.
- Lather, P. and St. Pierre, E. A. (2013) 'Post-qualitative research'. *International Journal of Qualitative Studies in Education*, 26(6), 629-633. <https://doi.org/10.1080/09518398.2013.788752>
- Leander, K. M., & Boldt, G. (2018). Design, Desire, and Difference. *Theory Into Practice*, 57(1), 29-37. <https://doi.org/10.1080/00405841.2017.1390331>
- Lewis, T. E. (2013). Education as free use: Giorgio Agamben on studious play, toys, and the inoperative schoolhouse. *Studies in Philosophy and Education*, 33, 201-214.
- Lopez-Pernas, S., Gordillo, A., Barra, E., and Quemada, J. (2019) 'Examining the use of an educational escape room for teaching programming in a higher education setting'. *IEEE Access*, 7, 31723–31737. <https://doi.org/10.1109/ACCESS.2019.2902976>
- MacLure, M. (2013) 'Researching without representation? Language and materiality in post-qualitative methodology'. *International Journal of Qualitative Studies in Education*, 26(6), 658-667. <https://doi.org/10.1080/09518398.2013.788755>
- Massumi, B. (2002). *Parables for the virtual*. Duke University Press.
- Matusov, E., & Hayes, R. (2000). Sociocultural critique of Piaget and Vygotsky. *New Directions in Psychology*, 18(2-3), 215-239.
- McKinney de Royston, M. and Sengupta-Irving, T. (2019) 'Another step forward: Engaging the

- political in learning'. *Cognition and Instruction*, 37(3), 277-284. <https://doi.org/10.1080/07370008.2019.1624552>
- McWilliams, J. (2016) 'Queering participatory design research'. *Cognition and Instruction*, 34(3), 259-274. <https://doi.org/10.1080/07370008.2016.1172436>
- McWilliams, J. and Penuel, W. R. (2017) 'Queer theory in the learning sciences'. In Esmonde, I. & Booker, A. N. (Eds), *Power and privilege in the learning sciences: Critical and sociocultural theories of learning* (pp. 93-114). New York, NY: Routledge.
- Muñoz, J. E. (2009) *Cruising utopia: The then and there of queer futurity*. New York, NY: NYU Press.
- Nasir, N. S., Lee, C. D., Pea, R.D., & McKinney de Royston, M. (2020). *Handbook of the cultural foundations of learning*. Routledge.
- Nicholson, S. (2015) 'Peeking behind the locked door: A survey of escape room facilities'. Retrieved from <http://scottnicholson.com/pubs/erfacwhite.pdf>
- Nicholson, S. and Cable, E. (2021) *Unlocking the potential of puzzle-based learning: Designing escape rooms and games for the classroom*. Thousand Oaks, CA: Corwin.
- O'Connor, K. and Allen, A. (2010) 'Learning as the organizing of social futures.' *National Society for the Study of Education*, 109(1), 160-175. <https://doi.org/10.1177%2F016146811011201311>
- O' Donoghue, D. (2020) 'Orientations, dispositions, and stances in art education research and scholarship'. *Studies in Art Education*, 61(3), 185-194. <https://doi.org/10.1080/00393541.2020.1809216>
- Patel, L. (2016) *Decolonizing educational research: From ownership to answerability*. New York, NY: Routledge.
- Paré, D., Sengupta, P., Windsor, S., John, C., and Thompson, M. (2019) 'Queering virtual reality. In Sengupta, P., Shanahan, M-C., and Kim, B. (Eds). *Critical, Transdisciplinary and Embodied Approaches in STEM Education*. Cham, CH: Springer, pp. 307–328.
- Peppler, K., Rowsell, J., and Keune, A. (2020) 'Editorial: Advancing posthumanist perspectives on technology-rich learning'. *British Journal of Educational Technology*, 51(4), 1240–1245. <https://doi.org/10.1111/bjet.12979>
- Philip, T. M., Bang, M., and Jackson, K. (2018) 'Articulating the “how,” the “for what,” the “for whom,” and the “with whom,” in concert: A call to broaden the benchmarks of our scholarship'. *Cognition and Instruction*, 36(2), 83-88. <https://doi.org/10.1080/07370008.2018.1413530>
- Plass, J. L., Homer, B. D. and Kinzer, C. K. (2015) 'Foundations of game-based learning'. *Educational Psychologist*, 50(4), 258-283. <https://psycnet.apa.org/doi/10.1080/00461520.2015.1122533>
- Rosiek, J. L., Snyder, J. and Pratt, S. L. (2020) 'The new materialisms and indigenous theories of non-human agency: Making the case for respectful anti-colonial engagement'. *Qualitative Inquiry*, 26(3-4), 331-346. <https://doi.org/10.1177%2F1077800419830135>
- Rosiek, J. L. (2021) 'Unrepresentable justice: Looking for a postqualitative theory of social change'. *Qualitative Inquiry*, 27(2), 239-244. <https://doi.org/10.1177%2F1077800420922263>
- Ruberg, B. (2019) *Videogames have always been queer*. New York, NY: New York University Press.
- Saldaña, J. (2009) *The coding manual for qualitative researchers*. Los Angeles, CA: Sage Publications.
- Selwyn, N. (2016) 'Minding our language: Why education and technology is full of bullshit... and what might be done about it'. *Learning, Media and Technology*, 41(3), 437-443.

- <https://doi.org/10.1080/17439884.2015.1012523>
- Sheridan, M. P., Lemieux, A., Nascimento, A. D. and Arnseth, H. C. (2020) 'Intra-active entanglements: What posthuman and new materialist frameworks can offer the learning sciences'. *British Journal of Educational Technology*, 54(1), 1277-1291. <https://doi.org/10.1111/bjet.12928>
- Snaza, N. & Weaver, J. A. (2015). *Posthumanism and educational research*. Routledge.
- Squire, K. (2005) 'Changing the game: What happens when video games enter the classroom?'. *Innovate: Journal of Online Education*, 1(6). <https://nsuworks.nova.edu/innovate/vol1/iss6/5>
- Squire, K. (2006) 'From content to context: Videogames as designed experience'. *Educational Researcher*, 35(8), 19-29. <https://doi.org/10.3102%2F0013189X035008019>
- Squire, K. (2008) 'Video games and education: Designing learning systems for an interactive age'. *Educational Technology*, 48(2), 17-26. <https://www.jstor.org/stable/44429558>
- Thiel, J. J. (2015) 'Vibrant matter: The intra-Active role of objects in the construction of young children's literacies'. *Literacy Research: Theory, Method, and Practice*, 64(1), 112-131. <https://doi.org/10.1177/2381336915617618>
- VeldKamp, A., Daemen, S. T., Teekens, S., Koelewijn, S., Knippels, M. P. J., and van Joolingen, W. R. (2020) 'Escape boxes: Bringing escape room experience into the classroom'. *British Journal of Educational Technology*, 51(4), 1220-1239. <https://doi.org/10.1111/bjet.12935>
- Vygotsky, L. S. (1966). Play and its role in the mental development of the child. *Voprosy psikhologii*, 12(6), 62-76.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Waermö, M. (2016) 'Broadening rules and aligning actions: Children's negotiation while playing hide-and-seek during break time'. *Learning, Culture and Social Interaction*, 11, 19-28. <https://doi.org/10.1016/j.lcsi.2016.04.001>
- Wargo, J. M. (2018) 'Writing *with* wearables? Young children's intra-active authoring and the sounds of emplaced invention,' *Journal of Literacy Research*, 50(4), 502-523. <https://doi.org/10.1177%2F1086296X18802880>
- Wargo, J. M. & Garcia, A. (2021). (Re)reading the room: The literacies of escape rooms. *Journal of Curriculum and Pedagogy*. <https://doi.org/10.1080/15505170.2021.1960224>
- Wargo, J. M., Morales, M., Blake, A. R., Corbitt, A., & Madres, J. (2022). Sounding escape: Examining the sonic contours of play and story in *The Author's Enigma. Mind, Culture, and Activity*, 29(3), 269-287.
- Warren, B., Vossoughi, S., Rosebery, A., Bang, M., and Taylor, E. V. (2020) 'Multiple ways of knowing: Re-imagining disciplinary learning,' In Nasir, N. S., Lee, C. D., Pea, R. D., and McKinney de Royston, M. (Eds.) *Handbook of the Cultural Foundations of Learning*. New York, NY: Routledge, pp. 277-293.
- Wohlwend, K. & Pepler, K. (2015). All rigor and no play is no way to improve learning. *Phi Delta Kappan*, 96(8), 22-26.