

From object-oriented to fluid ontology: a case study of the materiality of design work in agile software development

Abstract In much of extant research on design cooperation, design materials are approached from noun-oriented ontologies and social topologies where the notion of ‘object’ is central. There is a long history of critique concerning such ontologies, most recently coming from the *anthropology of making*, because they are failing to capture the dynamic and fluid aspects that characterize the *living*, constantly changing world that we inhabit. Though often recognized, the implications these critiques have for design cooperation research and practice have been drawn only to a limited extent. In this study, we discuss and empirically examine such implications by adopting a fluid ontology in the analysis of design cooperation. We use data from design conversations in a firm that practices extreme programming, a form of agile software development, to exhibit what theorizing design activity in terms of fluid things, fluid spaces, and continuity has to offer to practitioners and analysts.

Keywords Objects · Ontology · Social Topology · Fluids · Lines · Materiality · Communication · Extreme Programming · Agile Software Development

1. Introduction

There are social objects which exist in, draw upon and recursively form fluid spaces that are defined by liquid continuity. (Mol and Law 1994, p. 659)

[Things] *occur*—that is, they carry on along their lines. This is to admit them into the world not as nouns but as verbs, as goings-on. It is to bring them to life. (Ingold 2015, p. 16)

Software development has changed considerably over the past 50 years since one of the authors (WMR) began writing code in the 1960s, at which time formal and plan-driven methods characterized the field. However, traditional software development confronted many problems, including the fact that users continuously change the specifications of what they really want and programmers misjudging their own progress. Approaches such as agile software development were conceived precisely to overcome these disadvantages (Beck 1999). Agile software developers ‘respond to change over following a plan,’ ‘welcome changing requirements,’ ‘harness change for the customer’s competitive advantage,’ and ‘promote sustainable development . . . to maintain a constant pace indefinitely’ (Beck et al. 2001). Agile software development teams are characterized by dynamic, often ill-defined practices and rapid adaptation to changing needs (Ingalls and Frever 2009). As a result, both the work object (i.e. software design and products) and social relations undergo continuous change. The software development firm participating in this study practices extreme programming, one type of agile software development. How does one theorize and empirically account for such a world of people and things continuously in flux?

A common approach to study social phenomena is noun-centered and focuses on objects. Thus, in the literature on design and human performance (activities), readers frequently encounter the nouns ‘object’ and ‘object worlds’ (e.g. Bucchiarelli 2002; Eckert and Boujut 2003) or the adjectives ‘object-oriented,’ as in ‘object-oriented activity’ (Bedny and Karwowski 2007; Lektorsky 1984), ‘object-oriented design’ (e.g. Crabtree 2000), object-oriented programming (e.g. Cabitza and Simone 2013), ‘object-oriented database’ (e.g. Saaed et al. 2011), and ‘object-centered,’ such as in ‘object-centered sociality’ (e.g. Engeström 2005; Ploderer et al. 2015). In these contexts, the material things involved in design tend to be referred to in terms of stable objects. But when these objects move from one form of activity to another—even within the same company—then they may be used and understood in different ways, which led to the development of concepts such as ‘boundary [intermediary] object’ (Boujut and Blanco 2003; Eckert and Boujut 2003), and the associated ‘interpretive flexibility’ (e.g. Glock 2003). Both notions have been used to explain why and how practitioners in different domains and pursuing very different goals, are able to coordinate their activities for a greater good—e.g., how the standardization of non-standard domains is possible across the activities of different departments in an airline manufacturing plant (Henderson 1998) or how different agencies in organ procurement (Hogle 1995) come to be coordinated by means of material objects (e.g. design drawings or tracking forms, respectively).

Objects take up space, have insides and outsides, have a relatively stable form (structure), and are related externally to other objects: they are ‘blobs’ (Ingold 2015). Put together, they constitute reality as we know it and as can be captured in information systems (Smith 2003) and other classificatory systems (Dewey and Bentley 1949/1999).¹ Associated with this treatment is a particular type of *social topology*, one that defines its subjects of study in terms of regions where objects are clustered and separated by boundaries from other regions (Mol and Law 1994). Studies of material culture (e.g., design) follow this topology when they focus on finished cultural objects or the making of such objects. From this perspective, people, too, are thought of in terms of the characteristics of objects, with definite insides (i.e., identities, subjectivities) that are distinct from the outside: there are boundaries.

There is, however, a history of critique concerning object-oriented ontologies that ranges from the ancient Greek (Heraclitus) to the present day (e.g. Deleuze and Guattari 1980; Nietzsche 1954; Romano 1998). The critique aims at the atomistic view of nature, which contrasts the Heraclitean, dynamic, developing, and living view of ‘*absolutely moving life*’ (Marx and Engels 1978, p. 122). Most recently there have been suggestions from anthropology that an object-oriented ontology ‘is profoundly out of touch with life’ (Ingold 2015, p. 16). One reason for this is that objects are fixed and static: they are not constituted as part of life and, therefore, do not continuously change. It is questionable how approaches that give primacy to content and form of objects can account for a world of materials in flow and forces, changeability and evolution.

The two introductory quotations suggest alternative forms of theorizing in the social sciences that retain the inherently dynamic qualities of life: liquids, fluids, lines, and continuities. These constitute a world in terms of verbs and change rather than in terms of

¹ ‘Object’ may also be used in the sense of goal or aim at which an intention or effort is directed. In this sense, too, the object is in the form of a noun and treated as a ‘blob.’

nouns and structures. In the social sciences, such a shift has been made thematic in the different orientations characterizing formal analysis (which, whether using quantitative or qualitative methods, aims at specifying Durkheim's *objectivity* of social facts) and ethnomethodology (which aims at specifying the living work/labor that both orders the world and makes this ordering visible) (e.g. Garfinkel 1996). Whereas there is growing attempt to address this shift in the cooperative design literature, human activities themselves continue to be theorized in terms of the transitive relations between a subject that acts upon a material object, which, in recent decades, includes tool-mediation as an intermediary between the two (e.g. Fjeld et al. 2002).

This study was designed to articulate a way of theorizing the materiality of designing building upon a *fluid ontology*, which confers primacy to movement and change (process) over stable objects (products). Rather than an absolute rejection to any reference to objects in design studies, we pose the questions, *What can design researchers and practitioners learn from conceding analytical primacy to the fluid, rather than stable, object-like features of design cooperation? And what does a fluid ontology have to offer to a theory of the materiality of designing?*

As we show through empirical analyses of design work in software development, considering (human, non-human) materials and bodies as fluid in cooperative design allows us to emphasize the *inherent* rather than extraneous social nature of design; it also allows us to understand the inherently changing nature of designs from their initial appearance in thinking, to their entire life cycle, and to their ultimate death and disappearance. We propose such a shift in ontology because objects, designs, and even languages do die and disappear. Consider, for example, the slide rule, which, from its invention around 1620, became *the* tool for scientists and engineers until about 1972, when the first, halfway affordable handheld scientific calculators became available. The tool evolved over the course of those 350 years, but today it is all but a (slowly decaying) memorabilia, collectible, or museum piece. We therefore suggest that rather than theorizing in terms of objects, which are stable *things*, there may be advantages to thinking about material flows, becoming-design; these flows continue once the product is released into the public, because not only will individual items be used and decay over time, but yesterday's inventions are forgotten or buried tomorrow. Theorizing designing in terms of material flows captures the lifetime of some phenomenon from its very beginning in a dim thought through its heydays and to its ultimate demise. Fluid ontology and fluid topology appear to be especially suitable to theorize events in a firm that by its own account practices extreme programming as a form of *agile* software development. Our goal in this article is to test the viability and affordances of such an ontology/topology.

2. Of objects and ontologies

2.1. Social ontologies and topologies

In the social sciences, three classes of social topology can be identified to account for how the social world is organized (Mol and Law 1994). A first topology is defined in terms of objects clustered into regions with boundaries that confine them; when objects move (are moved) into different regions, they are thought of as boundary objects (e.g.

Bossen et al. 2014; Subrahmanian et al. 2003), because migration changes the practices related to them; or, equivalently, at the point where practices change, boundaries are detected. A second type of social topology exists in the form of (actor) network theories, which combine human and non-human actors into a single whole (e.g. Callon 1986). On the one hand, the actor network approach allows a more symmetric anthropology, which brings together on a level plane the humans and the nonhuman materials that they manipulate to account for the successes and failures of technological design. On the other hand, the approach retains a focus on stability that clashes with the aim of articulating a socio-technological world in continuous change (Sørensen 2009). This is so because ‘a network is a series of elements with well defined relations between them’ (Mol and Law 1994, p. 649), where agency spreads among the nodes (Ingold 2011).

An object ‘always refers to something with a certain unity and autonomy’ (Harman 2009, p. 152). The idea of the fluid was introduced because object- and network-centered ontologies cannot explain the nature of certain social phenomena, such as anemia, which is a different thing in different parts of the world (Mol and Law 1994). In the study of such phenomena, we are therefore ‘looking at *variation without boundaries and transformation without discontinuity*’ (p. 658, original emphasis). Rather than requiring of boundaries, boundary objects, and interpretive flexibility to address continuity and change, fluids exhibit a unity of movement and form. In a fluid topology, it is difficult and even impossible to identify nice and neat identities required in an object-oriented topology because ‘fluid objects absorb all kinds of elements that could only ever have come into being within the logic of other topologies’ (Mol and Law 1994, p. 663). Fluids are not stable or solid. They do not have fixed boundaries. Rather, ‘the organism (animal or human) should be understood not as a bounded entity surrounded by an environment but as an unbounded entanglement of lines in fluid space’ (Ingold 2011, p. 64).

2.2. From object to fluid social topology

The notion of object is central to many frameworks relevant to cooperative design literature. One case in point is cultural-historical activity theory, where the notion of object was conceived in a very definite sense of that to which activity is oriented (Leont’ev 1978), a sense that is equivalent to the Russian *predmet*, which should be taken in the sense of object/motive, for it includes societal need, sense, and relevance (e.g. Fenwick et al. 2011). This is to be distinguished from the notion of object as something standing opposite to a subject, the Russian *objekt*. However, it is common to find these two senses confused, with empirical analyses often treating things and people as standing in external relation, requiring of the intervention of a third material object (e.g. signs or tools) to bridge between them (Mikhailov 2004). This occurs when material objects are said to ‘mediate’: as signs, between two human subjects (e.g. Ploderer et al. 2015; Vygotsky 1989), as tools, between subjects and the objects of their activity (Engeström 1993), or as texts between experts and their world (e.g. Cole and Engeström 1993). Mediation, thus, becomes a theoretical artifact that is required because complex situations have been broken down into element-size building blocks (‘blobs’); but because elemental forms do not account well for the larger whole (i.e. activity) being investigated, mediators are required (Mikhailov 2004). Not only is it possible to theorize without the

concept of mediation, but also there are recommendations to abandon it for the purpose of recovering the moving and transforming aspects of activity (Roth and Jornet 2016).

The topology of object ontologies, because of the boundaries it draws between individuals, tends to struggle with articulating how ephemeral and metaphysical thoughts affect the world, for example, in bringing about innovative design creations. Such an approach, therefore, introduces a disjunction between (immaterial) mind, where design is conceived, and its material expression, as if the former caused the latter. However, philosophers (Merleau-Ponty 1945; Wittgenstein 1953/1997), psychologists (Vygotsky 1987), and anthropologists (e.g., Ingold 2011) alike have warned about making such a distinction, suggesting instead, based on close analysis of the relationship between thinking and speaking, that the material expression constitutes all there is. Thought (design) becomes itself in the course of material expression.

Objects not only are stable but also have definitive form; it is because of the subjectivity of people that objects are different things in different places or for different individuals. Thus, and likely unintendedly, notions such as *interpretive flexibility*, often used to describe cooperative design work (Glock 2003), are grounded in an ontology of stable objects, which may have ‘different meanings’ depending on the perspective of the user or the individual contemplating it (Eckert and Boujut 2003). There are internally non-contradictory things, the ‘meanings’ individuals have constructed, that collide in the public sphere. Whatever the social dynamics, and despite these dynamics being the intended object of analysis, the empirical investigation takes the form of a tracing of inter-action between these self-contained things.

An alternative to the object-oriented ontology exists in a fluid ontology, where change is immanent rather than imposed on objects from the outside. A fluid ontology is therefore consistent with a dialectical approach, where contradictions do not arise from the different positions or differences between persons who interpret objects differently; instead, the contradictions are inherent in the fluid, continuously becoming thing (Il’enkov 1982): ‘Dialectics requires in this case that external contradiction of two things be interpreted as a mutually necessary manifestation of the inner contradiction of each of them’ (p. 266). As a result, ‘any concrete, developing system includes contradictions *as the principle of its self-movement* and as the form in which the development is cast’ (Il’enkov 1977, p. 330, emphasis added). In its conception (but not in its uptake) cultural-historical activity theory fundamentally embodies a fluid ontology that rejects both blobs and networks in conceiving of consciousness as non-additive: ‘It is not a plane, nor even a volume, filled with images and processes. It is not connections of his separate “units”’ (Leont’ev 1978, p. 95). Instead, consciousness is ‘an internal *movement* of his formers, activities included in total *movement* realizing the real life of the individual in society’ (p. 95).

The idea of considering design as a dialectical process is of course not new, and researchers continue to strive towards investigating the products and materials of cooperative design as *objects-in-design* (Binder et al. 2011), and as processes of becoming (Roth et al. 2016). Efforts have been made to re-conceptualize the notions of boundary objects and interpretive flexibility in terms of developing and continuously changing correspondences between materials and the joint bodily and affective engagements that are involved in sustaining design ‘objects’ as being the ‘same’ despite evident change (Jornet and Steier 2015). We expand on those studies by elaborating on

the features and implications of a fluid ontology and social topology. Such an ontology and topology is to be appropriate for theorizing the ‘open event-ness of Being,’ the ‘actual event-ness of the one-occurrent event,’ and ‘the historical actuality of [a given act/activity and the historical actuality of its being, the actual and once-occurrent experiencing of it’ (Bakhtin 1993, pp. 1–2). Bakhtin worked towards a fluid ontology because an object that is finished cannot be experienced, and, therefore, cannot be known. Thus, ‘insofar as I am actually experiencing an object, even if I do so by thinking of it, it *becomes a changing moment in the ongoing event* of my experiencing (thinking)’ (p. 32). In cognition, the object is changing as well as experience and thinking.

In working towards a fluid ontology and topology, we agree with other studies that accept design reasoning to be observable design work (Glock 2003); and we are sympathetic to the attempt of using the notion of object to (as in ‘digital object’, Monteiro 2010) as a way of emphasizing the materiality of human practices however abstract they might appear (e.g. the work of mathematicians proving Gödel’s theorem, Livingston 1986, or the concrete objects in the work of theoretical physicists, Merz and Knorr Cetina 1997). However, more than Glock—who accepts that the visible aspects of reasoning are only a part of design work, another part of which are invisible mental processes—we hold it with others that all reasoning is social through and through (i.e., it is social *in a strong sense*) and, therefore, external and inherently visible (e.g., Livingston 2008). In fact, cultural-historical psychologists have pointed out, anything that can be attributed to the individual is but a reflection of the social (societal) and therefore public relations that the individual has had with other persons (Leont’ev 1978; Vygotsky 1989).

3. Empirical background

3.1. Context and data

Our empirical materials derive from an extended study of one software development firm with the pseudonym *BeamCoffer* that took place over an 18-month period in the course of which a former software developer with 20 years experience in the field established an extensive database (Socha 2015).² One particularly intense data collection episode extended over a 13-day period during which nearly 400 hours of video recordings were made simultaneously using 9 GoPro cameras—posted at workstations ($n = 5$), a huddle area ($n = 2$, one time lapse), a full-room time lapse, and one roaming—and one hand-held (roaming) camera. There are 292 hours of screen capture, thousands of photographs (e.g. from a time lapse camera recording a central whiteboard every 5 seconds), and numerous interviews with key stakeholders.

The product of the firm is a software system that allows families and friends to connect and stay in touch online in a variety of ways. In 2013, there already were over 13 million subscribers of the product (in late-2015 described as ‘tens of millions’), which features both web-based and client versions for a variety of platforms (Macintosh, Windows, iPhone, and iPad). Although it had been acquired by a larger parent organization, the company continues to operate independently. The firm practices *extreme programming* as a form of *agile software development*. In this approach,

² An Institutional (ethics) Review Board approved the study; all individuals appearing in the video recordings signed ethics forms, which also granted them confidentiality.

adaptive, continuous improvement of products, rapid and flexible responses to changes in the market and on the user end, and an evolutionary approach to software development are characteristic features of work. Teamwork and effective collaboration figure high among the defining characteristics of the company, where developers work in pair programming. In this practice, two individuals partner for a first programming session. After a two-hour period and following a huddle in which ‘succinct updates’ are made available, a new individual often replaces one of the original members of a pair at a workstation. Following another huddle and pairing, the two individuals programming at a given workstation during the final part of the day may be different from those who started there in the morning. Although the work is largely organized into pairs, it cannot be understood using the pair as the unit of analysis because 20 percent of the interactions occur with members of the organization outside of the pair (Socha and Sutanto 2015).

At BeamCoffer, a typical day has the following structure. At 10am, available members of the firm meet for a huddle, where they produce succinct updates, and the developers then move into a 2-hour pairing session. Following the lunch period (noon–1pm), there is another huddle followed by a 2-hour pairing session. Another huddle and 2-hour pairing session following a half-hour break (3:00–3:30pm) concludes the day. The materials drawn upon cover one entire day in the work of BeamCoffer.

3.2. Participants and tasks

For this paper, we selected materials from one day, where, following the first huddle in the morning and during an immediately following whiteboard session, two developers are tasked with (a) articulating some ideas concerning a ‘simplest editor’ to extend the existing product (noted as ‘Simplest Editor/think’) and (b) involve others to answer the question marked on the whiteboard: ‘What is a design? In the context of software production.’ This initial discussion involves Simon, a desktop lead, Scott, a developer, and Jeremy, a mobile content developer standing around a mobile whiteboard in the huddle area (Fig. 1). Red colored signs that stated the same afternoon as completion date (‘WED pm’) accompanied both task markers. Scott and Jeremy subsequently moved to a lounge area to begin their design work on the simplest editor.³ (Episode 1, appendix, was recorded during that time.) After about 40 minutes of discussion, they move into a meeting room with a whiteboard. (Episodes 2 and 3, appendix, were recorded on that occasion.) Here, they continue their discussion at the whiteboard for 30 minutes before sitting down at the table next to the whiteboard for another 58 minutes. Just prior to the late afternoon huddle, Scott and Jeremy met up with Simon in the lounge area for a debriefing discussion. Of this discussion, the first 25 minutes were captured on video. From the participants’ perspectives, what they had done was *formulated* during the third and final huddle of the day. Jeremy glossed what he had been doing as having had ‘a discussion with Scott and Simon about “what is the [product name] design and continuing that, what’s feasible technology, and other details that concern size”.’ Scott, having his turn after a few other individuals had talked, added to Jeremy’s gloss: ‘what he said and I am an agnostic assistant.’

³ Actually, the reactions from the desktop lead during the afternoon session show that the two developers were perceived to have worked on a ‘simple editor’ rather than on the design of a ‘simplest editor.’



Fig. 1 Video shot from one of the two cameras recording the post-huddle meeting involving (from left) Simon, Jeremy, and Scott during which the task of designing a simplest editor was specified on the movable whiteboard.

3.3. Analyses

Our analyses arose from individual and collective ‘data sessions’ (Heath et al. 2010), according to the interaction analysis approach (Jordan and Henderson 1995). We gathered in groupings involving either the authors or larger configurations with other scholars from computing and engineering sciences interested in the same data corpus. A fundamental focus of interaction analysis is to reproduce the *dynamic* of the events under investigation. This dynamic is understood to arise from the give-and-take of the participants, who make available to each other whatever is required for carrying on the current business. What matters are not the investigators’ interpretations of what some utterance or action ‘means’ but how others in the situation analyzed take up what others do and say; it is in the uptake that the original speaker / actor finds out how an utterance / action has affected others, and, thereby, how it has changed the context, and in turn is changing the speaker (Bateson 1996). Only those utterances, actions, and aspects of the physical context are admitted in data sessions that can be demonstrated to have *interactional salience* and *interactional relevance*, that is, are actively attended to, exhibited, and used by interaction participants—including the minutest body movement, orientation, and positioning (Birdwhistell 1970). The analyses reported below are based on the recognition that the micro- and macro-level aspects of society are not different and distinct orders or reverse sides of the same coin but that the individual and societal each implicate each other (Bateson 1936). This has the consequence that ‘a careful analysis of people in interaction shows how the smallest and least talked-about strips of behavior can help to constitute and reveal a great deal about a social order’ (McDermott and Roth 1978, p. 324). Behavior and context are not independent because any sequence of behavior is constitutive of the context in which it occurs. An *ethnographically adequate*

description of interaction shows how participants to a setting orient to each other and make available everything required not only to communicate but also to make visible the very conditions that enable communicating in the way participants do and for maintaining these conditions (e.g. Livingston 2008; McDermott et al. 1978).

4. Materials in flux: an empirical study of design in software development

This study is designed to examine the possibilities that a fluid ontology offers for understanding (agile) design research and practice. In contrast to work that assumes object- or network-centered ontologies, our analyses exemplify the fluid nature of material entities, including people, things, and tools. A fluid ontology and its associated fluid topology abandons the boundaries—between communities, between the self and other—that characterize object-oriented ontologies. The research questions and analyses then cannot concern how subjects and objects (or sets thereof) relate or connect to each other. Instead, we ask, *what is revealed about the materiality of design when a fluid ontology is assumed? How can such fluid ontology account for those relatively stable aspects that often are referred to as objects?* We address these questions in the following sections, where we analyze fragments from the design discussions that followed the initial meeting described in section 3.2, where two software developers were given the task to design a ‘simplest editor.’

We introduce the notion of fluidity by examining a fragment that takes place early in the discussion and which features no material objects but only moving human bodies (gestures) and shifting ways of talking (section 4.1). It is precisely the absence of ‘objects’ that allows us to illustrate the fluid nature of the design work, which is shown to be thoroughly social and which finds its most radical expression in the fact that the participants’ bodies are both the subjects and the objects of the design activity. Rather than design subjects opposed to design objects, we find identity, in the sense of a moving unity of opposites (Mikhailov 2004). Once we establish this identity as a way of accounting for the design situation, we do not simply throw aboard the word ‘object’, but rather set ourselves the task of accounting for their emergence in and as a fluid design trajectory. Accordingly, and drawing from fragments of the meeting featuring a whiteboard, we illustrate how, in and through a fluid relation, stable objects are achieved as an issue of concern and orientation in the setting (section 4.2); and we analyze how, in the opposite direction, external self-contained things (objects) become fluid when they are drawn into the social flux of design (section 4.3). Finally, we show how in the unity of flux, there is a memory or reverberation that concerns both persons and design materials in intransitive (that is, without object) correspondence (section 4.4). To allow readers to see the fragments mobilized here in a larger context, we provide in the appendix the more extended episodes from which the former are taken.

4.1. Materials in flux: designing with/without objects (bodies)

Historically, objects have constituted the most essential unit of analysis to account for the role of materials in making (e.g., design) practices (Ingold 2013). In fact, inscriptions, tools, and other material artifacts populate research articles almost as much as they populate design settings. Given their prevalence, a focus on objects seems adequate, and

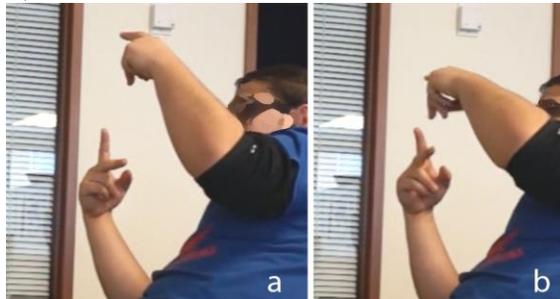
even those researchers (like us) attempting to elaborate the inherently fluid and social nature of design work cannot but draw on terms such as *things* and *objects* to make their arguments (e.g. Binder et al. 2011).

When analyses of design practice focus on objects and the boundaries between other objects and subjects, some of the most primary materials, including the living human bodies and the air or ground within and upon which they move, tend to be taken for granted or disregarded as immaterial (Ingold 2015). Yet, human bodies, and the traces they leave through such fluid and apparently ephemeral things as gestures and silences, constitute an important material basis for cooperative design work to move on. We examine these fluid and social features as we analyze a sequence in which the two software developers, Scott and Jeremy, sit in the lounge area and discuss the possible features of the ‘simplest editor’ that has been marked as one of the two main topics for day. Our analyses show how, without recourse to objects other than their own gestures, pauses in conversation, the design object (in the sense of *predmet*, that to which the activity is oriented and which it realizes, Leont’ev, 1978) develops.

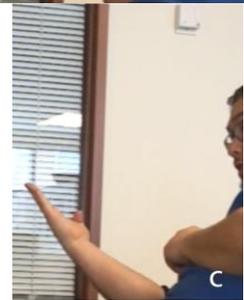
In Fragment 1, we observe a multi-modal presentation where a design object (an aspect of the editor) is elaborated by one of the developers. At first, the finger/hand configurations provide what we can see as the image of a larger rectangle (turn 01, [a]) followed another object that is nested within it. When the small object, which has its own representation gear, is flipped it updates its configuration, which has to be reported to the parent, which does the drawing on the main canvas. (Transcription conventions are available in the appendix.)

Fragment 1 (Excerpt from Episode 1, Appendix)

01 J: so with nested objects (0.5)
 >(see=its?) [a] < (1.5) flip this
 [b] housing’n’this other object
 that has its own little
 representation ((3 beats around
 [b])) (0.2) gear (1.4) °when
 this°



base (0.3) ((quick movement with sudden stop at [c]))
 [°this this] (0.7) emBEDded object (0.5) updates
 [*] *((3 rH beat gestures, [c]))
 (1.8)
 [↑ ITup ↓ da:tes
 ((beat, [c]))]
 (1.8)



but (0.5) °it needs te° ((*lH beat with configuration [d]*)) tell its parent t up date because its * *((*movement from [d] to [e]*)) parent ((*beat [e]*)) ((*S gaze into the distance, as if questioning*)) is ((*gaze back to J*)) actually whats

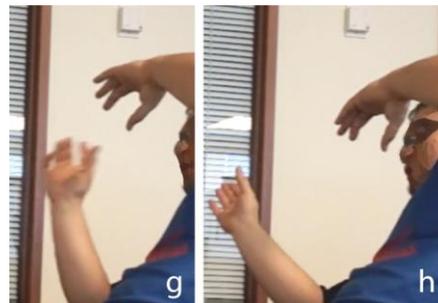


In this brief fragment, a variety of design features are set up in conversation, distinguished verbally and gesturally. There is a larger surface (gesture [a]) within which a smaller element (gesture [b]) is contained. Hierarchical relations between parent (gesture [d]) and child (gesture [c]) are made visible by the left hand (lH) and right hand (rH), respectively, the former being located up, to the left, and closer to the speaker whereas the latter is lower, to the right, and away from him. This now affords bringing these different things into the communicative process without actually naming them. Thus, for example, the communication between child and parent processes is made visible in the right hand that moves towards the left hand (gesture [e]). In the movement from [d] to [e], the reporting process from the child to the parent is visible.

We observe this use only seconds later, when Jeremy uses the expression ‘this guy’ (turn 07) while producing a right-hand beat gesture similar to that in [c]. This ‘guy’ is changing its position. The recipients, or the witnesses (e.g. researchers) do not have to stop wondering who ‘this guy’ is in each of the three instances and even though there are two different things involved, which they would achieve by consciously interpreting the situation at hand. Instead, we can perceive ‘this guy’ in the same way as if Jeremy had said ‘this sofa’ while pointing to one of the sofas in the lounge area where they were sitting at the time. We can also perceive which ‘render self’ is changed because (a) the child, which has a render method, reports, as per gesture, to the parent (image [i]) and (b) the ‘this’ can be seen to be the parent, as per the beat gesture with the left hand in the position that had previously been attributed to the parent.⁴

Fragment 2 (Excerpt from Episode 1, Appendix)

05 (0.9)
 06 S: ((nods))
 → 07 J: [so (0.3) *this GUY* ((*rH beat, similar to [c]*)) changes its=positi'n in calls (1.0) so (0.2) whatyeDO=thenis s'when the parent ((*beat, [g]*)) owns=the CHILd ((*rH beat, [h]*)) (0.5) that has a render ((*rH beat*)) (0.3) °method and → this guy's=((*lH beat*))=a=render=



⁴ Rendering refers to the process that transforms algorithms into the images that can be seen on the display device.

- =method° [i] (2.7) um (1.6) it [i] (0.6)
 changes this ((rH beat, [j])) render self
 (1.5) so that (.) this ((rH beat)) render
 self (0.8) calls ((lH index to rH, similar
 to [i])) (0.5) this render self so
- basically (0.4) this guy ((rH beat, similar
 to [j])) says render; (0.3) it ((lH index to
 rH, as in [i]))



Even though a lot of work is completed here in gestural and verbal terms to intelligibly unfold the design, this does not mean that the recipient actually has been able to follow. The speaker himself has noted, at the end of Episode 1 (turn 09, see appendix) that something about what has been unfolding is ‘pretty abstract.’ He offers to show Scott some code structure, which we may expect to be implementing the relation between parent and child. Near the end of turn 01, Scott is gazing into the distance, as if questioning how to hear and see what is expressed. Indeed, only a little later will the two be getting up and walking to a whiteboard located in the adjacent meeting space, where Scott then will be drawing a larger and a smaller rectangle and writing a number of words and statements (see Fragments 3, 4 below). There is no product here, no determinate object or idea, but rather a thing in the making, a making that is using no other things than words and gestures.

Notable in the transcribed fragments are the pauses, many of which are long given that the ‘standard maximum’ silence in conversations lasts approximately 1 second (Jefferson 1989)—though research in the discovery sciences has reported much longer silences during laboratory work (e.g. Roth 2004). In Episode 1 alone, there are seven pauses longer than 1.0 second (see appendix). There are other markers that suggest that the process of articulating design is design thinking rather than the externalization of a finished thought or idea. In fact, the entire episode is marked by the stop-and-go manner in which it unfolds. For example, in the phrase immediately preceding turn 02, we hear ‘it needs to tell its parent to update because its parent is actually what’s drawing-on.’ Then there is a 0.6-second pause before there is another spurt, ‘on the main canvas, so.’ This phrase actually repeats the last word articulated before the stop, which affords hearing what comes as the continuation of the phrase preceding the pause. The phrase is followed by another 0.6-second pause.

Together, gestures and pauses constitute core features of the work that is involved in advancing designing. In fact, both gestures and pauses, although ephemeral, are the *only material thing* constituting the whole situation as a one characteristic of design. In this situation, then, the subjects of talk and the objects of talk, as materials, coincide in substance: the same bodies that are doing the talking are also doing the hearing and seeing of that talking. What the talking is about and what does the talking is in this sense self-referential. Although there is no doubt that Jeremy is talking *about* things, and that those things can be followed in and by attending to Jeremy’s talk and gestures, conceiving of those things as self-contained and located within an object topology does not help us to understand how the design episode *moves* and *unfolds*, if only because there is evidence that the participants themselves are not somehow externalizing an already existing internal image, but rather they are generating it in talk.

Gestures and speaking pauses constitute evidence that there is an object-in-design, the form and function of which is not yet fully known to the participants rather than a finished product that is being externalized and rendered. It is in and as speaking that design thinking unfolds. Therefore, if we are to find a design content, we may say that the content of thought expressed *lives* in conversation and, therefore, changes with it. This is so because ‘content, after all, does not fall into my head like a meteor from another world, continuing to exist there as a self-enclosed and impervious fragment’ (Bakhtin 1993, p. 33). Rather, and as theorized in dialectical materialist approach concerned with understanding the historicity of culture and thought, it is in the movement and not in its being a given form that design thinking unfolds. For, as ‘the thinking body, when it is inactive, is no longer a thinking body but simply a “body”’ (Il’enkov 1977, p. 45). What we observe here are not just bodies. Instead, the phenomenon is *participative thinking*, a thinking that is elaborated with and for the other. In fact, if we were to account for the frequency and length of the pauses observed, their occurrence would have to be traced not only to the nature of the content of what is being talked about, but also and perhaps most primarily, to the space that is being given for hearing and taking in. The same could be said of Jeremy’s gaze, which shifts between orienting to his own gestures, and orienting to Scott, who also is displaying attention to the talk. The frequencies of those occurrences (gestures, words) that form the design materials in this fragment are therefore a function of *conversation*, not only of speaking out, but also of hearing and taking in. We observe spaces, gazes, and mutual orientation in general at each step of the design process. Speaking and talking, when considered in this manner, are not of one given person and about a given topic, but are the irreducible social relation (Bateson 1979). The fluid nature of design, in these fragments, is therefore indistinguishable from its social nature. The materials on which the design draws are shaped in and for the social relation to move forth.

4.2. From fluid to object

In the fragments that are exhibited here, the design is shown to be living, continuously unfolding, and developing in and through concrete performances in irreducible social relations. But scholars and design participants alike find a great deal of appeal in referring to design objects in associated object-oriented ontologies. In fact, the participants in our study *do* refer to things and eventually come to treat design objects as solid, even when there is no one solid thing that can be grasped as the simplest editor (if only for its very processual rather than blob-like nature). Fluid ontology and fluid topology therefore also need to show how the appearance of stasis becomes possible. The question then has to be posed how fluid objects—tied to and marked by the contingencies of living design work—get to the point that they are treated as solid objects.

To address this question, we draw from a sequence where some of the design objects that first emerged in and through gestures in the air (Fragments 1, 2), now are discussed over inscriptions on the whiteboard. Our analyses focus on how the participants jointly manage talking and performing over and about the inscriptions in such terms as to be talking about the same design thing, despite a changing context. That is, assuming a fluid ontology we observe how the participants manage to sustain a design object despite a constantly shifting material field or context. The participants have just moved from the

lounge area into the meeting room, where there is a whiteboard. We enter the episode as Scott has finished placing a number of inscriptions (text, drawings) on the whiteboard (Fig. 2) and Jeremy has joined him there.

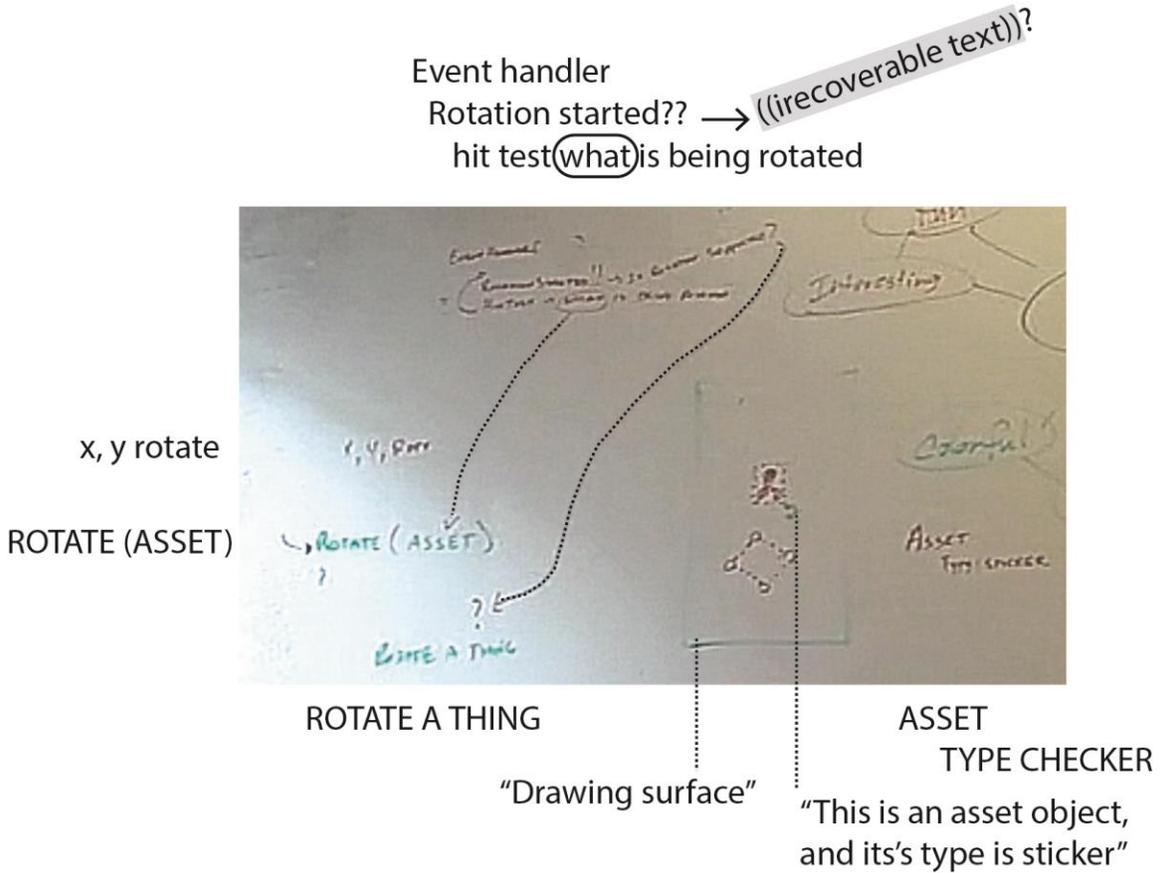


Fig. 2 The inscriptions left behind on the whiteboard when Jeremy and Scott have left. Things, like the arrows and some of the text, have been added in the course of the design conversation.

In the excerpt, Scott’s hand hits the whiteboard surface as if a cursor had been clicked within what has been marked as a ‘drawing surface’ (see Fig. 2). Initially, there is a stop and a description of the larger rectangle to be the drawing surface, and then a restart follows in the form of another hit of the whiteboard. This is followed by the rotation of the right hand, itself followed by an expression as if someone or something realized that something has happened: something has started to rotate (turn 01). Scott turns his gaze towards Jeremy. There is a considerable pause, and then Jeremy nods. Only then does Scott continue. We can hear this continuation as an alternate description, set up by the particle ‘or’ preceding it. In this alternate description, the ‘hit test’ immediately follows the ‘touch down’ (turn 04).

Fragment 3 (Excerpt from Episode 2, see Appendix)

01 S: >you=kind'a=go * ((hits WB)) that'd be thiss ((circular gesture over the top of large rectangle)) the canvas



g [o oh (0.2)] * ((hits WB, rotates hand))
>something's=starting=t=rotate< ((gaze towards J))

02 (0.7)

03 J: ((nods))

04 S: ((gaze back to 'canvas')) >ye=know< u:m o::r (0.2) when you touch <down> (0.4) ((touches down on canvas)), >you c'n gotta go touch down< >>y'kn<< do your hit test first ((IH to 'hit test what is being rotated,' Fig. 1)) ((gaze to J))

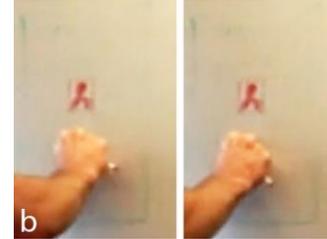
05 (0.3)

06 J: ((J nods))

07 S: >wha okay whats on it<

08 J: ((3 head nods by J))

09 S: [yea then it] says ooh rotation started (0.5)
>you=know em<



At the end of turn 04, we observe again how a pause in the production of the account is sustained until there is evidence of mutual attention and attunement. Scott turns the gaze to Jeremy, a pause is developing, and then, after the latter nods, the former continues with what turns out to be the description of the event following the hit test: what is the entity (asset, Fig. 2) that was touched, and then a report is made within the event handler that a rotation has started (turns 07, 09).

Here, too, we observe the social nature of the design process. Everything articulated in the fragment is recipient-designed, not only presupposing the intelligibility of what is materially available to Jeremy but also using linguistic resources that have their origin in culture generally to which they return in speaking. But producing presumably intelligible (social) communication does not mean that it is intelligible in any particular case. Speakers therefore seek confirmation that the recipients are following. This is the case, here, when Scott orients to Jeremy at the end of turn 01. Scott only continues after Jeremy provides a nod that can be perceived both as a confirmation of following and as a 'continuer', that is, a token that allows the present speaker to continue because the other person has ceded the communicative floor (e.g. Hutchby and Wooffitt 2008).

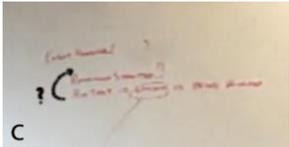
In the extended next turn, the design develops along several dimensions. We might gloss the developments in Episode 2 (see appendix) in this way. First, an arrow is added showing the relationship between two existing whiteboard inscriptions (turn 14, [c]); and another textual inscription is added towards the end of the episode (turn 29, [d]). Second,

over the course of seven turns, a description of the event is added that is marked as being similar to what has been said before (turns 11, 13, 15, 20, 23, 26, 28). Besides the question ‘Does the selected object support rotate?’ (turns 13, 15), there is a statement concerning the background’s probable support of rotation (turn 20), that a sticker manager would test the presence of a sticker for rotation (turns 23, 26), and that a second touch down would be involved in some way (turn 28).

When the fragment starts, Scott is oriented to the whiteboard and gazing at the upper part of the inscriptional whole (Fig. 2) while Jeremy is talking. He draws an arrow, which presents in visual form the relation he has previously articulated verbally: the hit test, concerning the question *what* is being rotated—i.e., the nature of the asset—reports to the higher process that handles the rotation of the selected object. During the entire time, spanning turns 11 to 16, his gaze is turned to the inscription. Although Scott produces signals of attention both verbally (‘yea,’ ‘um,’ turns 12, 16), he may be perceived as attending to the inscription that he has been producing in the course of the meeting so far. It therefore may not be surprising that Jeremy stops talking (turn 15) only to begin speaking again (turn 20) after Scott has said ‘yes’ and turned his gaze towards the former.

Fragment 4 (Excerpt from Episode 2, Appendix)

- 11 J: yea right [thads thads] this’s (.) °w° >similar t’what i [have] in
 12 S: [°yea yea °] [°yea°]
 ((S nods))
 13 J the [in this (0.3)] does this object
 14 S: [*] *((draws arrow tail to tip, [c])
 15 J: that you [have] selected support rotate
 16 S: [um] [°yea°]
 [*] *((S nods, rH beat gesture))
 17 (0.6)
 18 S: yea ((gaze to J))
 19 (0.3)
 20 J: b’cause da back [ground will] probably [would] support rotate
 21 S: [>>background<<] [sure] *((S turns to WB))
 ((S nods)) [*]



c
 Event handler
 ↻ Rotation started??
 Hit test what is being rotated

Prior to moving into the meeting room where the whiteboard was available, Jeremy had just provided a verbal and gestural account (partly transcribed in the previous section) where parent-child relationships between (rectangular) objects are described as one of the features that would make possible the editor to be simple as the task description stated. The whole account being jointly (as per mutual attention) produced can therefore be heard as part of a longer sequence in which the adequacy of a hearing is being tested: Jeremy has given an account, and Scott now tests whether his account is adequate. Thus, we hear Jeremy noting that what is being articulated is ‘similar t’what i have’.

Despite the two presentations being performed by very different material means and in very different terms, the two participants appear to agree that both accounts are similar. The similarity is not simply stated, but is further displayed in yet another performance, in which the now-present drawing is again referenced, adding richness and more detail to it.

The account is jointly produced; and as Jeremy continues adding verbally, nodding, and pointing, Scott draws, acknowledging and displaying active participation in the production of the account. That is, there is constantly unfolding and jointly produced *work* invested in constituting the diverse accounts *about the same design thing* (or set of things; here an editor's underlying process). But then again, the object-ness of the thing rests entirely in the in-between space that both separates and unites the participants. The whiteboard, the drawings on the whiteboard, the gestures over it, all are shifting features, even though some of these traces are more durable than the gestures and sound-words produced in the first fragment. The objectivity (solidity, durability) of the design thing, even though it now involves material things other than the participants' bodies, is sustained by the mutual (perceptual, conceptual) attunements to invariances that are fully relational or social. The things drawn, therefore, do not stand between (or mediate) the subject (Jeremy)–subject (Scott) or the subject–object relation, because this relation is not one across two sides of a river, but grows along, changing subjects and materials.

4.3. From objects to fluid

In the preceding analyses we show how, despite the inherently fluid and social nature of design as seen from a fluid ontology, the participants achieve design objects that can be referred to and become objects of further design. By contrast, in this section we show how one particular material object, despite its material constancy, may become fluid in and through being drawn in social relations.

The way in which given inscriptions (e.g., on the whiteboard) and other material objects come to be part of a design trajectory is not fixed but varies. This variation, which may occur in two ways, often is conceptualized in terms (of chains) of *interpretations* (e.g. Ricœur 1986). First, variation may occur across participants, two or more people, groups, or communities of practice using the same design artifact (drawing) in different ways, which has been conceived of as affording *interpretive flexibility* in design (objects) (Glock 2003; Mayernik et al. 2013). Second, the variation may occur in the course of time, a phenomenon termed *interpretation drift* (e.g. Yasuoka 2015). In both instances, the social topology being drawn to account for variability is one of objects (blobs) and their boundaries.

From the perspective of a fluid ontology, however, the issue that matters is not *what* something (e.g., a drawing, a phrase) *is*, which may vary across different participants, but rather how material things can become the subject of praxis in such a way as to change the very context in which those things are used. Here we articulate this issue by examining a fragment where the same stretch of text takes on very different functions. The fragment derives from the design conversation that preceded Scott and Jeremy's discussion represented in Fragments 1–4. A desktop lead (Simon), a developer (Scott), and a mobile content developer (Jeremy) are standing next to a movable whiteboard (Fig. 1). In the course of approximately 13 minutes, the desktop lead explains and communicates two tasks to be completed or led by the other two. One of these tasks concerns the development of a simplest editor for one of the company's projects, the other occurs over and about an inscription related to but more general than the first task: 'What is a design? (context prod[uction]).' Over a period of 10:54 minutes, there are 34 gestures pointing towards or moving along the inscription. Scott produces four of these

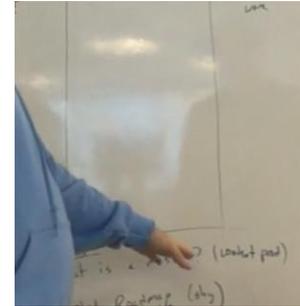
gestures; the remaining 30 are the result of Simon's movements. That inscription called upon by the hand/arm movements is used in different ways, illustrated in Fragments 5a–c.

Fragment 5a

01 Si: whoever wants to be there, think about

what is the design
 ((lH sweeps over text))

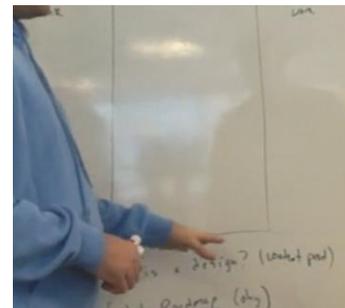
really from the eye in the context of the production
 ((touches whiteboard, then moves across during the articulation))



Fragment 5b

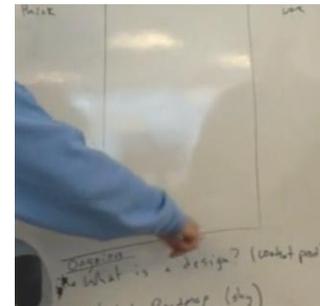
01 Si: and this, the group having this discussion
 ((lH 2x over text))

will in the end probably say 'define what a design is'



Fragment 5c

01 Si: so this dis– so this dis– this discussion
 ((rH 3x right / left movement over text))
 in the end produces



In Fragment 5a, the gesture sweeps over the text at a point where the phrase articulates the object of the activity of thinking to be conducted by 'whoever wants to be there,' that is, in the place where participants are going to discuss 'What is the design?' In the second fragment (5b), the sweeping gesture falls together with an indexical term 'this,' the referent of which is immediately elaborated by 'the group having this discussion.' Here, the inscribed phrase is used in the sense of the actors involved in the discussion of what the design of the new editor should be (in the context of production). Finally, in Fragment 5c, the hand/arm movement falls together with the indexical phrase 'this discussion,' which is the process in which an answer to the question is to be found. That is, in the course of about 11 minutes, the same inscribed phrase is used in the subject position (people, group involved), a process (the discussion), and the object (the question to be answered). Of the total number of hand/arm movements that point to or move along the text, $n = 17$ are associated when the phrase marks content, $n = 10$ index the process (discussion), and $n = 6$ instances, the phrase takes the position of the subject. One pointing gesture is not associated with talk and, therefore, is not assignable to these

categories. Instead, it marks an orientation towards the inscription as if Simon was about to say something ('but . . . but . . .'), at which time Jeremy begins to speak. In this instance, the hand/arm movement can be seen as a move to take the speaking floor, which was then taken by another participant.

Pointing is part of the joint, social work that carries ahead the event in which the design task is becoming. In this work, a constitutive relationship is established between something pointing (e.g. a hand movement or [gaze] orientation) and something being pointed to. First, pointing presupposes a thing pointed to. Pointing is happening because there is something that can be pointed to. Second, something comes to be salient (e.g., for the viewer, recipient) in and through the pointing. From the recipient perspective, something is a pointing if there is also something that could have motivated the pointing; and the existence of a something motivates treating the hand/arm movement as a pointing rather than as something else. There are many hand/arm movements, some related to the content of speech, others merely serving interactional function (e.g., beat gestures), and still others being grooming gestures or ticks.

The gestures mark things in the environment as salient, which, as accented visible, thereby become integral part of the communication. It is not that the gestures stand for something else but that they make salient something in the environment to be part of the communicative whole. The examples show that how the inscribed phrase comes to function is different not only between subjects but also, and more importantly, within subjects. That is, the phrase does not *have* a 'meaning,' which might be particular to individuals interpreting the phrase differently because of its inherent interpretive flexibility. Instead, the phrase has different, situationally changing, fluid functions. Moreover, what matters is not 'interpretation' but the interactional significance of the ways in which phrases and hand/arm movements come to function in the evolving design communication. That is, rather than having a fixed ontology, the phrase is a *fluid thing*, flexibly adaptable to the always contingent context of its use. The thing defines its use as much as the use defines the thing. It is a form of 'text' relating to its 'context' with which it forms a sense-constitutive contexture [*Sinnzusammenhang*] (Schütz 1932).

In object-oriented approaches, this phenomenon might be glossed in terms of interpretive flexibility. The material object is taken as given, a Kantian *thing-in-itself*, and what changes is how people think and talk about it. However, as soon as we choose a unit of analysis that encompasses the dynamic aspect of life, the naming ('interpreting') of things becomes an integral aspect of the phenomenon (Bateson 1987; Dewey and Bentley 1949/1999), as apparent in the category language-game, which 'consists of language and the actions into which it is woven' (Wittgenstein 1953/1997, p. 5). Our 'object' no longer is the material inscription in and of itself but the ways in which people name and use it. At that point, the ever-changing nature of the object is undeniable. Such observations, which testify to the fluid nature of things that appear in designing work, explode the idea that there may be 'information-carrying artefacts . . . as independent entities' (Eckert and Bojut 2003, p. 145). The present description instead is consistent with the contention that in describing the relations between people and the work they do, what matters are not the dictionary meanings of information passed (Bateson 1996). Rather than focusing on a 'mechanical description "A gave B such and such information,"' we are interested in the vastly different 'description of the interchange "A answered B's question immediately"' (p. 68). Thus, if these marks were considered to be freestanding objects (signs) left

behind following the transactional work, their living and ever-changing communicative function (sense) would not be recoverable—a finding that also has resulted from other studies of work at the whiteboard (Suchman and Trigg 1993).

4.4. Recursive nature of fluidity: reverberation and correspondence.

In the preceding sections, we observe how the participants populate the surface of the whiteboard with various things, which then afford future design actions, including manipulations of objects that can be pushed (clicked) and rotated. However, the materiality of design is not tied to the inscriptions. Instead, it is more appropriate—and in the sense of Wittgenstein (1953/1997)—to think in terms of performances in which different aspects of the situation come to stand out, and which come to form part of a larger history of development. The articulation of design unfolds in a continuously changing context, to which each reaction contributes and which it changes. Accordingly, material aspects cannot be seen as self-contained objects that *cause* particular outcomes. Rather, within a fluid ontology, things are thought of as constituting recursive currents within the evolving system, a system that therefore self-affects and has a memory.⁵ When materials are drawn into the unfolding design conversations, the whole system of relations is transformed not just immediately in terms of part/whole relations, but also across time and throughout different modalities. As a result, we need to talk not about subjects and objects but about correspondences (of one material with another) and reverberations across multiple modalities.

To exemplify this issue, consider the following excerpt from Episode 3 (see appendix). The fragment forms part of a series of recurrent formulations of the framework outlined previously, of which two examples were given in section 4.2. Our study shows that work similar to the one described in section 4.2 may be produced without anything on the whiteboard, which then becomes a surface on which things and processes appear in an ephemeral way. In this part of the conversation, Jeremy has a turn at developing the unfolding design. The fragment and associated screen prints show him orienting repeatedly to the whiteboard, where his right hand moves as if he were manipulating entities residing precisely on the surface. From there, his gaze turns to Scott, and back to the whiteboard, where his thumb moves as if pushing down on something, or where the hand moves along a certain stretch while he is talking about something being moved. Jeremy's hand is posed on the whiteboard and, when the developing phrase concerns an object (on the interface), we can hear a sound when the fingers hit the surface (turn 01). This can be seen as significant because until just right before Episode 3, Jeremy was standing away from the whiteboard; he stepped forward just at the point when he also talks about an object receiving a touch. In touching, therefore, there is a literal rather than merely metaphorical touch that would point the recipient to something else. Now that there is a target object, which is only one among several that have 'event listeners' (turn 07), it affords further unfolding and elaboration of the design. For example, the hand stays in the configuration over a considerable amount of time (turn 07), which allows the recipient to see the grammatical subject of the sentence: the target object that just has received the touch.

⁵ In a material phenomenology, consciousness arises from the self-affection of life; this radically immanent self-affection 'is nothing other than our flesh [*chair*]' (Henry 2000, p. 173).

Fragment 6 (Excerpt from Episode 3, Appendix)

- 05 J: so (0.2) >when we get< (0.1) a; touch ((*touches WB surface*)) (0.4) u (0.2) >thenit< regis ter:rs it=a: thenit (0.2) then it knows=what target=object it is
- 06 S: ((*S nods*))
- 07 J: (0.5) °an° so=it igno:res (0.5) >all=the=other< target=objects (0.7) that have (0.3) event list'n'rs to them [a]
- 08 S: ((*S nods*))
- 09 (1.6)
- 10 [b] >andthenits< [c] (((*moves thumb as if operating something*)) 0.6) anifit has=a (0.1) ges(.)ture [b] (0.4) tached to=it
- ((*moving thumb, looks at it, as [b]*)) ((*gaze away back towards S, [c]*)) an' waits for the second

touch
*

 ((*gaze towards S,*) *((*thumb touches surface hearably*)))



Gazing towards the hand on the whiteboard invites looking at what is happening there, which, in this case, is a thumb movement that closes the angle between thumb and the remainder of the hand, as if someone were pushing a joy stick or airplane go-around button (gesture turn 10, [b]–[c]). After a 0.6-second pause, we then hear the description of an action that occurs if the target object has a gesture attached to it: the target waits for second touch (turn 10). In this situation, we observe Jeremy's initial orientation to the recipient, Scott (turn 07, [a]). Just prior to restart after a longish pause (turn 09), Jeremy is turning his gaze to his hand on the whiteboard (turn 10, [b]). Such a turn invites the recipient to orient his gaze into the direction of the gesturing hand and the things tied to it (Goodwin 2003), here to the target object and its event listeners. There is a gesture, which anticipates the naming by about 1 second, which falls together with a repetition of the same thumb movement.

Here, then, the target object appears on the whiteboard surface not in the form of a drawing, as in a diagram, but audibly, touching (turn 01, 05, 10) and operating upon it by means of the gesture (turn 10). That is, even though there is no drawing appearing on it, the whiteboard in its material presence allows other things to be present that are woven into the evolving design conversation and, therefore, into the design that continuously develops as it becomes increasingly specified and changed. The very fact that Jeremy's performance occurs over the empty whiteboard but bearing perceptual similarities with Scott's account across Fragments 3–4 suggests the existence of a form of memory that is not Jeremy's own. That is, there is a trace, a memory, which does not belong to one participant alone but to the system constituted by the two participants and their changing material environment. This memory bears traces of an accumulating history of prior performances and perceptual differentiations that increasingly concretize the software design. Those differentiations thus *reverberate* across occasions, and throughout the different modes of presentation (talk, drawing, gesture).

We observe the same phenomenon in the same episode again (turn 14–19, see Appendix), when Jeremy repeatedly shifts his gaze to the whiteboard and back to Scott. In the first instance, the talk describes the object as not having moved, which is associated with the right hand in the same position (turn 15, [d], [e]). In the second instance (turn 19, [f]–[g]), there is first a gaze reorientation to the hand on the whiteboard (turn 19, [f]), then a redirection of the gaze to Scott associated with a movement of the hand across the whiteboard surface that falls together with the statement ‘so when you move [it].’ That is, there is again a change in gaze that first invites the other’s gaze towards the hand, which then makes a gesture while the returning gaze is in a position to perceive the effect of the unfolding verbal and gestural expression. In this, the participants orient and invite each other to follow an unfolding set of material resources (here hand movements over specific areas of a whiteboard), where what is to be discovered is not each of the things thereby inscribed, but how these things come to relate to each other coherently as part of an unfolding history of (bodily, embodied) references. Accordingly, the most basic unit is not the object being inscribed, or the surface on which it is inscribed, but the *correspondence* between surface and body, that together constitute the trace, a form of distributed memory. In correspondence, there is no matter and an interpreting mind, but ‘material flows’ and the ‘sensory awareness’ thereof (Ingold 2013, p. 97).

5. Discussion

This study was designed to articulate the ways in which adopting a fluid ontology/topology may contribute to our understanding of the materiality of *living* cooperative design work, a question that we investigate in the context of agile software development. In this regard, our purpose is not to dispose of or claim that the terms ‘object’ or ‘thing’ should not be used in design literature. On the contrary, our analyses document the prevalence of and indeed draw from an abundance of things in cooperative design work. Rather, our research interest concerns an exploration into the possibilities and limitations of different analytical choices with respect to issues of materiality in design. We discuss different ontologies and social topologies so that the worlds revealed and the associated possibilities for research and practice differ. In this section, and drawing from the empirical analyses presented above, we discuss those differences and possibilities. First, we discuss how fluid and object-oriented ontologies offer readings of design cooperation that are symmetrically alternate: fluid things and object things are categories that pertain to different topologies of design materiality. Second, we discuss how a fluid ontology reveals the inherently social of design rather than having to arrive at the social from the individual.

5.1. Fluid things and fluid objects

Our study shows two software developers working on a simple editor to be integrated into the existing software as part of their company’s value of providing responsive solutions to their clients’ needs. Assuming an object-oriented ontology, we might examine such work as one that first identifies self-contained subjects, objects, or networks, and then would trace relations between them. As a result, the analytical work

would proceed from objects (products) to process or movement. That is, change, creativity, and innovation in the design process would be explained in terms of how things (people, objects) relate to other things (people, objects). A fluid social topology, by contrast, concedes analytical primacy to movement and change (process). If everything changes and moves, however, design researchers and practitioners may be concerned that a fluid ontology may not be able to account for the prevalence and obvious relevance of material things in design processes? Assuming a fluid ontology, our analyses show how, as soon as one includes material things in the flux of social praxis, these things become fluid and are continuously shifting. In the opposite direction, we also show how, in and through continuously shifting materials, something like a design object (a simplest editor) comes to be stabilized and solidified across occasions.

In this study we observe how material things such as the words ‘what is a design’ on the whiteboard during a design meeting become fluid, shifting, and never just one determinate thing that can be detached as an object independent from the whole situation. We also show how a fluid ontology is particularly well suited for addressing the fact that, even in the absence of material things (objects), a (software) design object (*predmet*), after being seeded, is fluid and continuously *becomes* all the while being sustained as a solid thing that the participants orient and respond to. One way in which objects become detached from the local contingencies is their invariance across mediums, so that they may exist in the ephemeral hand/arm movements and body orientations or as inscribed objects on the whiteboard and in the drawings/writings Scott produces in his records of the meeting with Jeremy. Thus, when they move to the whiteboard, Scott renders what he has heard Jeremy to say in the couch area by explicitly marking Jeremy as the originator of the ‘drawing surface’ and the ‘little rectangle’ contained therein. That is, what have been ephemeral gestures (Fragment 1, turn 01a, b) later are pen drawings inscribed on a whiteboard and named in the related talk. In the part of the meeting that follows, these drawings are treated as embodiments of Jeremy’s gesture, and, therefore, as invariant across the two settings. This ‘invariance’ arises when we consider the object as a line of becoming or a line of flight (Deleuze and Guattari 1980; Ingold 2011).

The nature of this invariance is not material, even if its accomplishment involves materials all the way. Its nature resides instead in the fluid social relations that perform such continuity and invariance. Thus, in the analyses above we show how the materiality of design does not only involve material ‘blobs’ (objects), but also includes such apparently ephemeral and shifting things as the participants’ bodies or the silences in speech. In these pauses, object-oriented ontologies find evidence of a transitive relation between subject objects and object objects. But, as we show in the analyses, between taking in and giving out during design conversations there are not inserted two respectively independent things or processes. If this was so, Scott and Jeremy would have to be taken as producing in speech what they already had produced in their private mind. Rather, at the level of the relation, giving (speaking) and taking (attentive listening, receiving) are the two parts of one and the same *transaction*. In this sense, we do not observe two different sorts of substances, one consisting of expressions (speech) and another one consisting of ideas (‘meanings’). Instead, expression *is* design. Because words, signs, and things are *in-between*—e.g., ‘the word . . . is absolutely impossible for one person but possible for two’ (Vygotsky 1987, p. 285). Opposed to the in-between, they emphasize flow. This is so because ‘in the in-between . . . movement is the primary

and ongoing condition' (Ingold 2015, p. 147).⁶ *Between* is to *in-between* as *liminal* is to *arterial*.

Previous design studies noted that whiteboards can constitute a space for *concrete conceptual objects*, that is, objects that in their conceptual dimension mark the presence of ideas and in their concrete dimension mark their own visibility and tangibility (Suchman and Trigg 1993). Indeed, there is a long history of thought in philosophy and psychology according to which anything that we may consider to be abstract thought merely is a reflection of the social relations possible in a particular society in its historical context (Marx and Engels 1978; Vygotsky 1997). What really matters is what people do with words and images (Wittgenstein 1953/1997); and what they do with words and images, even when they do it on their own or for themselves, inherently has the public, social use as its genetic-historical precursor (Vygotsky 1989).

Our study adds to this literature the observation that things on the board, things gestured, in as far as they become relevant to design work, behave more like fluid things. As things, they participate in different kinds of work, for example, naming tasks, people, or processes. When those fluid things exist on the whiteboard in some way, a simple 'this' or pointing gesture suffices to mark it as part of what is to be situationally salient. However, when all the objects are rendered by gestural means—as is the case in several of the fragments analyzed—additional (different) means are employed to mark which of the gestures is to be foregrounded as thing. One or more beat gestures are produced in such situations, where the object is moved out of and back into its position (repeatedly). The something that is made available and salient verbally, bodily-gesturally, or perceptually in the environment does not have 'meaning' in itself; instead, what matters to communication is not the location of a thing among other things, but the rhythm or moment at which it appears among all other things in the stream of unfolding communication (Bateson 1996). One implication is that the content of the talk cannot be reconstructed from the whiteboard contents, because the things present have had very different functions. The whiteboard itself is indifferent to the nature of the fluid things—here including drawing pads, nested objects, code, functions—so that very different things come to co-inhabit the space, including things that were produced in a different meeting and had no pertinence to the present discussion (e.g., see Fig. 1 on the very right).

Object-oriented ontologies appear to treat as material that which can be seen as self-contained; they also appear to (even if unintendedly) treat as immaterial that which is changing and fluid. It is in this way that objects can be seen as crossing boundaries, and as being interpreted differently across different persons and situations. That is, the very primacy of objects in the object-oriented ontologies introduces a chiasm that divides the material (objects) and the immaterial (interpretations thereof, meanings). This also becomes a dichotomy between the solid and the fluid. In the fluid ontology, there is not such a chiasm, as everything material is also always changing, even if this occurs at very different time-scales. The distinction between the material and the immaterial gives place to another between life, which is ongoing and constantly changes, and just passed life (an event, a thing, a person), which after it has taken place can be named and referred. But the naming and referring are always fluid.

⁶ Dewey and Bentley (1949/1999) use *between* and *in-between* synonymously, opposing it to the use of *inter-* as 'mutually' and 'reciprocally.' Our use of *in-between* is in the latter sense.

5.2. Fluidity and the social nature of design

Object-centered ontologies derive from the methodological choice of taking the individual ‘blob’ (Ingold 2015) as the minimal unit of analysis. The social is theorized to arise from the *interaction* of these individual blobs. When the unit is the individual, internal thoughts, feelings, and actions are taken as opposing to and reflecting upon other external units or elements (other subjects, other objects). When the unit of analysis expands so as to include a social relation, however, things are never definitively settled but always are subject and subjected to the encompassing social relations within which they emerge perceptually and discursively. Participative thinking and participative consciousness are dynamic and living because they are integral part of and follow material life; and ‘participative Being leads to the loss of oneself in it’ (Bakhtin 1993, p. 49). That is, in a fluid ontology, the self-contained, stable individual gives way to the fluid being. Everything considered within theory ‘must be determined as a constituent moment in the *once-occurrent* event of Being’ (p. 2). Both ‘objects’ and ‘subjects’ then are attributes of social relations; they are internal rather than external. Social things are fluid things.

In a fluid ontology, designing does not just have some material dimensions, some material properties, but instead is material through and through. In the episodes, we do not observe a design object that is rendered or externalized in a way analogical to how computers render the contents of their memory by means of memory (core) dumps, which then may be negotiated if the dumped contents differ between participants. Even the most experienced scientists articulating a common conception can be seen repeatedly writing and erasing until an inscription takes its final form (e.g. Roth 2015). Instead, everything pertinent is articulated graphically, gesturally, and verbally and, therefore, exists materially for oneself and for the other *in and as* the expression. There is not first design thinking and then design communicating, but there is a unit of design [thinking | communicating] that develops (Jornet and Roth in press).

It is precisely because of this materiality that software and software design exist for others, inherently (rather than incidentally, tied to the presence of two or more people) is social. Materiality is the condition for nature of software design as shared phenomenon. External means social. If it were not external, it would not exist as what we know software design to be. Software design is social through and through. It is not so much that there is a design, lodged in the heads or anywhere else, and partially represented in material form, to be negotiated by the participants. Instead, we observe ‘doing [designing a simplest editor],’ where the bracketed part is the members’ gloss that describes the work ‘doing’ (Garfinkel and Sacks 1986). That work is utterly social. It is so not because there are two or three individuals involved, which is only a trivial notion of the term (Roth 2016). Rather, the work is social in the strong sense because everything that the participants do, they do it in ways that make it visible to others the aspects of the context to which they attend, and therefore of the production of the context that specifies what they do.

As soon as we consider the design as consisting of the production of fluid thing, it no longer involves self-identical things. This is so because the smallest category capturing a flowing design contains inner contradictions: in fluids, for example, the smallest unit that

retains the quality of flow contains pressure differences. The answers to the question, ‘What is the pressure?’ will include incompatible statements. In a similar way, the question ‘what is the design’ will elicit different statements, including incompatible ones. These different statements constitute the social relationship: ‘the two parties to the interaction [are] two eyes, each giving a monocular view of what goes on and, together, giving a binocular view in depth’ (Bateson 1979, p. 133). In dialectical logic, the differences are due to the thing in flux rather than to the different positions (subjectivities) of the investigators (e.g. Bakhtin 1993; Il’enkov 1977; Vološinov 1930). This also allows us to understand that the same phrase on the whiteboard has very different functions in different contexts featuring the same speaker, such as when the same phrase marks human subjects, their activities, the object of these activities, or their goals.

Our analyses show that the nature of what a participant says or does is not just a function of the individual. Instead, any speaker or agent finds out from the reactions of one or more others what he has said or done (e.g. Bateson 1996). That is, speaker and agent are changed not only in their speaking and doing but also in the reception of the effects they have brought about. The words and actions cannot be understood as causes that have changed design and context, but they are themselves changed—as soon as we take a dynamic perspective. This is why a fluid ontology may be not only a viable but also a more interesting program for design research, for, just as design, fluid things change and are changed. The traditional cause–effect thinking—which has been subject to critique for its lack of correspondence with reality (e.g. Il’enkov 1977; Mikhailov 2004; Nietzsche 1954)—is thrown off balance. Similarly, in a fluid ontology, the opposition between self-contained objects and self-contained bodies does no longer hold (e.g. Dewey and Bentley 1949/1999), the metaphors of correspondence and reverberation being more adequate in accounting for the role of materials in cooperative design.

Theorizing the social by means of (solid) objects returns us to Cartesianism, which divides the mind from the body, which makes it possible to have different subjectivities each making its own interpretation of the same material body. When we think social situations such as cooperative design work as composed of individual subjects and objects that are external to each other (philosophers term this *partes extra partes*), the surface of the (object’s, subject’s) bodies being a boundary, then (a) mediators are required to fuse individuals into a social and (b) mind is of a different kind, a different substance than material (Mikhailov 2001). In our analyses, however, the individual and the social are not two things, not two sides of the same coin. Instead, the individual and social exist together, each being part of the condition of the other and thereby co-implication one another. Each segment in the communicative event, including the diverse materials external to the participants’ bodies, is social and, therefore, in common and *in-between* (as opposed to between). If it were not so, no communication could occur. Even when the intelligibility of some expression were to be challenged, whatever has been said, done, or visible already is recognized as a communicative intent, that is, an attempted articulation of something. Thus, when Scott orients his gaze towards the ceiling in the way people do when they do not follow someone else’s talk, his subsequent move to the whiteboard and his attempt at articulating what he has heard shows that he did treat Jeremy’s action as a move in a design game. Whatever the design at that instant,

it is fluid, without definite shape, but nevertheless material and, therefore, external and social.

The design things constitute aspects of a larger world in which the participants move about, point and refer to, or gesture over. They are known in the ways and through they relate to everything else apparent to and presupposed by consciousness: the thing-totality (Heidegger 1977), the language-game (language + activity) (Wittgenstein 1953/1997), or culturally and historically contingent societal activity (Leont'ev 1978). These things, including the sound-words produced in the course of activity, establish the common world in which participants know their way around. In discussions concerning the philosophy of language, there have been suggestions that we need to abandon the traditional conception of language as a code with an associated grammar, where individuals participating in an exchange have to engage in interpretation to derive the intended meanings of the speaker (Davidson 1986; Rorty 1989). Instead, knowing a language—i.e., having the ability to speak intelligibly and to hear/understand what others say—is similar to knowing one's way around the inhabited world. That is, to know a language is equivalent to knowing one's way around the world. In our analyses we therefore observe how the work of producing and sustaining a design object (a simplest editor) as an accountable feature of the design setting also and at the same time involves a shift in the participants' bodily and perceptual orientations to each other, which in our analyses have traced in terms of a distributed memory. This further testifies to the fluid nature of design, as it is in and through changing design praxis that all possibly detachable things (objects, persons) change. Paraphrasing Marx and Engels (1978) in their analysis of human phylogenesis, we might therefore say: as designers express themselves, so they are.

6. Coda

In this study, and drawing from descriptions and analyses of episodes from design in agile software development, we exemplify a fluid ontology and social topology. The case we make is analogous to the shift between viewing language as (a) a system with (relatively) stable word meanings and grammar and (b) a living phenomenon that changes every time someone speaks, writes, reads, or hears (e.g., Bakhtin 1984). Language as a living phenomenon explains the changes in literary genres, whereas viewing language-as-system does not. The first, object centered view still has value in that it provides something a snapshot, something like a photograph; but, like a photograph, it falls short in that it cannot provide an explanation why the object continuously changes. The ontology we articulate here may be particularly relevant with respect to agile software development, which involves continuous discontinuity, with designers and design materials constantly shifting, and yet leading to one single design object. At the same time, that object itself is conceived as alive and continuously changing, thus allowing us to understand any one of its current states in the context of a life cycle.

A fluid ontology has implications beyond extreme programming and agile software development in that it contributes to the efforts of developing a theoretical approach for the social sciences more generally. Thus, as soon as we begin thinking about design as something living, with a course of life from birth to death, we no longer speak about users as using designs in unintended ways, or as interpreting the designs in ways that

differ from the intentions of the designers. Instead, designs are living things not only in agile software development and extreme programming, where they adapt to the contingencies of relevant local situations, whether these are the development offices, the manufacturing sites, or the places where they are used. Fluid ontology and fluid social topology allow us to think of the end of the life of a design, and the implications that this has for recycling or disposal. A design no longer is a ‘thing in-itself [*Ding an sich*]’ separate from and independent of its different appearances in consciousness (Kant 1956) but it is a living, thus fluid cultural phenomenon whose history is entwined with the history of material culture writ large. Moreover, thinking the social world using a fluid ontology and topology allows us to overcome the Cartesian dualism, which, in considering human beings as special objects external to and impenetrable by each other (i.e., as *partes extra partes*), also separates body and mind, and makes intersubjectivity the problem (Mikhailov 2001). In a fluid topology, things exist *in-between*, are simultaneously real for all those in social exchange. They are constitutive parts of the intra-intersubjective⁷ world that we inhabit.

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⁷ Dewey and Bentley (1949/1999, p. 138) also use the adjective ‘intra-organic transactional.’

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Appendix A: Transcription conventions

The transcription conventions are those of standard conversation analysis (Jefferson 2004). All words are written using small letters (unless exception noted below); they are run together when the corresponding sound wave is.

<i>Notation</i>	<i>Description</i>
(0.4)	Time without talk, in tenth of seconds
(.)	Period in parentheses marks hearable pause shorter than 0.1 seconds
((turns))	Verbs and descriptions in double parentheses are transcriber's comments
flip it you have to flip	Square brackets indicate overlapping talk
[so flip it]	Grey highlighted text within square brackets indicates the extent of the gesture seen in the offprint presented to the right
*	The asterisk marks a gesture, movement, or sound subsequently described where there is space in the transcription
[a]	Small letter in square brackets refers to offprint presented to the right
°y'know°	Degree signs enclose words spoken with less than normal intensity
°°possibly°°	Double degree signs mark speech almost impossible to hear
jUST	Capital letters were spoken with louder than normal intensity
<i>fairly deep</i>	Italicised letters indicate emphases, stress
:	Colons indicate lengthening of phoneme, about 1/10 of a second per colon
>i look at the<	Angular brackets inward mark faster than normal speech
<what happens>	Angular brackets outward mark slower than normal speech
(?)	Missing words, one word per question mark
(stash?)	Word followed by question mark indicates uncertain hearing
.hh	Noticeable in-breath
hh	Noticeable out-breadth
-,?;.	Punctuation is used to mark movement of pitch (intonation) toward end of utterance, flat, slightly and strongly upward, and slightly and strongly downward, respectively
=	Equal sign indicates that the phonemes of different words are not clearly separated, or latching by a second speaker
↑	Significant jump upward of pitch

[Click here to view linked References](#)**Episode 1**

01 J: so with nested objects (0.5)
>(see=its?) [a] < (1.5) flip this
[b] housing'n'this other object
that has its own little
representation ((3 beats around
[b])) (0.2) gear (1.4) °when
this°



base (0.3) ((quick movement with sudden stop at [c]))
[°this this] (0.7) emBEDded object (0.5) updates
[*] *((3 rH beat gestures, [c]))
(1.8)
[↑ ITup ↓ da:tes]
((beat, [c]))
(1.8)



but (0.5) °it needs te° ((lH beat with
configuration [d])) tell its parent
[t up] date because its parent ((beat))
[*] *((movement from [d] to [e]))
((S gaze into the distance, as if
questioning)) is ((gaze back to J))
actually whats



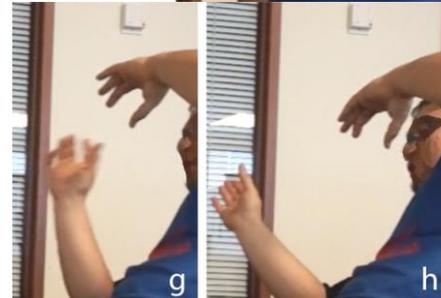
→ [draw] ing=on [f] (0.6) on the main ((3 beats))
02 S: [*] *((S turns gaze towards tablet, nods twice))
canvas= [so
((S begins to write))

03 (0.6)

04 J: now so its parent needs to sign off for the next render



05 [(0.9)]
06 S: ((nods))
07 J: [so (0.3)] this GUY ((beat, similar to [c]))
changes its=positi'n in calls (1.0) so (0.2)
whatyeDO=thenis s'when the parent
((beat, [g])) owns=the CHILd ((rH beat,
[h])) (0.5) that has a render ((rH beat))
(0.3) °method and this guy's=((lH
beat))=a=render=



=method° [i] (2.7) um (1.6) it [i] (0.6)
 changes this ((rH beat, [j])) render self
 (1.5) so that (.) this ((rH beat)) render
 self (0.8) calls ((lH index to rH, similar
 to [i])) (0.5) this render self so basically
 (0.4) this guy ((rH beat, similar to [j])
 says render; (0.3) it ((lH index to rH, as
 in [i]))



makes sure that this guy ((lH beat on rH, configuration similar to [i])) renders
 too (0.3) so (0.4) paren (0.4) >wh'tevr< th' child ((lH beat, as in [c]))
 renders. (0.3) d'paren ((rH beat, configuration as in [h])) (0.4)

08 S:

ties
*

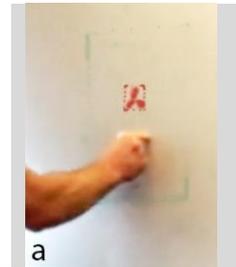
into
*((two nods))
((turns head towards tablet))

09 J: that render also °renders itself for° does the CHILd render (.) °what the parent
 renders° (0.3) but (0.1) >anyway< (0.2) u:m (0.1) i can show you some code
 structure cause's pretty abstract to

10 S: yea

[Click here to view linked References](#)**Episode 2**

01 S: >you=kind'a=go * ((hits WB)) that'd be thiss ((circular gesture over the top of large rectangle)) the canvas



g [o oh (0.2)]
* ((* hits WB, rotates hand))
>something's=starting=t=rotate< ((gaze towards J))

02 (0.7)

03 J: ((nods))

04 S: ((gaze back to "canvas")) >ya=know< u:m o::r
(0.2) when you touch <down>; (0.4)

((touches down on canvas)) >you c'n gotta go touch down<>>y'kn<< do
your hit test first, ((IH to "hit test what is being rotated," Fig. 1))
((gaze to J, where it stays to turn 10))

05 (0.3)

06 J: ((J nods))

07 S: >wha okay whats on it<

08 J: ((3 head nods by J)) [yea]

09 S: [then it] says ooh rotation started, (0.5)

>you=know em<

10 (0.2) ((gaze to WB))

11 J: yea right [hads thads] this's (.) °w° >similar t'what i [have in]

12 S: [°yea yea°] [°yea°]

((S nods))

13 J the [in thiss (0.3)] does this object

14 S: [*] *((draws arrow tail to tip, [c]))

15 J: that you [have] selected support rotate

16 S: [um] [*] *((S nods, rH beat gesture))

17 (0.6)

18 S: yea ((gaze to J))

19 (0.3)

20 J: b'cause da back [ground will] probably [would] support rotate

21 S: [>>background<<] [sure] [*] *((S turns to WB))

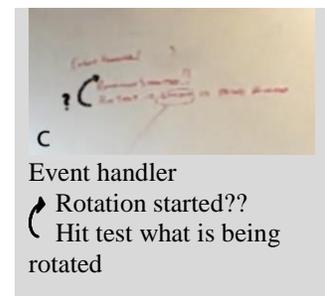
(0.3)

22 S: u h [hm] ((S nods))

23 J: [um] (.) and so thats were sort of like [the] sticker mana [ger,

24 S: [sure] [yea] [((S nods))]

25 (0.6)



- 26 J: would say [0.2) you got a sticker,
((orients to writing on the board below "hit test"))
- 27 (1.4)
- 28 J: yes ((nods))
- 29 S: [(0.9) uh (1.7) rotating so n second finger gets put down
((writes something small, irrecoverable from records))
((nods))
((tape ends, with break before the next one starts))



[Click here to view linked References](#)**Episode 3**

- 01 J: it disables all the a (0.4) gestures until something gets a touch * * ((*sound of fingers hitting WB surface 2x*))
- 02 $\left[\begin{array}{c} (1.1) \\ (0.2) \text{ (DB)} (0.8) \end{array} \right]$ ((*J knocks against the whiteboard*))
- 03 S: kay
- 04 (0.5)
- 05 J: so (0.2) >when we get< (0.1) a; touch ((*touches WB surface*)) (0.4) u (0.2) >thenit< regis ter:rs it=a: thenit (0.2) then it knows=what target=ob ject it is
- 06 S: ((*S nods*))
- 07 J: (0.5) °an° so=it igno:res (0.5) >all=the=other< target=ob jects (0.7) that have (0.3) event list'n'rs to them [a]
- 08 S: ((*S nods*))
- 09 (1.6)
- 10 [b] >andthenits< [c] (((*moves thumb as if operating something*))) 0.6) anifit has=a (0.1) ges(.)ture [b] (0.4) tached to=it ((*moving thumb, looks at it, as [b]*)) ((*gaze away back towards S, [c]*)) an waits for the second $\left[\begin{array}{c} \text{touch} \\ * \\ * \end{array} \right]$ ((*gaze towards S,*)) * ((*thumb touches surface hearably*))
- 12 S: $\left[\begin{array}{c} ((S \text{ nods } 2x)) \\ (0.8) \end{array} \right]$
- 13 J: >andthen'I'll< start the $\left[\begin{array}{c} \text{gesture} \\ * \end{array} \right]$ * ((*2x thumb movement*))
- 14 S: ((*S nods 2x*)) (0.2) °ka $\left[\begin{array}{c} y^\circ \\ \text{or} \end{array} \right]$ ((*gaze to board*)) >otherwise it hasn't mo:ved< [d °and° ((*gaze to S, e*))
- 15 J: $\left[\begin{array}{c} y^\circ \\ \text{or} \end{array} \right]$ ((*gaze to board*)) >otherwise it hasn't mo:ved< [d °and° ((*gaze to S, e*))
- 16 S: ((*S nods*))
- 17 J: touched and (0.2) as you touch ((*rH finger touches down*))
- 18 S: ((*S nods 3x, very slightly*))
- 19 J: down [f] (0.3) ((*gaze to WB, g*)) >sowhenyoumove< [h] (0.4) ((*moves hand across WB, S watches*)) <it> ((*gaze to S*))
- $\left[\begin{array}{c} \text{registers that motion} \\ * \end{array} \right]$ and it unregisters that motion. * ((*hand moves diagonally back and forth, gaze to WB*))

