Possible Journals: Learning in Context (10K words)| Futures | Environmental Education Research (5K-7K words - env or sustain or planetary futures focus)

Enlisting Imagination to Understand and Support Teacher Learning and Agency for Participatory Science

To create something new or make a change you have to be able to imagine how things could be different, and that means in the past too. (McGonigal, 2022)

Introduction

In what ways does learning in the context of a school classroom position students and teachers to meaningfully contribute beyond their classrooms? Nobody, at any age, can be either fully free or completely stuck but the changeability and interdependence between what students and teachers contribute in classrooms with what they can or might contribute beyond classrooms such as through a campus garden or within their local (or wider) communities remains challenging to understand and support (cf. Lave, 2012).

To engage these twin challenges, we explore the relationship between learning and agency. We examine this relationship by engaging teachers in an activity that invites them to imagine new possibilities onto an ongoing shared agenda. The goal of projecting new possibilities onto situated agendas reflects a longstanding pragmatic perspective on the relationships between means and ends and how interplay of any agenda's coupled means-and-ends might shape perceptions for present action. Projecting new possibilities includes an emerging future but also a contingent past; looking backward or forward, individuals can imagine and project actions and consequences onto situated agendas. This temporal widening is a kind of ‘‘distance experience’’ (Mead, 1932) through which to imaginatively explore the past and the future along multiple temporal horizons.

Distancing in this way can reshape perceptions for present action insofar as action is not only rooted in the present moment but also channeled by the past; rereading and re-imagining the past can alter existing expectations and lines of action. Projecting new possibilities onto situated agendas is a way of organizing distance experiences. Creative and willful projections by individuals and groups can expand perspective on means-and-ends; by stepping back from the immediacy of a situated agenda, individuals can begin to perceive action as a trajectory with a wider temporal aperture. That is, stepping back may expand or reframe perceived action in wider relation to other, interrelated actions that reach both forward and backward in time (Mische, 2022). Stepping back and projecting cultivates a capacity to ‘‘get hold of the conditions of future conduct as these are found in the organized responses we have formed, and so construct our pasts in anticipation of that future’’ (Mead, 1932, p. 76).

- Supporting knowing and making through playing with time in order to orient thought and action to use cases (rather than institutions or disciplines) and to do so contextually and reflexively with socio-ecological accountability. Shifting from disembodied, decontextualized, institutional/normative, and objective knowledge, to socio-ecological knowing, making, and playing that are continuously adapting to and transforming with evolving yet enduring challenges.

Specific Context-for-Action

Our team has been exploring possibilities for playing with time within the context of learning activities focused on exploring energy systems of the past, present, and future. We are particularly interested in helping teachers and students understand and imagine sustainable and just alternatives to energy systems currently implicated in human-influenced climate change (Abramsky, 2010; Bridge et al., 2018; Pasqualetti, 2021). While decarbonizing energy systems is a widely accepted goal, technocentric strategies may constrain change because energy transitions can be uncertain and unpredictable (Jaxa-Rozen & Trutnevyte, 2021; Longhurst & Chilvers, 2019). Further, any transition strategy inevitably remains contested by the competing perspectives of varied stakeholders (Miller et al., 2013) and constrained by existing social and economic infrastructures that can not easily couple with new technologies and policy configurations (Kurtz et al., 2020). At stake is not only how much, but also in what ways different energy generation, distribution, and uses of energy systems are deployed in our homes, neighborhoods, and economies. These systems set the foundation of how people design and organize for our future communities and ecosystems, and are coupled with interdependent systems such as climate, pollution, water, food, and health (Wiser et al., 2016). Moreover, this foundation is dependent on our human capacity for exercising imagination and agency (Miller, 2022).

Education can play an important role in engaging next generation leaders with interconnected systems and vantage points on energy transitions (e.g., Authors, 2021; Author, 2023; Antik-Meyer & Alderman, 2021; Begmatovich & Anora, 2021; Cole et al., 2023; Merritt et al., 2023). In this paper, we emphasize the importance of local settings and practices in co-producing alternate pasts and possible futures perspectives on energy transitions. Mapping the processes and products of small group activities illuminates partial perspectives as well as excluded and unanticipated dimensions that underscore the importance of reflexive and responsible foundations for shaping sociotechnical systems.

References for this section

Abramsky, K. (Ed) (2010). Worldwide energy revolution: Social struggles in the transition to a post-petrol world. AK Press.

Bridge, G., Barr, S., Bouzarovski, S., Bradshaw, M., Brown, E., Bulkeley, H., & Walker, G. (2018). *Energy and society: A critical perspective*. Routledge.

Brogren, M., & Green, A. (2003). Hammarby Sjöstad - An interdisciplinary case study of the integration of photovoltaics in a new ecologically sustainable residential area in

Stockholm. Solar Energy Materials and Solar Cells, 75(3–4), 761–765. https:// doi. org/ 10. 1016/ S0927- 0248(02) 00133-2

Jaxa-Rozen, M., & Trutnevyte, E. (2021). Sources of uncertainty in long-term global scenarios of solar photovoltaic technology. Nature Climate Change, 11(3), 266–273. https:// doi. org/ 10. 1038/ s41558- 021- 00998-8

Kurtz, S. R., Leilaeioun, A. M., King, R. R., Peters, I. M., Heben, M. J., Metzger, W. K., & Haegel, N. M. (2020). Revisiting the terawatt challenge. MRS Bulletin, 45(3), 159–164. https:// doi. org/ 10. 1557/ mrs. 2020.

Miller, C. A., Iles, A., & Jones, C. F. (2013). The social dimensions of energy transitions. Science as Culture, 22(2), 135–148. https://doi.org/10.1080/09505431.2013.786989

Miller, C. A. (2022). Redesigning political economy: The promise and peril of a green new deal for energy. In B. Fong & C. Calhoun (Eds.), *The Green New Deal and the future of work.* Columbia University Press.

Pasqualetti, M. J. (2021). *The thread of energy*. Oxford University Press.

Wiser, R., Trieu, M., Millstein, D., Macknick, J., Carpenter, A., Cohen, S., Cole, W., Frew, B., & Heath, G. A. (2016). On the path to SunShot: The environmental and public health benefits of achieving high penetrations of solar energy in the United States. National Renewable Energy Laboratory. NREL/ TP-6A20-65628. http:// www. nrel. gov/ docs/ fy16o sti/ 65628.Pdf

---

Antink-Meyer, A., & Aldeman, M. (2021). Middle grades teachers' content knowledge for renewable energy instruction design. Research in Science & Technological Education, 39(4), 421–440. https:// doi. org/ 10. 1080/ 02635 143. 2020. 17670 48

Begmatovich, A. U. & Anora, K. (2021). Methods of forming elementary concepts of renewable energy sources in physics on the basis of interdisciplinary connections. Eurasian Journal of Humanities and Social Sciences, 3, 74–77. https:// geniu sjour nals. org/ index. php/ ejhss/ artic le/ view/ 275/ 242

Cole, L. B., Fallahhosseini, S., Zangori, L., & Oertli, R. T. (2023). Learnscapes for renewable energy education: An exploration of elementary student understanding of solar energy systems. Interdisciplinary Journal of Environmental and Science Education, 19(1), e2305. https:// doi. org/ 10. 29333/ ijese/ 13034

Merritt, E. G., Weinberg, A. E., & Archambault, L. (2023). Exploring energy through the lens of equity: Funds of knowledge conveyed through video-based discussion. International Journal of Science and Mathematics Education. https:// doi. org/ 10. 1007/ s10763- 023- 10352-3

Theoretical Perspective

We enlist a social and cultural view of learning and knowing (e.g., Cole, 1996; Greeno et al., 1996; Nasir et al., 2020), wherein learning is understood as an ongoing process inextricably bound to evolving social situations. Learning and knowing emerge in relation to actual activity and the contextual conditions that afford and constrain possibilities (Greeno & Engestrom, 2014). Dewey (e.g., 1938) similarly conceived of experience as active engagement with both the actual and the possible, defining imagination and intelligence in the same terms: “to see the actual in light of the possible” (Alexander, 1993, p. 384). Understanding actuality and potentiality in this view are complementary—two sides of the same coin of experience—each encompassing the temporal interplay of past, present, and future (Alexander, 1990).

Learning, in this framework, is therefore a situated negotiation between what is and what could be. It involves ongoing transactions between individuals and environments (Priestley et al., 2015), through which actors continuously interpret, project, and reconfigure their relationships with the present and future but also the past, which is the focus of our study. By examining the present in relation to the past, learners engage in temporal inquiry that enables them to reinterpret existing trajectories and imagine new ones. By extension, imagining alternate pasts is not simply a counterfactual exercise but a mode of tuning a situated chord of past, present, and future that can expand the learner’s capacity for agential engagement and intentional action (Emirbayer & Mische, 1999).

By co-constructing alternate pasts, individuals reflect on what might have been to reorient what might yet be. They participate in a temporal dialogue in which reflection, imagination, and action interpenetrate. Sensemaking (constructing coherence) and sensebreaking (disrupting coherence) operate in tandem to reveal new meanings and alternative pathways within a situated agenda (Pendleton-Jullian & Brown, 2018). To imagine an alternate past, then, is not to deny what has been but to reengage it differently—to reinterpret its significance, rework its boundaries, and create new conditions for perceiving and responding to the present. Temporal reflection thus becomes a site of agency, where action in the present is informed by reconfigured understandings of both past and future.

In this view, teacher agency is both a relational and temporal achievement (Cochran-Smith et al., 2022; Priestley et al., 2015). Temporality illuminates how agency enlists both habits of the past and projections into the future to make judgments in the present. Emirbayer and Mische (1998) describe this temporal integration as a musical chord, where each orientation—past, present, and future—resonates in a dynamic harmony unique to the individual. Exercising agency, therefore, involves co-constructing one’s temporal chord through reflective and imaginative practice. Dewey (1922) helps clarify this view by emphasizing that “all habits are demands for certain kinds of activity and they constitute the self” (p. 22). Habits are not fixed routines but active tendencies—primed responses seeking opportunities for expression—that individuals can appropriate or transform in relation to present judgment and future projection. This view illuminates both a reciprocal and transitive relationship among the past, present, and future. Tuning the notes of a chord involves reciprocal movements in meaning among past, present and future. Achieving new chordal resonance, in turn, constitutes a transition, generating new relations with a situated agenda.

Design-based research (DBR) offers a productive methodology for investigating how such temporal and imaginative processes unfold in practice. In this study, DBR is used to

examine how teachers engage with a historical situation (e.g., coupled food, energy, and water systems in the early twentieth-century U.S. Southwest) as part of a counterfactual learning activity that invites them to imagine alternate pasts. By reimagining these historical trajectories, teachers reflect on the contingencies and assumptions underlying present energy systems, thereby expanding their capacity to imagine and act toward preferred futures. This reconfiguration of temporal understanding constitutes a form of temporal design—an intentional shaping of how experiences unfold across time without presuming their outcome. The future, accordingly, is not a fixed destination but a relational and emergent space co-constructed through imagination, interpretation, and action.

In sum, this theoretical framework conceptualizes learning as a dynamic relationship among past, present, and future that affords new ways of seeing, acting, and becoming within complex systems. Understanding learning and agency through this lens reframes time as a constitutive dimension of thought and action, not a neutral backdrop. It positions imagination as a central educational practice for reconfiguring temporal experience, enabling learners and educators alike to intervene in the unfolding of situated agendas by composing new harmonies between what has been, what is, and what could yet be.

Literature Review

Understanding how learners and educators engage with time can illuminate relationships between agency and imagination. Time itself can be viewed both as an ontological category and a social construction. The idea of time refers to a measurable, physical dimension: it orders past, present, and future through processes of duration, acceleration, and recurrence. This view, grounded in physical and biological rhythms, situates time as an external condition observed and measured. In contrast, the idea of time can also be deeply entangled with social practice. Social theorists such as Nowotny (1996) have shown that the experience of time is mediated by cultural norms, economic arrangements, and political priorities. For example, industrial agriculture can compress temporal cycles to maximize efficiency, transforming both the pace and meaning of food production (Adams, 1998). This comparison underscores that time is multi-dimensional, at once organized and lived, quantitative and qualitative, objective and intersubjective (e.g., Raia, 2020).

The ways humans experience time relates to the linear deadlines, calendars, and schedules that structure activities as well as to the cyclical, seasonal, rhythmic recurrences that give continuity to spiritual and agricultural practice, but also human ways of being and knowing. Heidegger (1962) described temporality as constitutive of human experience and a horizon of understanding. Specifically, individuals make sense of the world, themselves, and their actions in relation to the immediacies of the present but also to possibilities for the past and future. Individuals orient to each moment by attuning. For example, Cole (1996) characterizes raising a child in terms of the ways that parents look backwards into their own past childhood experiences in order to anticipate the actions they might take to raise their own child. Dewey (1922) similarly argued that thought and action are always pragmatic, situationally grounded, and temporally open-ended. Means and ends, for Dewey, are not separate entities but interwoven aspects of activity, emerging together as people act within contexts of uncertainty and possibility. Similarly, Raia (2018) underscores that projecting oneself into possible ways of being is less a cognitive act than an ongoing enactment in interaction, highlighting how

existential temporality is inseparable from identity and imagination in educational contexts. These perspectives emphasize that temporality is not a neutral backdrop but an active medium through which humans orient thought and action in the present, and in relation to the past and future.

Building on this, scholars of historical time have argued that past and future are not fixed entities but dynamically co-constituted with the present. Koselleck (1985/2018) distinguished between “spaces of experience” and “horizons of expectation,” showing that the way people interpret the past is always inflected by imagined futures, and vice versa. Such entanglements mean that temporality itself becomes a site of imaginative and political contestation. Fictional and speculative traditions amplify this insight. Bellamy’s Looking Backward (1888) and Oreskes and Conway’s The Collapse of Western Civilization (2014) exemplify how counterfactual narratives invite readers to inhabit alternate timelines, generating critical distance from present trajectories and prompting reflection on what could have been or what might still be.

This dynamic relation between actuality and potentiality is at the heart of imagination as a temporal process, reflecting Dewey’s ecological orientation to human activity (Alexander, 1990). Building with this orientation, Pelaprat and Cole (2011) describe imagination as a process of image-making that resolves “gaps” between biological constraints and cultural mediation, enabling coordination across time and space. In their view, imagination ends when discrepancies are provisionally resolved into an image of the world in which action becomes possible; activity begins when those imagined resolutions are embodied and shared on a socio-historical scale. Zittoun and Gillespie (2015) similarly theorize imagination as a looping process in which individuals uncouple from the immediacies of the present, explore alternative temporal horizons, and then re-enter situated contexts with reconfigured perspectives. These loops of imagination can be individual, interactive, or collective, and they highlight how imaginative engagement is tethered to temporal orientation.

Yet imagination is not purely an affordance; it can also be constrained by narratives (e,g, Scranton, 2025) and plausibility (e,g, Alexander, 1993) as well as time. Mische (2009), for example, emphasizes that while narratives of the past can be revised, they remain disciplined by truth claims that distinguish them from purely speculative futures. Similarly, Dewey (1922) noted that recombining the past is limited by the cultural repertoires available to individuals and groups. At the same time, speculative play with alternate pasts can expand the range of possibilities for present action. In this sense, playing with time is less about escaping actuality (what is perceived as real) than about enlisting potentiality to deepen relational engagement with it.

The educational significance of these varied perspectives lies in how they link temporality, imagination, and agency. Agency, following Biesta and Tedder (2007) and Emirbayer and Mische (1998), is not a fixed capacity located within individuals but a relational achievement embedded in contexts of action. Agency resonates like the three notes of a musical chord, in which orientations to the past, present, and future intertwine in varying degrees of harmony. Learning, likewise, is an ecological function that operates between individuals and the socio-material environments in which they participate (Cole, 1996). Both learning and agency are therefore temporal accomplishments: they emerge through engagements that recombine actuality with potentiality across shifting horizons and timescales (Lemke, 1990).

In this light, educational designs that invite learners to “play with time” can cultivate new forms of agency (cf. Ferrero, 2022). We conjecture that, by co-constructing alternate pasts, participants can gain reflective distance from received patterns, expand their imaginative repertoires, and reconsider action within socio-technical systems. Historical recollection, as Alexander (1992) and Krznaric (2024) suggest, can itself be a resource for action oriented toward humane futures. A design-based approach to temporality, what we term *timequakes*, seeks to operationalize this insight and expand on prior efforts to explicitly anchor temporality in disciplinary practice (e.g., Raia et al., 2021). Timequakes provide structured opportunities for learners to uncouple from the immediacies of their present, imaginatively recombine temporal orientations, and re-enter situated agendas with new possibilities for thought and action.

Design

As an example of design-based research, this study maps a conjecture (Sandoval, 2014) that embodies supports for an ecological theory of agency through designs that make visible and tractable the interplay between individual intentionality—formulating and considering possibilities, then exercising choice—and the material, social, and cultural contexts of situated action. This section maps the following high-level theoretical conjecture about learning through temporality onto design conjectures within a learning environment: providing opportunities for participants to recognize and reimagine a historical context-of-action supports more expansive orientations toward exercising agency in the present within that same context. This conjecture links imagining alternate pasts—as a temporally transitive process of reflection, sensemaking, and sensebreaking—to the learning goal of expanding agentic imagination. In this way, the study interrogates temporality as a constitutive dimension of learning through which participants recompose their relations among past, present, and future in ways that can reorient their capacity to act.

The timequake activity serves as the primary embodiment of this conjecture. A timequake is a brief and bounded engagement with a historical narrative intentionally designed to support participants in creating alternate possibilities. It discretely frames a situated agenda in relation to time, bracketing it off from the continuous flow of activity to render its temporal contours visible; that is, bracketing serves to interrupt the continuity of practice so that participants can perceive and examine the underlying temporal structure of agendas that ordinarily unfold without reflection. Within this bounded temporal frame, participants modify the narrative in order to co-construct the alternate past of a situated agenda while simultaneously envisioning new possibilities for the same ongoing agenda in the present. In this way, a timequake organizes an educational opportunity to both see a situated agenda differently—by examining the reciprocal relationships among its past, present, and future—and act differently in relation to it—by engaging the transitive movement between potentiality and actuality.

Participants in timequakes engage with discretely framed, situated historical narratives about the food–energy–water (FEW) nexus in the Sonoran Desert and explore how what actually unfolded might have differed given other possible choices. This activity reifies the theoretical notion of temporal agency by situating participants in a space of intentional reflection on alternate pasts. Through this design, tools (fictional yet plausible historical accounts), task structures (modifying and discussing those accounts), participant structures (small-group collaboration followed by whole-group synthesis), and discursive practices (reframing,

reinterpreting, and projecting implications) are coordinated to create conditions for learners to navigate between past possibilities and present action.

Timequakes mediate a collaborative and reflective process through which talk and collective revisions of narratives become temporally transitive. Talk focuses on collective sensemaking around the contingencies of historical development and reflective discourse linking potential pasts with possible presents. By co-constructing alternate pasts that disrupt conventional expectations, teachers engage imagination as both a generative and synthetic capacity—one that enables them to see beyond the constraints of reality and to design new possibilities within complex, contingent agendas. As temporal disruptions, timequakes scaffold the co-creation and synthesis of alternate possibilities and, in turn, seed transformative intent for shaping present and future trajectories.

The outcome of a timequake is twofold. First, the process results in the recomposition of learning, agency, and temporality within a situated agenda. Second, the recomposed temporal reorientation cultivates expanded and sustained engagement with situated agendas beyond the classroom, enabling a more expansive orientation toward the collective work of participatory science. Teachers perceive and act within the temporal structure of the food–energy–water (FEW) nexus by recognizing how past trajectories, present conditions, and imagined futures interact to shape possibilities for action, specifically in relation to agrivoltaics participatory science project with students, partners, and local communities. Teachers can design for possibilities that emerge in relation to, rather than apart from, the ongoing agenda by reading and navigating the complexity of these agendas and acting through multiple, adaptive, and nonfixed pathways.

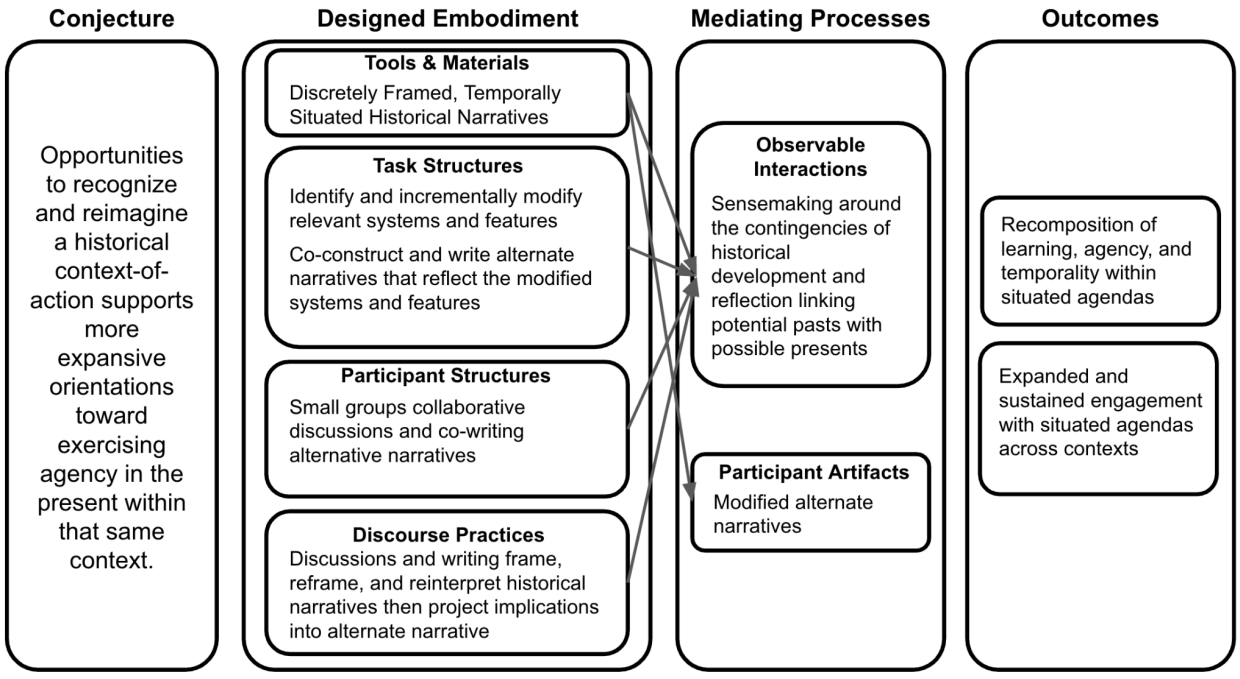


Figure 1. Conjecture Map [link]

Alternate Past Timequake [Timequakes_NexusExplorer24] Personal Notes

The timequake activity featured in the study presents narratives about everyday life in two contrasting historical periods, each written as a first-person letter that integrates elements of the local food–energy–water (FEW) nexus. For example, a letter from the U.S. in 1900 describes new indoor plumbing and its influence on daily routines. Each narrative serves to situate participants in a tangible, lived relationship with the FEW systems of a discrete time and place, foregrounding the material and social arrangements that constitute a situated agenda. Small groups engage with each narrative through a progression of four tasks. First, they read the letter to characterize the FEW nexus in terms of the fictitious author's own situated agenda. Second, they reframe the situation by identifying and incorporating earlier or later elements of FEW systems—such as tracing indoor plumbing back to hand pumps or forward to hot and cold water systems. Third, the group uses these contingent FEW systems to create new ways of thinking about the situation, asking how alternate technologies, choices, or social priorities might have shaped different pathways. Finally, they synthesize these possibilities by modifying the letter to reflect an alternate history, rewriting the narrative to express what might have been and how it could inform present possibilities.

Methods

We use design-based research (Barab, 2014) to embody time play (cf., Suddendorf & Corballis, 1997) in the design of timequake activities. We employ a concurrent nested mixed methods research approach (Biesta, 2010) to interrogate social interaction as small groups enact the timequake design.

Participants

We report an enactment of the design above with three K-12 STEM teachers--Justin, Nancy, and Samantha--in the southwestern U.S. Each participated in the study midway through a paid professional development fellowship associated with the Sonoran Photovoltaics Laboratory classroom-based participatory science program (SPV Lab; Jordan, Zuiker et al, 2025; Zuiker et al., 2023). The six-week fellowship provided the ten-person cohort with opportunities to contribute to photovoltaic engineering research and to co-develop SPV Lab educational materials. During the subsequent 2025-2025 academic year, each teacher organized SPV Lab programming that compared campus garden plots with and without photovoltaic panels. Because plots with panels typically produce more food and energy, students also considered the value of agrivoltaics for their local food, energy, and water systems (Fortner et al., 2020).

Data Generation

Participating teachers enacted the design above during an hour-long video conferencing session. Separate small groups of three teachers each consented to participate then reconvened to debrief and discuss their experiences. We generated social interaction data by recording triad and whole group discussions (120 total minutes) and by capturing written and graphical artifacts that the groups created.

Data Analysis

To interrogate our high-level theoretical conjecture, we conducted interaction analysis (Jordan & Henderson, 1995) by transcribing, annotating, and tracing how participants co-constructed meaning in real time as each task unfolded and over time across all tasks. We enlist Zittoun and Gillespie's (2015) concept of the loop of imagination to characterize imagination as a movement of thought and action. A loop begins with a trigger (i.e., designed activity) that involves resources (i.e., designed historical letters) to achieve an outcome (see Figure 1)

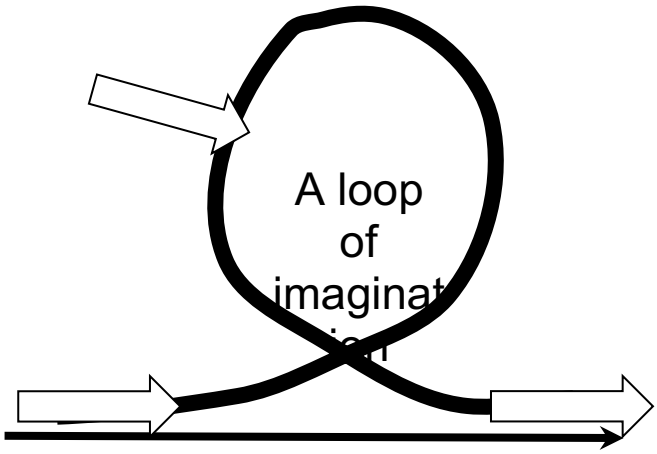


FIgure 1. A loop of imagination (adapted from Zittoun & Gillespie, 2015)

Our analysis identifies and interrogates three analytic dimensions of loops: temporal orientation (how participants shifted between past, present, and future perspectives), generalization (how they connected local reflections to broader patterns), and plausibility (how they evaluated imagined possibilities as credible, desirable, or actionable; see Table 1).

Table 1. Analyzing the Loop of Imagination (Zittoun & Gillespie, 2015)

Dimension	*Definition*	*Example*
Temporal orientation	Orienting toward past, future, or an alternative present	Re-experiencing first day of school or imagining next holiday
Generalization	Utilizing either concrete and specific or generalized and abstracted semiotic means	Dreaming of strawberries or chemical equations
Plausibility	Relative distance to actual, socially shared circumstances	Dreaming of strawberry pie or unicorn pie

These dimensions also map onto a three-dimensional analytic space that visualizes loops (see Figure 2).

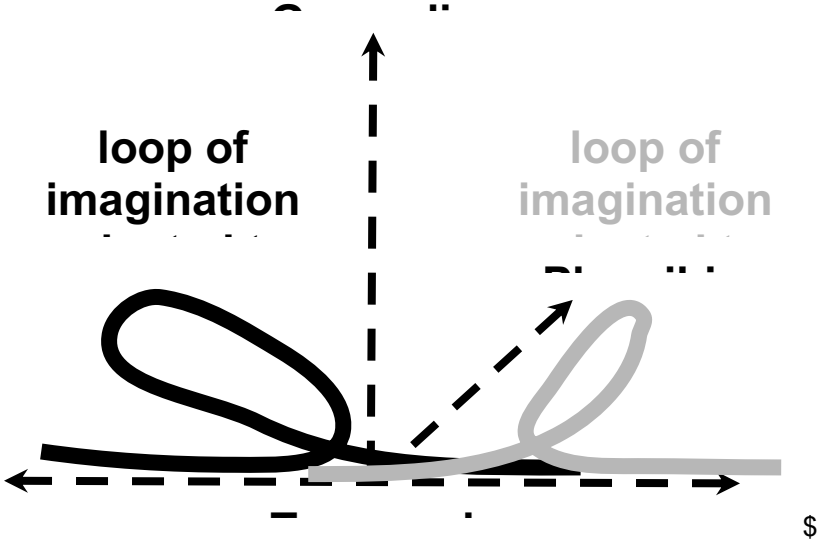


FIgure 2. Mapping different loops of imagination (adapted from Zittoun & Gillespie, 2015)

By analyzing how interaction among the participants organizes and achieves loops along these dimensions, we visualize and trace how groups moved through cycles of reflection and projection—how they paused, disrupted, and recomposed temporal relations in ways that made agency visible as an unfolding, relational process. Our analytic process was abductive (Marková, 2012; Valsiner, 2012). We iteratively generated conjectures about how timequakes functioned as designed triggers in relation to empirical episodes. Our analytical goal was neither to prove our conjecture nor to simply illustrate it, but rather to characterize the mediating relationship between design and theory (Sandoval, 2014) in order to understand its impact and refine the concept of temporal agency as a process of imagination, reflection, and action.

NOTE: We might unpack the different types of loops we discuss in the findings (this could be a methodological and/or theoretical contribution we can make)

- interactive, collaborative, progressive, individual, collective

Findings

In this case narrative, we analyze social interaction in order to characterize how timequakes mediate temporal engagement. We concentrate on a single enactment among one teacher triad in order to illuminate impact and refine a theory of timeplay. In general, both enactments demonstrate that teachers played with time, engaging the current FEW nexus in wider relation to alternate past possibilities. We focus primarily on an enactment aligned with our design intentions in order to illuminate how temporal interplay during timequakes position educators to engage with the actuality and potentiality, organizing opportunities to explore how eco-technical-social systems transformations contribute to possible and preferred futures. However, we enlist contrasting examples to temper our interpretations and inform ongoing efforts to understand and refine the ways in which timequakes mediate timeplay.

Episode 1: Initial Engagement with a Loop of Imagination [~900 words]

We focus on Justin, Nancy, and Samantha because they, as a triad, collaboratively enacted all four tasks featured in the intended design, progressively engaging the relationship between actuality and potentiality that defines temporal agency in our framework. The initial episode begins as the group reads a fictional letter from 1900 and pauses to interrogate a reference to trolleys. They search “1900s trolley” to ground their imaginative work in historical material. The episode begins as Justin shares insights from an internet search.

Table #. Episode 1a (timestamp)

Justin:	Yeah (.) it says it reached its extensive use in San Francisco and Seattle because they had a lot of downhill momentum for those trolleys.
Nancy:	That makes sense (.) because walking up and down those hills is not something you want to do there
Samantha:	But that's also really interesting because we know you have it down, but then it would take a lot of energy and work to pump to pull that up
Nancy:	That's true
Samantha:	But again, maybe it's just more used because of the need being greater
Nancy:	Right (.) and the steam (.) was that wood steam do you think? or was that coal? It was probably coal.
Samantha:	That's what I think
Justin:	Probably (.) yeah
Nancy:	So do you think because of the new reliance on coal and how coal (.) “oh my gosh! Coal is so much more better (.) more efficient of an energy source” Do you think that's why we got stuck on coal? Was right here? In this?
Justin:	That and the abundance compared to wood=

Drawing on Zittoun and Gillespie (2015), this episode marks the beginning of a temporary uncoupling from the here-and-now and a looping backward in time before re-entering the immediate situation with a reconfigured perspective. To begin, Justin's search for historical facts functions as a trigger: it signals a deliberate effort to enrich the group’s interpretive resources before composing an alternate past. As the episode progresses, comments from all three anchor the letter to historical evidence until Nancy’s final turn at talk introduces speculative reasoning about energy trajectories, asking “Do you think that's why we got stuck on coal?” Reading and interpreting the letter establishes both a context and an imaginative resource that scaffolds this initial uncoupling. As a result, the group collectively reconstructs an early 20th-century energy system—steam engines, hilly terrain, coal and wood fuels—that reflects a transaction between the actual and the possible (Dewey, 1938).

Consistent with our conjecture about interplay among the past, present, and future, collaboratively engaging with the narrative creates the conditions for a past energy system to serve as a resource relevant to present judgment and future projection related to their SPV Lab fellowship (cf. Emirbayer & Mische, 1999). Specifically, Nancy’s speculative question initiates a first loop of imagination, bridging a historically situated energy transition to coal with an ongoing

dependence on carbon-based fuels in the present. We employ Zittoun and Gillespie's (2015) loop of imagination to map this initial event. In relation to time, using the indexical "we" expands the temporal orientation of the loop, linking the past narrative to the present situated agenda central to the SPV Lab fellowship. The same expansion, in turn, generalizes the idea of an energy transition by linking the historical narrative to a contemporary socio-technical critique. Finally, as a form of speculative reasoning, Nancy's question considers what might have been (i.e., possible) without departing from what could have been (i.e., plausible). As such, her speculation remains tethered to empirical history, or disciplined by truth claims that distinguish counterfactual reasoning from fantasy (Mische, 2009). Taken together, Figure 1 below illustrates Nancy's question in terms of a loop of imagination.

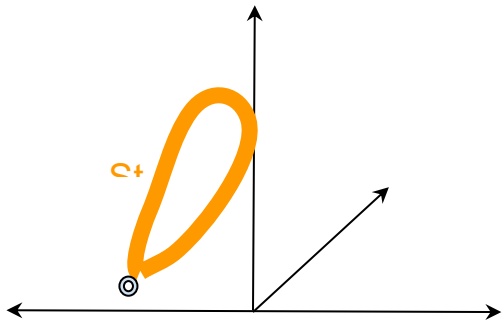


Figure 1. Loop of imagination depicting the individual loop in episode 1

In relation to her question, Nancy's recognition of a societal "we" that is "stuck on coal" constitutes a temporal re-coupling of energy transitions as a situated agenda that extends forward from 1900. Her talk is agential not because it enacts change directly, but because it reorients perception toward problematic trajectories and opens deliberative space for imagining alternatives. By describing then reframing a "new reliance on coal" as the possible origin of being "stuck" in the present, her question holds past and present in productive tension and aligns with Dewey's (1922p. 22) conception of habits based on the past as "demands for certain kinds of activity,"or an active tendency seeking transformation. The outcome of this episode, however, is neither a finalized insight nor a concrete plan of action but rather a recomposition of temporal orientation: a shift in how the participants perceive their own entanglement with historical energy systems. As such, it remains a momentary oscillation between historical inquiry and speculative projection that resonates with the intended design: reflective, situated, and temporally expansive engagement with socio-technical transitions as both historical inheritances and future possibilities.

This initial engagement with a loop of imagination shapes the group's collective inquiry. Nancy's question momentarily suspends the first task of the intended design (i.e., reading and interpreting the letter), entering a reflective space where they reconfigure temporal relationships among past, present, and future. Consistent with our design conjecture, it illustrates how the initial task and resources of the intended design scaffold an intentional and intersubjective shaping of the activity without predetermining its outcomes. Nevertheless, it remains unclear

whether or how an initial and momentary oscillation contributes to a more enduring temporal recomposition of the situated agenda.

Episode 2: Progressive Engagement across Multiple Loops of Imagination (1100 words)

After characterizing the FEW nexus in the historical letter, the group continues with the second task: altering two systems by incorporating earlier elements of one and later elements of another, leaving a third unchanged along the historical timeline of the actual 1900. We conjecture that the letter and task together operate as a designed trigger for uncoupling the participants' temporal orientation from both the proximal here-and-now situated agenda as well as the historical there-and-then of 1900 (Zittoun & Gillespie, 2015, p. 41). This uncoupling organizes an opportunity to imagine and explore what could have been as a way of reflecting on what might yet be. In relation to the long arcs of energy transitions and the immediacies of a participatory science program, these opportunities specifically intend to cultivate reflective distance from received patterns and to amplify an alternate history based on different judgements in the past-present (e.g., 1901) and different projections into a past-future (e.g., 1920s)--key features of temporal agency (Emirbayer & Mische, 1998).

The episode associated with this task begins as Samantha poses a speculative question to her peers: "what if Tesla's idea would've been--because it's more efficient--would've been the one to take off?" Her question re-enters the historical setting through the well-documented "war of the currents" (e.g., McPherson, 2012), juxtaposing Tesla's alternating-current and Edison's direct-current models for US electricity distribution while also remaining disciplined by actual historical circumstances (Miche, 2009). It marks the beginning of a loop of imagination that explores historical possibility (Figure 2a below). It is temporally oriented towards a counterfactual, alternate past; it is minimally generalized from actual to probable concrete electrification models; and remains highly plausible. It also exemplifies seeing the actual past in light of possible pasts (Dewey, 1922), creating an affordance for reflecting on the present as well.

As the episode continues, Nancy extends Samantha's speculation by proposing an alternative fuel rather than an alternative current. In the transcript below, Nancy shares her speculation and Samantha intermittently ratifies an unfolding scenario and then disciplines it by invoking the Dust Bowl as a historical counter-constraint.

Table #. Episode 2a (Timestamp)

Nancy:	I'm wondering what would've happened if instead of going gasoline for cars (.) what if they would've gone the corn ethanol route (.)
Samantha:	Yeah
Nancy:	How would that have affected the food system because suddenly cereal would be way more expensive
Samantha:	Yep
Nancy:	because that's how we're powering our cars (.) you know=
Samantha:	=Yeah (.) yeah=
Nancy:	=And would we eventually even get to solar energy because would we have the problems with like 'cause at first people

	are like “oh we're gonna run out of this” but we wouldn't’ve run out of corn
Samantha:	But think about (.) because we have a lot (.) who's gonna farm it (.) think about the Dust Bowl (.) think about all these things that are coming (2.0) I mean (.) there's a lot.
Nancy:	The Dust Bowl happened (.) one of the reasons it happened (.) was because they were over-farming it for industrial purposes
Samantha:	So would the corn have grown (.) do you see what I'm saying (.) Our system isn't really equipped for relying back on [inaudible]. So that could have had a really big impact on history.

Similar to prior loops, Nancy begins the second loop in our analysis of Episode 2 with a speculative prompt and Jaime also engages, establishing an intersubjective aspect. With respect to our analytical framework, the loop oscillates in its temporal orientation, from 1900 to the mid-twentieth century Dust Bowl, an implied near-present event (Figure 2b below). In relation to second loop described above, it generalizes to the same alternate past to an energy alternative as well as its systemic effects on agriculture, pricing, and renewable transitions; it remains variably plausible, fluctuating between credible and increasingly speculative contingencies like limitless corn, which conflict with ecological thresholds. Jaime’s concluding challenge--“would corn have grown?”--re-couples speculation with actuality.

We conjecture that closing the loop in this way constitutes a pragmatic outcome of reflective evaluation rather than a product of fanciful exploration. Through this movement, participants do not simply imagine alternatives for their own sake but co-construct the significance and contingency of a distal historical situation, and in wider relation to both proximal historical moments and the present. In doing so, they engage in a form of temporal reasoning that reveals interdependencies among systems—energetic, ecological, and social—across a historical arc. This reflective process reorients how meaning is made from the past, transforming perception and understanding, rather than revising what historically occurred.

With respect to design, this outcome supports our conjecture that timequake activities can scaffold temporal agency by enabling participants to re-couple imaginative speculation with reflective evaluation. The goal is not to validate counterfactual accuracy but to expand participants’ capacity to perceive and interpret systemic relations through time, thereby composing new possibilities for thought and action in the present.

As a final loop of imagination associated with this episode, the group disengages from historical speculation and turns reflexively to the timequakes activity itself. Samantha suggests that it would be “great for seventh grade and eighth grade where they're doing sustainability” and Nancy replies “This would be amazing. And the kids love exploring multiverses, alternate timelines.” Here, imagination loops back into education, transforming the timequake experience into a design idea for their own classrooms (Figure 2c below). This loop is collaboratively co-constructed. The temporal orientation centers on the near future of curriculum design; its generalization extends from specific energy systems to the broader pedagogical possibilities for playing with time; and its plausibility is grounded in the teachers’ practical knowledge. The shift contextualizes shared experience in wider relation to pedagogical possibility. Contextualizing

social imagination involves “a process of synthesis on the part of actors, as they attempt to reconcile their own developing projects-in-formation with identities and narratives that are being projected at them” (Mische, 2001, p. 140). By synthesizing two situated agendas—the FEW nexus and education—the teachers translate imaginative reflection into pedagogical intention. Their dialogue renders visible the design’s ultimate purpose: not simply to rehearse historical alternatives but to cultivate educators capable of temporal recomposition within their own systems of practice.

The loops of imagination associated with this episode evolve from individual to intersubjective to collaborative, progressively widening participation and temporal reach. Each demonstrates how imagination operates as a situated, transitive process: uncoupling from actuality, exploring potentiality, and re-coupling through reflective evaluation. This sequence exemplifies the designed affordances of a timequake as a bounded temporal intervention that scaffolds temporal agency. We conjecture that agency emerges not as autonomy but as temporal attunement—an expanded capacity to perceive, judge, and act across interwoven horizons of past, present, and future.

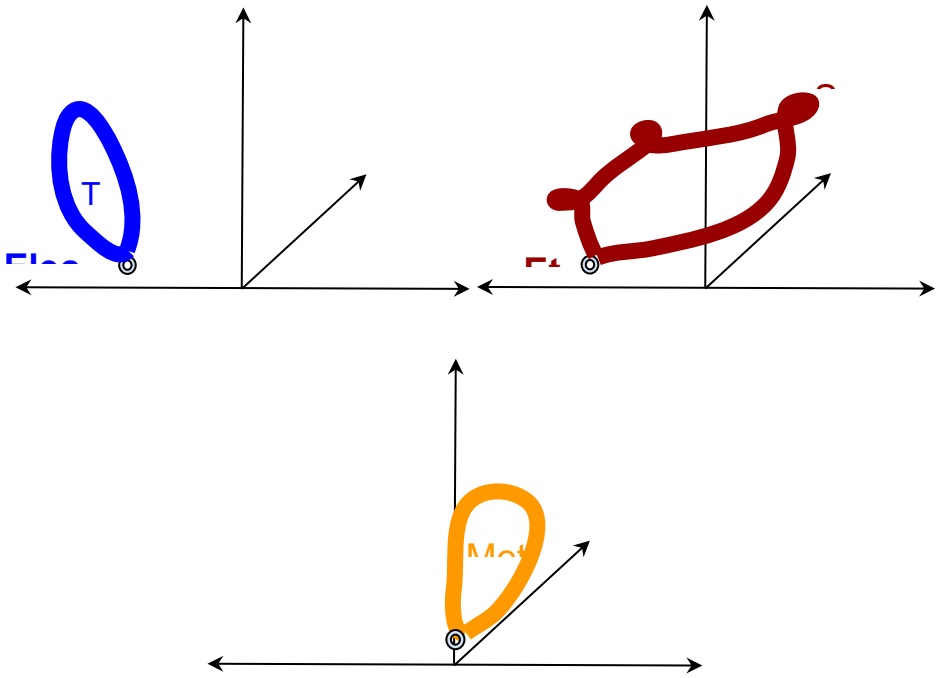


Figure 2. Loops of Imagination in Episode 2

> By increasing their capacity for practical evaluation, actors strengthen their ability to exercise agency in a mediating fashion, enabling them (at least potentially) to pursue their projects in ways that may challenge and transform the situational contexts of action themselves (although, given the contingency and uncertainty of interactions, the consequences of their actions cannot be controlled and will often “feed back” in ways that necessitate new agentic interventions). (Emirbayer & Miische, 1998, p. 994)

[TQ24-Past-Group1-JKM @ ~10:32]
video1984956327.mp4

I revised the timequakes ms findings up to episode 3 with the hope that it is a foundation for building coherence across all three episodes. The first two episodes combined are 2000 words. Right now episode 3 is 3800 words. Before going any further, I'm wondering if would you like to revise (and have time to revise) Episode 3, or would you prefer that I take the lead with the goal of consolidating it to a 1,000–2,000 word sub-section?

Based on the first two episodes, my general impression of the revision plan would be something like (a) centering the analysis on temporal, imaginative, and agentic dynamics (uncoupling → exploring → re-coupling) and (b) using the same structure as episode 1 and 2: brief empirical excerpt, loop analysis, and links to the design conjecture.

Episode 3: Expanded Engagement through Intercontextual Loops of Imagination (2254 words)

Episode 3 follows the group's uptake of Nancy's wondering from Episode 2, "moving forward" the energy system in their alternative 1900 timeline by superimposing corn ethanol fuel, a technology that did not come into general usage until nearly 50 years after their timequakes reality. The episode begins as the group reorients to their shared task of editing the original Sam letter to create a "different" or "alternate" 1900.

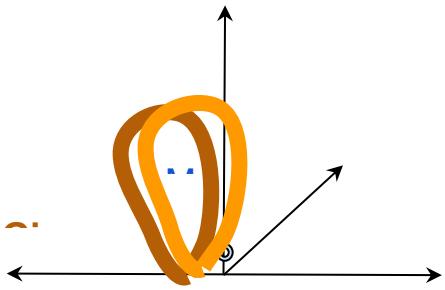
Episode 3a: Timestamp

Nancy:	After the timequake there's a different alternate universe happening?
Justin:	There you go.
Nancy:	We're in the multiverse now.
Justin:	{laughs]

This collective act of re-orienting triggers what Zittoun and Gillespie (2015) describe as "uncoupling" from the here-and-now. In this case, the uncoupling becomes "meta": the group explicitly acknowledges that they are disengaging from actuality.

As in the final loop of imagination in Episode 2, the group temporarily suspends historical speculation, this time directing meta-attention to their own present experience within the timequakes activity. By imagining themselves entering "the multiverse", they intentionally and explicitly pass through a portal of possibility. This passage is accomplished through two overlapping collective loops, the first grounding the group in the given historical past represented by the Sam letter, the second placing the group itself within an alternative time-space, the "multiverse", at their own present moment. Through these coupled loops, group members tacitly and explicitly commit together to leaving behind actuality in order to enter into a

shared space for re-imagining potential worlds.



Consistent with our design intentions, orienting to the letter-writing activity enables group members to cognitively and affectively shift themselves in time, from the group's present to Sam's 1900 past, while also shifting the universal time-space/place-world in which they are working. Nancy's invocation of an "alternative universe" ratifies a concrete alternative past, inviting the group to engage the local particulars of the place-world they are creating, rather than elicit abstract, general historical contingencies. For timeplay to occur, a potentiality that is situational must be collectively honored. To trigger this potentiality, group members move from individual constructions toward intersubjective co-construction of a metaverse as they prepare to engage in timeplay.

This collective act of meta-uncoupling allows the group to recognize that they jointly stand at a threshold of entangled contextual and temporal meanings. Nancy's reference to the multiverse echoes an Episode 2c discussion about curriculum design, pulling the group's own discursive past into the present (Jordan & Daniels, 2010) as a resource for uncoupling. This interactional juxtaposition of their own imagined near-future context with their proximal here-and-now situated agenda creates intercontextuality (Floriani, 1994) through which the group collectively enacts the conditions for timeplay. Their translocation of the multiverse also marks progress from Episode 2a where Samantha expressed being "stuck". Here, the group not only becomes unstuck, but also intersubjectively co-constructs an uncoupling by invoking the same frame and situating themselves in the multiverse. As each member ratifies orientation to the multiverse, signalling mutual availability and alignment to their joint task (Jordan & Henderson, 1995), they step through the portal together.

Following this entry, the group turns to the task of using the original Sam letter as a starting point for introducing a pivotal change in the timeline: moving the energy system forward to an ethanol-based system in order to imagine a plausible alternative 1900. Justin draws attention to both the original letter and the task: "So are we typing it kind of like what he writes, but we're going to add different things in?", triggering a chain of individual mini-loops of imagination.

Anchoring their exploration in the given artifact, Nancy imagines adding in a specific application of ethanol energy in the trolley referenced in the letter. This mini-loop addresses a contingency: if alternative fuels exist, then alternatively fueled devices and socio-technical infrastructures, in this case, transportation, might also exist. Justin then wonders whether an ethanol-based energy system might influence the height of buildings; Samantha considers

possible impacts on refrigeration (“iceboxes”). Like trolleys, both building height and iceboxes are explicitly referenced in the original letter.

In reference to our design conjecture, the emergence of these mini-loops - and their successive failure to be taken up at the group level - may indicate the group wrestling with orientating to the task. By anchoring initial speculation in elements provided by the given artifact, the group launches a tentative exploration of counterfactual possibilities through contingency thinking. The designed artifact offers multiple entry points for imagining how things might be different. However, with each successive independent mini-loop focused on individual components (trolleys, buildings, iceboxes) rather than considering the interdependent relationships within the holistic system, the group makes limited progress in imagining possibilities for a plausible alternative past.

Nonetheless, we conjecture that these individual mini-loops represent a small but important act of playing to potentiality in timeplay - the invitation to remix historical systems in order to interrogate-illuminate contingencies among coupled systems, the partially determined and partially determining confluence of elements in the episode. Alternative technologies imply alternative resources, drawing attention to innovation efforts that shape not only the current time, but also imagined future impacts on the socio-technical environment, including infrastructures, devices, resource development, and ecosystemic disruption.

Despite their limitations, these mini-loops serve an important design purpose. Prompted by the designed activity structure, the group’s attention becomes firmly focused on creating a counterfactual history grounded in the original letter’s context. Progress is evident as the mini-loops complement and build on the single progressive loop described in episode 2a. Building on this tentative exploration of potential effects of forging ahead the energy system, the group makes further use of contingency thinking to decide whether water or food systems would revert to an earlier period, as per the timequake instructions. Samantha suggests that the water system remains the same because some changes are “impossible” to couple (e.g. growing large corn crops for ethanol without adequate irrigation) while the food system should “fall back” due to potential neglect resulting from ethanol production. The group quickly ratifies her proposals.

With a collective orientation to the letter-writing task established and the temporal direction of each FEW system settled, the group engages in complex systems thinking that enables greater seismic potentiality than in earlier discourse. Breaking free from the anchoring artifact, the group now imagines together, a non-trivial act of collaboration that generates an interactive loop of imagination exploring possible alternative-future outcomes of alternative-past dynamics among multiple interdependent systems.

Episode 3b:

Samantha:	I still feel like if we're going to power our cars and our automobiles with corn, then there has to be a shift because there's only a certain amount of land. There's only a certain amount of people who are farmers. The farmers are going to get more money from farming corn for ethanol. So what is that going to do to the food? –Because they're all a system.
Nancy:	I feel like if you jump like 50 years into the future, you would see way more differences.
Samantha:	Right, even like 10 years because food changes quickly. Like, you know, in

> that time, food was still very localized because we didn't have trains, we didn't have food flying internationally. So if you have in your community…25 farms and they want to make the biggest buck, they're going to start to farm corn because that's where the money is.

As the exchange continues, Justin and Nancy extend Samantha's reasoning, noting that corn would now serve dual purposes (food and fuel), driving up prices and reducing availability of livestock feed and food crops. Samantha imagines that these cascading effects might create a food shortage "until they work out that system" and proposes how this might be represented in the letter itself ("...we could say, 'Sam's eating a lot more beans'…").

Finally, Nancy extends the loop–and the speculative timeframe–by expanding timeplay initiated in Episode 2. Invoking the 1930's Dust Bowl, she explores how the proposed system dynamics could lead to longer-term effects, corn blight and threats to energy security, that might act as an early warning/detection system to head off this near-future ecological and economic disaster.

Taken as a whole, this collective loop of imagination illustrates agentic timeplay in which group members collectively move beyond singular components to explore feedback dynamics in coupled systems spanning food, energy, land use, labor, economy, and ecology, and across multiple timescales: immediate, near-future, and farther future. Members build directly on one another's speculation to expand contingency thinking into a chain of feedback and feedforward effects felt through counterbalancing forces, tipping points, and cascading effects far from the initial energy system change. This systems thinking is accomplished by attention to differential actions of and effects on individuals within the imagined 1900 socio-technical-ecological system and by consideration of interdependent FEW systems themselves.

Notably, the group' exploration remains bounded by chains of single-causal relationships. Their discourse assumes punctuated equilibrium (the system will "work itself out" and settle down) and does not fully address the multidirectional, multiplicative messiness of entanglement. Nonetheless, it illustrates a progression from independent speculation on independent outcomes toward wrestling with complex system dynamics.

Regarding our design intentions, the group travels only a small distance from received patterns, never fully decoupling from known future events with the result that their historically plausible future remains bounded to actuality and does not move into imaginative implications for the educators' own present or future (a time warp rather than a timequake). The affordance of the Timequake design is seen here not as much in how the design activates speculative potentiality, but in how the letter acts as a trigger for appreciation for ecological thresholds. The group's discourse expands their capacity to read complexity, imagine contingent events and actions, and reason about alternative historical trajectories. We conjecture that this affordance supports participants to reconsider action within socio-technical systems and anchor temporality in disciplined practice.

The successive individual and collective loops above culminate in a final meta-event in which the group re-couples and imaginatively recombines temporal orientations of present, accepted past, and alternative past. This re-coupling is accomplished in the group's final talk turns before all the groups rejoin to share their alternative past letters. Here again, the group steps out of speculative timeplay, this time to reflect on a key takeaway and express emotional connection.

Episode 3c

Samantha: What is so fun is to realize - when you think this way, you realize how

	interconnected those systems are. And unless you're thinking about it, it really is hard to separate how one thing would affect another, would affect another, would affect another. Where do you start and stop your chain reaction? And that is really powerful.
Justin:	Yeah.
Nancy:	Now I'm really worried about, like, how would they feed themselves in our new reality? {laughs}
Samantha:	Yeah.
Justin:	{laughs}
Nancy:	{Appears tired. Finger over eyes} It's not even real, Nancy, not even real. {talking to self}

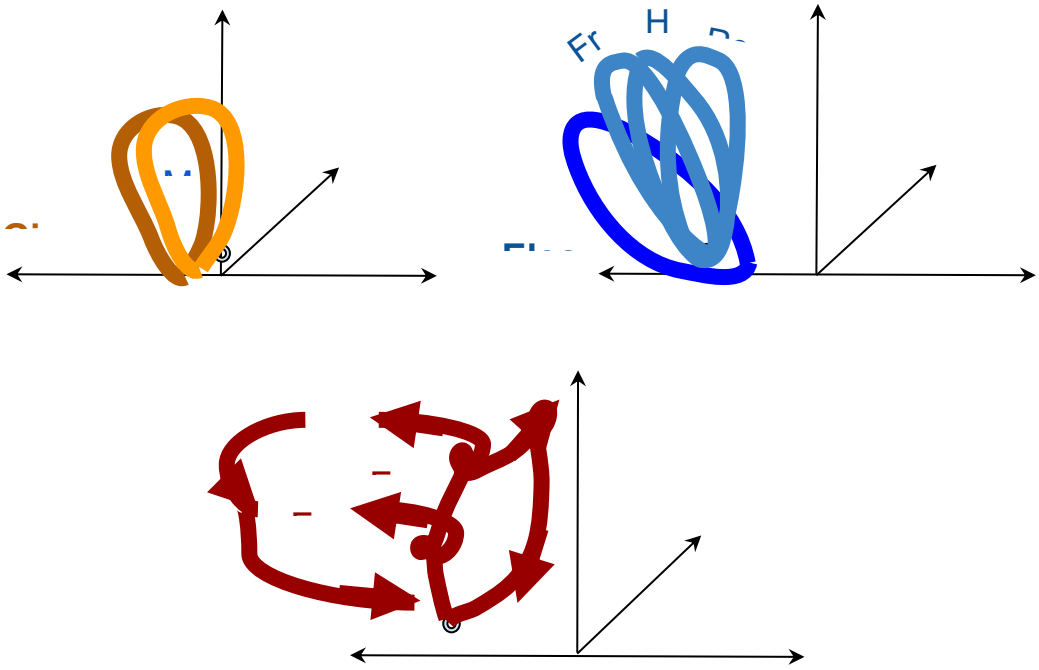
In this meta-commentary about their envisioned alternative past, Samantha expresses delight in her realization of interconnectedness among systems, and a greater appreciation of complex contingencies. Nancy reinforces and extends this insight, voicing one final causal concern: the threat of food insecurity in the alternative past the group has co-constructed, a concern ratified by the others.

Notably, Nancy's concern is not only conceptual, but also deeply emotional. The emotional weight of consequences of the group's decisions and sensemaking is exhibited in her expressing of "worry" (ratified by Justin and Samantha) for the imagined people populating "our new reality" and in her concomitant physical gestures and self-soothing self-talk. Earlier in the timequakes experience, emotional expressions were largely attributed to the character of Sam (e.g., Sam is "miffed", "sick of eating meat", "worried about our energy"). Here, affect shifts from the fictional character to the participants themselves in their present moment as an empathetic response. The emotional intensity and valence normally reserved for the actual world now has expanded to include this alternate reality.

Such affective investment in a fictional world seems a marker of timeplay. We conjecture that the design of a timequake experience encourages intercontextuality, forming linkages between a group's here-and-now experience, their situated agendas, and the speculative past, creating one encompassing context (Engle, XXXX). Nancy's empathy, in effect, collapses time, allowing her to experience the imagined past in the present. As Nancy, Justin, and Samantha co-create their counterfactual narrative, they create coherence by weaving their own affective experiences into the world they are building. As the world becomes more detailed, those feelings draw together the present real and imagined past world, imbuing the latter with greater texture, coherence, clarity, as well as complexity. If "world-building is a tool for turning speculation into agency" (Pendleton-Jullian and Brown (2018), then the affective depth evidenced by this group suggests an emerging capacity for agency over alternative realities and, hopefully, over here-and-now situated agendas.

The loops of imagination associated with Episode 3 move from individual to collaborative speculation, and from temporal singularity to temporal collapse-recombination, with each successive loop expanding imaginative possibilities and intercontextuality. Taken as a whole, these loops illustrates how the timequakes design enabled educators' fluid engagement in agentic timeplay, first meta-uncoupling from the here-and-now, then exploring increasingly complex systems of potentiality, and finally, meta-recoupling evolving time, contexts, and

situated agendas that were emotionally-laden and consequential. We conjecture that, by designing to bracket and reframe historical situations, timequakes present opportunities for educators to co-create new ways of thinking about the past (i.e., meta-uncoupling), including (a) "reading" complexity (i.e., systems and complex systems thinking) and acting in complex alternate worlds in multiple, varied ways with evolving situated agendas (i.e., contingency thinking).



Note: The group imagines multiple interconnected systems with both positive and negative feedback across multiple timescales (immediate, short-term, and near-future effects). Setting off this interactive loop of imagination, Samantha introduces several new [chain] interdependent contingencies that have not yet been considered: Ethanol production decreases available land and labor for food production in the imagined present and near future while increasing food costs for residents and economic capital for farmers (in the short-term). These dynamics threaten to reach a tipping point from which emerges a *corn blight, the Dust Bowl*, which decreases energy produced from ethanol in the long run.

Figure 3. Loops of Imagination in Episode 3

Discussion

- Timequakes do not just provide an "alternative view" that alters the stance or position of a learner that illuminates and escapes a previous blindness. Timequakes seek to expand capacity to shape practices and situated agendas to which they are not detached but engaged. In this sense, participatory science can embody concerned involvement rather than detached methodology. In this sense, timequakes are a kind of situational mechanism for "coaching" or developing practices that can foster appropriate questioning and about the processes and events that shape systems and challenges.
- Participatory science presupposes an increasingly relational, distributive, and collectively constituted and performed academic enterprise, but one that operates against the backdrop of the ideology of individualism in science and education (cf. Elkins-Tanton, 2021)
- Timequakes organize opportunities to explore situated agendas outside the immediate flow of time, which is arguably the most complex and most elusive factor in situated agendas.
- Imagining ways of acting in alternate histories likely also induces capacity for exercising agency in situated agendas by creating possibilities for thought and action that influences that agenda.
- In moving beyond the constraints of the original letter while remaining within the realm of the plausible, the group demonstrates how timequakes can create structured opportunities to imagine ramifications not reflected from the designed resources while disciplining speculative imagination.
- Post-carbon energy transitions as a situated agenda presumes that individuals do not fully control our actions but can gain more mastery over outcomes by acknowledging incomplete control. By collaborating with the ecoregional conditions, we can better shape actions and enable agency to emerge. Overconfidence in human capacity and effort, characteristic of individualism, can embody cruel optimism that, in turn, can be detrimental to our own goals and purposes. Situated agendas recognize this collective-ecological approach.
- This study is not a definitive treatise or a "correct" synthesis of temporality, learning and agency. Our goal is to participate in the ongoing development of a theoretical basis for designing for situated agendas in relation to varied temporal rhythms of entangled domains. This contribution advances a radical shift in designing, not just better accounts of different designs.
- We hope this work evokes an openness to discourse that can guide efforts to deepen the embedment and integration of education into socio-scientific challenges and other situated agendas as individuals and whole communities continue moving in the tumultuous space between the traditions they embody and emerging new understandings.
- Developing the temporality of design methodologies can inform efforts systems that are consistent with our theories of human thought and action.
-
- As an exercise in relational engagement through temporal reach, we consider our study in relation to a scholarly observation from four decades ago.

> In the present context of globalization and its resulting crises, the modern world once again faces a crisis in aligning the experience of past and present. To realize that each present was once an imagined future may help us once again place ourselves within a temporality organized by human thought and humane ends as much as by the contingencies of uncontrolled events. (Koselleck, 1985/2018)

We conjecture that the timequakes activity enabled the group's systems thinking by recomposing temporal orientations that refocus the challenge of energy transitions in wider relation to a dynamic, contingent temporal aperture, the group implicates not only what could be but also what could have been (alternative branches of stochastically iterated systems mappings). This recomposing is set in motion through the groups' collective orientation to and linking of three temporal elements of the Timequake activity (Figure X).

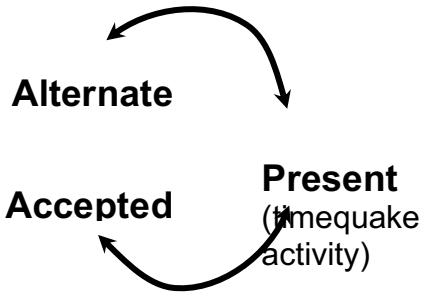


Figure X. Co-constructing an alternate past for situated agendas (e.g., FEW Nexus) is a tool for linking speculation and agency (figure adapted from APJ & JSB, 2018b, p. 75)

From a design perspective, a question that might be asked is, which directions from that threshold - what *triggers* (Zittoun and Gillespie, 2015) enable participants to intersubjectively "uncouple" from the here and now? The enactment of uncoupling above raises questions about whether and how Timeplay designs might purposefully assist in "meta-uncoupling" by considering the conditions that enable participants to "uncouple". We wonder whether the shift to task prompts the meta activity by focusing attention on timeplay in an explicit way, as the group reminds themselves of the temporal challenge ahead. If so, it is worthwhile to consider what aspects of the enacted design triggered those conditions.

- Moreover, in what ways do groups deconstruct the systems offered for interrogation and timeplay into aspects versus considering the interdependent relationships within the holistic system they are working on?
- What about the design is influencing holistic v. non-holistic interrogation?
- Are there ways that designers could or would want to shape how participants/players think about changing the whole system apart from its component elements?

In one way, the timequakes design encourages holistic interrogation by explicitly coupling multiple (FEW) systems. In another way, the current design encourages non-holistic interrogation by intentionally forcing their temporal decoupling (i.e., two FEW systems must take a different direction in time). Nonetheless, the group's contingency thinking keeps the systems

coupled and allows playing with time, to some small extent.

Notes to connect SPV Lab

- Link to Nancy book chapter - her adaptation of a timequake: this is consistent with but not prove the conjecture

References

Adam, B. (2005). *Timescapes of modernity: The environment and invisible hazards*. Routledge.

Dewey, J. (1922). *Human nature and conduct*. Modern Library

Ferrero, L. (2022). An introduction to the philosophy of agency. In The Routledge Handbook of Philosophy of Agency. Routledge.

Floriani, A. (1994). Negotiating what counts: Roles and relationships, texts and contexts, content and meaning. Linguistics and Education, 5(3–4), 241–274. https://doi.org/10.1016/0898-5898(93)90002-R

Jordan M. E., & Daniel, S. (2010). Heedful interrelating in the academic discourse of collaborative groups. *Journal of Classroom Interaction, 45*(2), 4-19.

Marková, I. (2016). *The dialogical mind: Common sense and ethics*. Cambridge University Press.

Miller, C. A., Richter, J., & O'Leary, J. (2015). Socio-energy systems design: A policy framework for energy transitions. Energy Research & Social Science, 6, 29–40. https://doi.org/10.1016/j.erss.2014.11.004

Mische, A. (2009). Projects and possibilities: Researching futures in action. *Sociological Forum*, 24(3), 694–704. https://doi.org/10.1111/j.1573-7861.2009.01127.x

Mische, A. (2022). Finding the future in pragmatist thought: Imagination, teleologies, and public deliberation. In N. L. Gross, I. A. Reed, & C. Winship (Eds.), *The New Pragmatist Sociology: Inquiry, Agency, and Democracy* (pp. 406–432). Columbia University Press. https://doi.org/10.7312/gros20378-016

Nowotny, H. (1996). *Time: The modern and postmodern experience*. Polity.

Rogage, K., Kirk, D., Charlton, J., Nally, C., Swords, J., & Watson, R. (2021). Memoryscapes: Designing situated narratives of place through heritage collections. International Journal of Human–Computer Interaction, 37(11), 1028–1048. https://doi.org/10.1080/10447318.2020.1865004

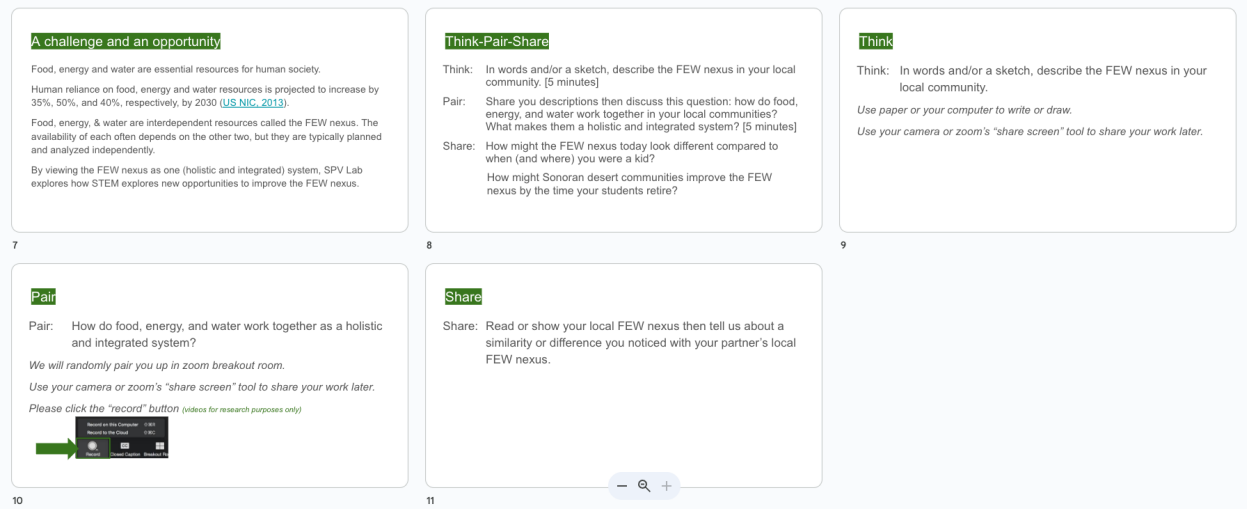
Sawyer, R. K. (2005). *Social emergence: Societies as complex systems*. Cambridge University Press.

Valsiner, J. (2012). *The Oxford handbook of culture and psychology*. Oxford University Press.

Zittoun, T., & Gillespie, A. (2015). *Imagination in Human and Cultural Development*. Routledge.

Appendices

Pre-Post Activity



https://docs.google.com/presentation/d/1bPSt_HAvEXwipRPFQvFD_ti73yM6aYWWZpniinURjHk/edit#

Junk in the Trunk

Secondary Case Less Aligned with Design Intensions

The secondary case features three teachers: Becca, Gokhan, and Steve and a facilitator. The activity of this group was less aligned with the design intentions. However, this group also completed all four tasks (i.e., reading letter, analyzing FEW in letter, altering FEW in letter, writing new letter) and did engage in some timeplay. We examine this case to better understand how timeplay worked with this group as well as to analyze and interpret ways in which our design was less successful. We then consider this case as a foil to the primary case

in order to better understand what design characteristics support timeplay as well as how future iterations of our design could better support timeplay.

Two differences in enactment of the activity with this group seem relevant to note. The first difference is that one member of the group, Becca, was unable to participate consistently in the activity because at times she was called away from her screen and at other times she was able to listen but unable to unmute or use her keyboard to communicate. The second difference is that whereas the first group completed the activity with little or no assistance from a facilitator, the facilitator in the second group was very active in directing the group to make decisions and reiterating group decisions to all members. Throughout the activity, there were several lengthy pauses [maybe look at the longest pause or the length of pause, on average, after questions or prompts] which may indicate lack of interest, confusion, distraction, or some other hesitancy to put forth ideas. The facilitator and one vocal member of the group, Steve, were most often the participants who broke the pauses and thus often spoke with each other with little input from Gokhan or Becca unless the facilitator or Steve explicitly invited the latter two's participation.

After reading and discussing a fictitious letter from the 1940s, they characterized the FEW nexus then reconfigured aspects of energy and food systems. Their discussions considered wood, coal, and ethanol as fuels for steam-powered transportation, the relative efficiency of alternate and direct current electricity, and indigenous irrigation canals. Using their hybrid nexus, the group revised the letter in order to construct an alternative history in which ethanol-based fuels reshaped the nexus. We interrogate their enactment as a contrast to the primary case by analyzing and interpreting ___ episodes.

[NOTE: I'm not sure if we should have an episode before the one in which Becca says "This is the part . . . "beginning with Becca's "if water was . . ." I think the purpose of an earlier episode might be to show how dominated by facilitator & Steve the conversation was (so, to illustrate limited or no collaborative looping) or to show how the group came to the descriptions of the before and after FEW elements in order to emphasize the leap that the group makes when they create a positive letter. As well, earlier discourse can illustrate, perhaps, the way the group was confined by a tenacious hold on the actual. Need to think more about this . . .]

Episode 1: Identifying opportunities to imagine

The group largely struggled to enter into timeplay up until they collaborated to complete the final step of the activity, writing the new letter based on their reconfigured nexus. The following brief exchange suggests that at least one participant seems not to have felt invited to imagine, in other words, invited to engage in timeplay, before writing the new letter:

Facilitator

> The next step is, or you can be, is to choose one system from each time period. So do we want the past to be water? Do you, Rebecca? And you can choose. So we've got three time periods, right? Right before Sam, Sam's time in 1940 and right, and the future. So from those things that we imagined, what should we take as our model for the water? What should we take as our model for food? And what about for energy? Sorry, if you're hearing the airport noise right now, I'm going to create a document while you guys decide.

Becca	Sorry, I got some more of the part where I had to focus again. [Speaker 1 laughs] This is the part where we imagine, right?
Facilitator	Yes. And so [what do you all want to do?]
Becca	[That's my favorite part.] [laugh (1&4)]

Becca's question if "this is the part where we imagine" suggests both that she is taking up the activity's designed invitation to timeplay in the last step and that she did not recognize the timeplay invitations being offered in the other steps of the activity. The latter possibility raises the question of how the preceding steps in the activity might be revised to make the invitation to timeplay more explicit and thereby expand who engages in timeplay and how.

Potentially of further importance to design considerations is that, as with our Primary Case, timeplay is invited by a participant re-orienting to an activity task. In this case, the facilitator began that orientation in summarizing the "next step" of the activity. Becca, who has just returned from a personal task, also reorients herself to the task when she asks for confirmation of what "part" of the activity the group is working on.

Becca's marking of "the part" as where "we" imagine shows not only orientation to the but also an orientation to the group. Her use of the first-person plural pronoun "we" suggests an orientation to collaborative imagination. This simple question, then, functions as an invitation, or at least permission-asking to cross the portal to a fictional reality.

Moments later, after the facilitator has revoiced the question about water, leaving open which of the two participants might answer, and after a xx second pause, Becca responds,

Becca	I dunno. What does the group think?

This seems to serve, again, as an invitation to others to join in timeplay. After a 3 second pause, the facilitator asks the other group member who is present to make the choice and he does. Because this participant does not respond to Becca's question, but rather to the facilitator's request, it is not clear whether or not he would have accepted Becca's invitation to timeplay, a nonaction that may have stymied timeplay.

Episode 2

Becca helps group engage in timeplay

Becca	if water was more clean then we would probably have, we had more public water and mass energy access, then we would probably have more tight-knit communities. We probably have less automobiles because we wouldn't need to find water or find resources. Cause what we're doing when we find jobs is we're finding resources. So there'd be more tight-knit communities for sure.

Episode 3

Write here.

In the episode above, the group is grappling with systems thinking; They have been tasked to create an alternative world in which one aspect has "gone ahead", one has stayed the same, and one has regressed. They are struggling because they are recognizing the interdependencies of these system elements. The last talk turn above attempts to frame out the new FEW system they are creating, using the language of reasoning to create a world that makes sense (because X, then y). In the argument they are making, they are mixing up what falls back (food) as being due to energy also falling back (electricity in the home), which is counter to their charge.

These challenges point to an important issue, choosing the thresholds for design. The Timequakes enactment had a wide scope for variation, leading us to wonder what level of variation is optimal. A related consideration is the relative value of the timequakes journey - participants' productive entanglement with contingency - and the timequakes product - an enlightened, coherent alternate history. I

> Speaker 4 (00:44:49): We could say something like, because he talks about the cast iron stove, right? [Yeah (J)]. We could say in the letter, we could say something like, "these new fangled automobiles run on this new ethanol energy. Why can't they put that in our homes and our stoves? We're still burning wood here."
> Speaker 2 (00:45:04): Oh, I like that. Love it. Yeah.
> Speaker 4 (00:45:09): All right. So let's see. So take all that
> Samantha (00:46:49): Is kind of like, he's like miffed, like why can't we?
> Speaker 4 (00:46:55): Yeah. Why can't we cook easy too?

Speaker 4's reference to "still burning wood" is an actual condition serving as a backdrop of energy inefficiency for which expanding the potentiality of ethanol would improve. Here it is positioned as a potentiality of the imagined "new ethanol energy", one that is imagined by the Sam character in response to seeing others benefit from the imagined energy technology (i.e., drivers of "new fangled automobiles"). It is also noteworthy that Samantha

Setting off this collective loop, Nancy tries to disentangle one energy source/strategy (ethanol engines) from another (electrical systems), including the social spaces for which the systems are imagined to be used (house vs. automobiles). Speaker 2 picks up these distinctions between co-existing energy systems, ratifying and trying to further disentangle the distinctions through a focus on their different uses.

> Speaker 3 (00:50:20): Because using corn as ethanol doesn't really affect the fact that - wouldn't affect Edison and Tesla. You would still have electricity in your house. You just wouldn't have as much pollution in the world now because you had, we chose a different fuel for automobiles.
>
> Speaker 2: So we're only saying the energy source we're doing different is just specifically for

~~automobiles...I feel like that needs to be a little bit more explicit in the letter. So when we say like, oh, there's 30 automobiles, we could say like, oh, there's 60 automobiles.~~

Content Log Tracker

	Pre-TQ FEW Model	Nexus Explorer (TQ 1)	Energizing Transitions (TQ 2)	Post-TQ FEW model	Post-TQ Small Group Reflections	Post-Session Tracker
Group	KM	JKM	JKM	KM	GMT.P. and video	**Nancy - Sept** *interview* Audio Notes *Emails w. M's Design* Image prompts for AI AI Images & assignment Document with tweets ~~**Tammye?**~~
	----	GSR	----	----	----	
	----	-----	HTT	----	JSTJ and video	
All	**Content Log Link?** Pre-FEW main room video Pre-FEW main room transcript	Whole Group Transcript Main video (TQ only?)	Whole Group Transcript **room transcript?** Main video (TQ only?)	**Content Log Link?** Main transcript Main video	———	
Artifacts	Group 1 Pre-FEW slide (KM) Group 2 Pre-FEW slide Group 3 Pre-FEW slide Group 4 Pre-FEW slide Individual Pre-FEW model	Case 1: JKM letter JKM slidedeck Case 2: GSR letter GSR slidedeck	JKM jam board HTT jam board	Group 1 Post-FEW slide Group 2 Post--FEW slide Group 3 Post--FEW slide	Post-TQ Small Group reflection slides Survey Journey.do announcement reflection	
Materials		Activity slidedeck NOTE-NEED TO LINK THE COPY OF THE DECK WE ACTUALLY USED THAT DAY.	Activity slidedeck	Slides together in daily slide	Post-TQ Small Group reflection slides (includes initial prompts)	

The group imagines multiple interconnected systems with both positive and negative feedback across multiple timescales (immediate, short-term, and near-future effects). Setting off this interactive loop of imagination, Samantha introduces several new [chain] interdependent contingencies that have not yet been considered: Ethanol production decreases available land and labor for food production in the imagined present and near future while increasing food costs for residents and economic capital for farmers (in the short-term). These imagined dynamics threaten to reach a tipping point from which emerges a *corn blight, the Dustbowl*, which decreases energy produced from ethanol in the long run.

Ethanol production *limited by* land and labor constraints

https://www.regenerativeeconomics.earth/regenerative-economics-textbook/s-systems-thinking-and-models/s-5-causal-loops-feedback-and-tipping-points

https://thesystemsthinker.com/causal-loop-construction-the-basics/

https://erinkmalone.medium.com/using-modeling-to-understand-whats-happening-within-a-system-bb5b9f4fc128

https://untools.co/reinforcing-feedback-loop/#:~:text=a%20simple%20example.-,Example,core%20mechanism%20of%20the%20loop.

https://vizzlo.com/create/feedback-loop#:~:text=Click%20on%20the%20phases%20to,the%20circles%20to%20reorder%20them

https://abriradicallyopendbt.com/feedback-loop-examples-how-they-shape-our-lives-minds-and-systems/#:~:text=Example:%20A%20thermostat%20in%20your,temperature%2C%20the%20heater%20turns%20off.

https://thesystemsthinker.com/learning-about-connection-circles/

END

Nancy's collapsing of time seems similar to what Engle discusses when she talks about intercontextuality: enough links between contexts create the encompassing context such that the learner doesn't see the context of learning, including its temporal position in the present as separate from the related life contexts (in this case "life context" is Sam's alternate reality). The emotional intensity and valence normally reserved for the actual world now has expanded to include this alternate reality. This sort of increased affective connection to the fictional world seems a marker of timeplay. [to what extent is it a product of timeplay and to what extent is it a mechanism for or necessary precursor to timeplay?]

NOTES FOR PAPER 2?

"If the future we imagine weighs in with the same level of detail as the past, then agency to affect the emerging future is greatly enhanced"

**

[BUT, it never moves into the future? What about GMOs?] - THIS DID COME BACK AROUND But only early??? DOUBLE CHECK

[Rationale linear economics: maximizing material good, RIO]

[structures/components, behaviors/(shaping) mechanisms, functions/purposes]

We see an enlightenment appreciation for wickedity.

The triad succeeds in iteratively illuminating a problem with "an evolving set of interlocking issues and constraints" (i.e, wicked). However, "the objective is to attain some ability to 'steer' the complex system.

But how do we steer a system through a complex, tangled web of interactions?" Holland, 2014, p.3

Enlightenment vs. Entanglement DU: chapter XX

"To design for resonance and impact in contexts that don't stand still — in a white water world—requires designing for emergent, not fixed, system behavior."

Energy Futures Center: how do we steer through complex webs of interaction?

Success: sustained engagement in situated agendas across contexts (SPV Lab) [more expansive orientations toward exercising agency in the present (SPV Lab) [i.e., greater appreciation of interconnected contingencies; some of the ways Nancy exercised agency are consistent with our conjecture; capacities tuned here: contingencies, feedback loops, becoming uncoupled from the prompt - agency supportive; recognition and thinking about systems not implicated in the letter or the prompt] - but in a linear fashion [limitation] rather than in a complex or entangled fashion.

"Unlike the Enlightenment, where progress was analytic and came from taking things apart, progress in the Age of Entanglement is synthetic and comes from putting things together." (Hillis, 2016, p. 4)

In a loop of imagination, does the feedback loop function to discipline imagination? e.g., counter balancing forces….; functioning of the talk turns/comments - are they building a system with feedback loops, disciplining a loop of imagination..
A time warp rather than a timequake
Broke free from the situated letter to explore these systems models themselves. Not so much for imagination/potentiality… not trying to change Sam's world, bring to change the world - and to do that, we need to understand these systems.. The letter is a trigger ("let's avoid getting hooked on oil" becomes an appreciation for ecological thresholds.)

"World building is a powerful tool for turning speculation into agency." (PJ & B, 2018, p. 75)

Emotional connection as worldbuilding →adding greater and greater texture to an imagined world supports agency

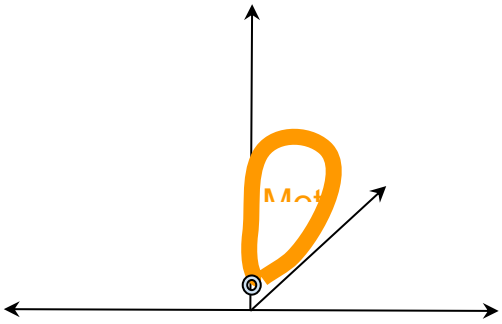
- Another progression of looping: becomes looping into enlightenment and away from entanglement… (holistic vs. rational dissection..)... The prompt focuses them away from experience of living to component parts that you should adjust, deconstruct, and reassemble.
    - P-J: multi-dimensional, multi-scalar, multi-morphic, everything-is-connected planetary problems, and the "smaller" scale problems that cascade from these (like forest fires burning out of control), our Enlightenment worldview is no longer good enough.
- Bounded within a rational thinking paradigm…?
- Future references
- Reprise of early "play" - how does it enter/fulfill the invitation to timeplay through the final task

Case 1: JKM letter
JKM slidedeck

THIS WILL BE DELETED
Resources for michelle's continued analysis

Conjecture Map [link]

DOUBLE CLICK



"Are stories real, or imagined"... J. B. (artificers in the employ of

Table 1. Analyzing the Loop of Imagination (Zittoun & Gillespie, 2015)

Dimension	*Definition*	*Example*
Temporal orientation	Orienting toward [alternative, counterfactual] past, future, or an alternative present	Re-experiencing first day of school or imagining next holiday
Generalization	Utilizing either concrete and specific or generalized and abstracted semiotic means	Dreaming of strawberries or chemical equations
Plausibility	relative distance to actual, socially shared circumstances [potentiality-actuality]	Dreaming of strawberry pie or unicorn pie

Outcomes

- Deeper connections between learning and agency for situated agendas
- Recomposed temporal orientations towards situated agendas
- Coordinated ecological engagement with situated agendas beyond classrooms

Analyze loops - do they get to/touch the present or the future? Are any loops co-constructed?
Review collaborative imagination paper (Ed & Ruth)

991 While the prior set of individual mini-loops was inspired by but disconnected from previous speaker's naming of possible contingencies, here speakers build on each other's thinking to expand the consideration of contingencies in a new way: as a chain of system effects that reach far beyond those implicated in the original letter, making themselves felt in times and places far from the initial energy system change. For instance, hearkening back to her earlier reference to the early creation of GMOs [referencing a future event; the dust bowl] - HOPING TO HEAD OFF THE DUST BOWL BY EARLY DETECTION. A reprise of timeplay initiated in Episode 2.

{STAYS WITHIN THE REALM OF THE PLAUSIBLE}, including how these dynamics might have headed off a near future actual event - the 1930's Dustbowl - in which overplowing of land for intensive farming of cash crops, including corn, contributed to ecological disaster that had severe and long-suffered economic effects.

Recognizing contingent and differential effects at multiple timescales, immediate (e.g.,), near-future (e.g., ten years), far future (e.g., "50 years"). Tipping points and cascading effects (Dustbowl).

This is key - by designing to bracket and reframe historical situations, timequakes create opportunities for educators to co-create new ways of thinking about the past (i.e., meta-uncoupling), including (a) "reading" complexity (i.e., systems and complex systems thinking) and acting in complex alternate worlds in multiple, varied ways with evolving situated agendas (i.e., contingency thinking)

imagining ways of acting in alternate histories also induces presuppositions about how participants might exercise agency in situated agendas by creating actions that influence that agenda.

timequakes organize opportunities to explore situated agendas outside the immediate flow of time, which is arguably the most complex and most illusive factor in situated agendas.

Taken as a whole, Episode 3c illustrates agentic timeplay, ….the expression of reciprocal feedback loops among coupled systems. The first two talk turns above bring several new dimensions into the conversation. This is the first time land comes into the conversation (in relation to agriculture), which also brings up growing things for purposes other than food, which also brings in economy and workforce dimensions (only a certain number of farmers, getting paid more). In this way, the group continues the collective loop, implicating multiple coupled systems into their….

While this loop never makes it into the groups' present reality or their own future, it does attempt to connect to the 1900s future - though it is limited by being tied to the actuality of that future. [Although the group does reference agri-tech- GMO, they don't do so in the loops I am working with; maybe look at this transcript again.

SZ: From progression to entanglement of loops. Think with DeLanda. "Any explanation of human behavior must involve reference to irreducible intentional entities such as 'beliefs' and 'desires'" (p.

17)... not just a matter of "rational man". This may be a limitation of the design… single but connected chains of causality.
Dust Bowl is a reprise…

Imagine a system in which the food system is degraded - they don't actually move it back in time. Instead of moving something back, they imagine the effects of (Degraded food system.

The design (moving back and forward) does not support thinking about emergence…

MJ NOTE: Loops of causality - they recognize multiple interdependent social, economic, and environmental inputs and how those form positive and negative feedback loops that influence system outcomes.

They also assume that the system with "work itself out" - and settle down - perhaps a faulty assumption when we are looking over long timescales.
Notably: their conversation does not address reciprocal feedback loops and multidirectional, multiplicative interdependent messiness of the dynamics of complex adaptive systems. It assumes a system that will "work itself out" -
Also notable is little to no reference to the future or the present. They stay rooted on the timeframe between 1900 and the Dust Bowl of the 1930's - assuming that past actual event will stay actual- perhaps only temporally dislocated.

We conjecture that the group's collective loop in Episode 3c explores potentiality in ways that lead to a new appreciation and capacity for complex systems thinking, to understanding, at least at an intuitive level, the kinds of feedback loops that exist in coupled systems. This systems thinking is enabled, in part, by distinctions the group makes among and consideration of differential effects of changes on various individuals living in their 1900 socio-ecological system as well as the interdependent FEW systems themselves. By doing so, the group now begins imagining *together*, a non-trivial act of collaboration that allows them to engage in an interactive loops that isare more complex/seismic than the chain of individual mini-loops in XXabove. ByIn doing soso doing, they move beyond the constraints of the original letter to imagine ramifications not reflected from the designed resources.

A time warp rather than a timequake [we get an INKLING OF ENTANGLEMENT, BUT DOESN"T break chains of causality]

In a loop of imagination, does the feedback loop function to discipline imagination? e.g., counter balancing forces….; functioning of the talk turns/comments - are they building a system with feedback loops, disciplining a loop of imagination..

The group broke free from the situated letter to explore systems models,.... Not so much for imagination/potentiality… not trying to change Sam's world, bring to change the world - and to do that, we need to understand these systems.. The letter is a trigger ("let's avoid getting hooked on oil" becomes an appreciation for ecological thresholds.) But it was not move far into imagination. Although they touch on the future '50 years'.The only specifics are "avoiding" a near-future event of the Dustbowl.

by designing to bracket and reframe historical situations, timequakes create opportunities for educators to co-create new ways of thinking about the past (i.e., meta-uncoupling), including

(a) "reading" complexity (i.e., systems and complex systems thinking) and acting in complex alternate worlds in multiple, varied ways with evolving situated agendas (i.e., contingency thinking)

Samantha initiates this loop by articulating a chain of contingencies linking energy, land use, agriculture, labor, and food. She reasons that powering automobiles with corn ethanol would require significant land, that only a limited number of farmers exist, and that economic incentives would push farmers toward corn production for ethanol rather than food. She explicitly frames these elements as “all a system.” “So what is [all] that going to do to the food? –Because they're all a system.”

Nancy responds by situating these effects across longer timescales, suggesting that “if you jump 50 years into the future, you would see way more differences”.

Samantha builds on this by emphasizing the localized nature of food systems in 1900 and the rapid pace of food system change, arguing that concentrated corn production would lead to food shortages.

As the exchange continues, Justin and Nancy extend Samantha’s reasoning, noting that corn would now serve dual purposes (food and fuel), driving up prices and reducing availability for livestock feed. Samantha proposes how these cascading effects might be represented in the letter itself….

~~Nancy: Yeah.~~

~~Samantha: And they're not going to be farming, now, wheat or broccoli or cotton. So I think that…It would create a food shortage until they work out that system.~~
~~Justin: Well, yeah, because now farmers have a double purpose for making corn: food and ethanol.~~

~~Samantha: Yeah. Maybe we just talk about, even if we just say a shortage in corn…because corn also could affect cattle…we could say, ‘Sam's eating a lot more beans…or ‘I'm sick of eating beans because…all the corn is going to the cars and meat's too expensive.’ Something like that.~~
~~Nancy: Yeah, I think that's good.~~
~~Justin: Okay.~~
~~———~~
~~Nancy: And now the price of meat would be higher because the corn wouldn't be fed [to livestock] because it isn't cheap anymore.~~
~~Samantha: Right. So it's a double food backslide.~~

Nancy further extends the loop (and her 50 years xxxx) by imagining longer-term vulnerabilities, such as corn blight and threats to energy security, invoking the Dust Bowl as an example of ecological, economic, and energy collapse.

Nancy: Right. Would you eventually put something like, ‘The corn is starting,

	there's starting to be a corn blight. We're worried about our energy.' Hopefully they can figure out how to keep it from…you know, like the whole Dust Bowl.

SUMMARY OF EPISODE 3:
The loops of imagination associated with this episode…

- are bookended by two metaevents that collapse/meld the current moment as experienced by group members with the alternative past they are tasked to create.
- evolve from individual to intersubjective to collaborative, progressively widening participation and temporal reach [but not future?].
- SZ: This is key - by designing to bracket and reframe historical situations, timequakes create opportunities for educators to co-create new ways of thinking about the past (i.e., meta-uncoupling), including (a) "reading" complexity (i.e., systems and complex systems thinking) and acting in complex alternate worlds in multiple, varied ways with evolving situated agendas (i.e., contingency thinking)
- SZ: imagining ways of acting in alternate histories also induces presuppositions about how participants might exercise agency in situated agendas by creating actions that influence that agenda.
- SZ: timequakes organize opportunities to explore situated agendas outside the immediate flow of time, which is arguably the most complex and most illusive factor in situated agendas.
- SZ: "reading" complexity is a way of attuning to foregrounded and backgrounded dynamics as well as to human = habits and the propensities of socio-technical-ecological systems.