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Gesture and imagination

On the constitution and uses of phantasms

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This study examines the role of gesture in collective imagining, the embodied process of bringing objects and events into quasi-presence during social interaction. Drawing on the phenomenological tradition, we argue in favor of an alternative to the gestures-as-simulated-action account proposed by Hostetter and Alibali (2008). Specifically, we suggest viewing gestures as key constituents of *phantasms*, quasi-present objects that are produced through multi-modal utterances. This perspective highlights the ways in which gestures mark profound transformations of participants' experiential histories, transformations that open up, for the speakers, new insights into the matters they strive to imagine. The study of these insights led us to emphasize not the simulative, but the creative roles of gestures. Our account of gesture in collective imagining is illustrated by a microanalysis of an episode from an interview with a mother-child dyad following their interaction with a mathematics exhibit in a science center.

Keywords: gesture, simulation theory, imagination, embodiment, mathematics education

Introduction

This paper explores the role of representational gesture in collective imagining, the social-interactive process of bringing objects and events into quasi-presence. We present a critique and theoretical alternative to recent simulation accounts of representational gesture by drawing on findings from a micro-ethnographic case analysis and on insights from the phenomenological tradition in philosophy. Our argument makes selective use of elements from this tradition and contributes to recent re-conceptualizations of imagination stemming from embodied, situated, and distributed theories of cognition. We then discuss research on representational gestures and their role in processes of imagining, providing both a critique

of the gestures-as-simulated-action theory put forward by Hostetter and Alibali (2008) as well as our own positive alternative account based on our ethnographic case study.

Imagination reimagined

For the purposes of our discussion here, we define collective imagining as the social-interactive experience of bringing to presence something which is absent in the current surroundings of the participants (Casey, 1979; Sartre, 2004). What we mean by *quasi-presence* is that, while the imaginers are aware that the events, bodies, objects, or signs they imagine are not “actually” around them, they act as if, in some incomplete ways, they are. This definition, like all the definitions offered in this paper, is a pointer to the type of everyday experiences to which we refer (i.e., quasi-presence), to the type of literature that analyzes it as such (i.e., phenomenology), and calls for examples on which we will later elaborate. Our conceptualization of imagining as an embodied, social process aligns itself with recent efforts to overturn the widespread and longstanding notion that imagination is based on mental representations. Specifically, scholars working in terms of embodied, situated, and distributed theories of cognition are drawing on close analyses of multimodal interactions in a variety of settings in order to argue that the processes and objects of imagination are distributed across persons, material artifacts, and embodied action (Alač, 2005, 2008; Alač & Hutchins, 2004; Alby & Zuccheromaglio, 2007, 2008; Hutchins, 2010; Murphy, 2004, 2005; Nemirovsky & Ferrara, 2009). In contrast to age-old ideas of imagining as a solitary, mentalistic affair and attendant rigid distinctions between the real and the imaginary, findings from these studies highlight that imagining is (a) a purposeful and socio-materially mediated process, (b) distributed across multiple, mutually elaborating elements of a semiotic ecology, (c) can be collaborative as participants respond to, build on, anticipate, or critique one another’s contributions, and (d) is intimately rooted in possibilities for perceptuomotor engagement with both real and imagined objects or events. Together, these findings motivate, *inter alia*, greater analytic attention to gesture’s participation in processes of imagining than might be given by more mentalist accounts of this phenomenon.

Our study aims to further this project by emphasizing the *experiential* or *lived* aspects of processes of collective imagining. In other words, taking as a starting point that imagination is not confined to an inner mental realm but is rather achieved through processes of multimodal interaction, we ask about the nature of participants’ lived experiences as they engage in collaborative acts of bringing something into quasi-presence. In order to approach this question, we focus on

the role of representational gesture in collective imagining. The next section is a brief review of literature interrelating gestures and imagination.

Representational gesture and imagination

It is a common observation that gesturing is pervasive when people imagine collectively, a phenomenon that has led to the design of many gesture studies based on contexts in which actors are asked to imagine jointly. Several of McNeill's classic studies are based on the examination of gestures by storytellers narrating to someone else a cartoon or movie they had just watched (Kita & Özyürek, 2003; McNeill, 1992). Kita (2003) studied people giving directions to unseen destinations. LeBaron and Streeck (2000) analyzed a conversation between two Japanese speakers telling each other about car accidents they had been involved in. In many circumstances imaginers incorporate props, tools, signs, models, and other "material anchors" (Hutchins, 2005) to their gesturing; two examples of teachers using material anchors to physically highlight aspects of imaginary uses and entities are included in LeBaron and Streeck (2000).

Many of the gestures that participate in imagining are identified as 'iconic' or 'representational', which, in the words of Streeck (2008, p. 285), are the ones that "make pictures": iconic gestures seem to depict something. In semiotics the word 'icon' is often defined as a sign that displays a likeness or similarity to its referent. Streeck (2008), espousing Goodman's (1968) critique of this definition, proposes that icons are not mirror images but interpretations: "the [iconic] gesture *is not* like its referent, but rather shows *what the referent is like*" (p. 286; italics in the original). Kendon (2004) characterizes three types of representational gestures: modeling, pantomime, and depiction. Modeling is the gesture in which a body part is used as a model of an object; for instance, people in the Boston area often display Cape Cod with an arm bent at the elbow and the wrist, using the other hand to point out locations in Cape Cod. To realize why speakers find this modeling informative, it is enough to see Figure 1 with the image of Cape Cod.

Pantomime gestures enact aspects of a pattern of action they refer to, such as when someone asks for a pen by enacting a writing hand. Depiction gestures appear to draw, sketch, or sculpt an object; they are "recognized as 'creating' an object in the air" (Kendon, 2004, p. 160).

Streeck (2008) views gestural depictions as "evocations by minimal means" (p. 297) of multiple practices that are familiar to the speakers; these practices include, among others, drawing, making things, transporting, and handling:

... we show each other things by holding, molding, making, or handling them *into being*. Gestures render them into the common imagination. And, as we



Figure 1. Image of Cape Cod. Adapted from a public domain image obtained from http://commons.wikimedia.org/wiki/File:Cape_Cod_-_Landsat_7.jpg. Accessed October 29, 2012.

make things appear, we put them in relation to other things. Gestural depiction is grounded, then, not in visual resemblance, but in the everyday interpenetrations of actions and things. (Streeck, 2008, p. 298; *italics in the original*)

Given that iconic gestures synthesize or bring together, in a minimalist manner, a broad range of heterogeneous practices, the issue that we take up is the nature of such synthesis: How do all these elements coalesce together in a stream of gestures to render things “into the common imagination”?

Hostetter and Alibali (2008) have addressed this question, suggesting that representational gestures simulate actions. They draw on results from gesture studies, experimental psychology, and neuroscience in support of the gestures-as-simulated-action framework. We find much in common with this framework, especially its drawing on embodied cognition and the portrayal of gestures as motor activities whose inhibition demands additional effort. However, we believe that invoking a process of simulated action is unhelpful. We make the case for this objection on two grounds. First, simulation tends to elicit the notion that through gestures we perform an abbreviated or impoverished replica of actual actions; in contrast our ethnographic case studies have led us to conclude that gestures enact profound *transformations* and often *enrichments* of actual action. Second, because gesturing encompasses both motor *and perceptual* activity, and given that the notion of simulated perception is closely related to the one of mental image, a simulated action framework is ambiguous with respect to the tenets of mentalism: fundamental questions about the nature of mental images remain unaddressed by the simulation framework (e.g., is the mind “watching” such simulation?). Hostetter and Alibali (2008) base much of their simulation framework on the evidence provided by numerous results from neuroscience and experimental psychology indicating a neuronal and behavioral overlap between imagining the perception or

the doing of something, and perceiving or doing it. However, we do not think that this neural overlap necessarily translates into a simulation account. A neuronal and behavioral overlap neither excludes fundamental transformations between the imaginary event and the actual perceptuomotor event, nor shows that the imaginary event is a mental version of the actual perceived by the mind's eye.

It seems to us that for the most part we do not imagine in order to simulate actions, but to inhabit a world that transcends our material surroundings, to bring the absent into quasi-presence, including that which is absent because it does not exist. Inhabiting or dwelling in worlds that merge and cross boundaries between real and fictional, reasonable and absurd, recollection and innovation, we experience unexpected possibilities that pervade everyday life. In the next section we elaborate on these ideas.

Imagining and the constitution of phantasms

In this section we draw on the phenomenological writings of Husserl to describe the notion that representational gestures help constitute for the participants what we call *phantasms*. We elaborate on Husserl's work because our own study of some of his writings inspired in us some of the key ideas for our proposed framework for interrelating imagination and gesture. Here we attempt to articulate our own interpretation and elaboration of some of his ideas that were particularly instrumental to the development of this paper.

We think of Husserl's philosophical trajectory as a lifelong struggle to grasp the nature of intentionality. Consciousness, by virtue of being consciousness of something, is intentional; in other words, every moment of consciousness intends something. Husserl proposed in many texts and using changing vocabularies, that intentionality constitutes an ongoing correlation between two "poles" of consciousness: act pole and object pole. These two "poles" of consciousness coexist and echo each other. The color and shape of a platter, for example, may be attributes of the platter's object pole, but the acts performed to perceive and make use of it — the act pole — may include turning one's gaze toward the platter, becoming ready or predisposed to see certain colors, extending our hands to grab it, saying that it is of such and such color, and so on. Perceiving an ashtray, to pick up one of Husserl's examples, entails an act pole that may engage my gaze and eye motion, my smelling in different directions, my urge to drop smoke ashes somewhere appropriate, my desire for cleanliness, or the motion of my hand to grab it. On the other hand, in the course of such a complex act, the object pole gets constituted as well: that small ashtray, full of extinguished cigarettes, familiar, in need of being emptied, and so on. In his later writings, Husserl used the word "noesis" to refer to the act pole, and "noema" to the object pole. Each aspect or trait of the noema (i.e.,

object pole) correlates with certain components of the noesis (i.e., act pole) and vice versa; for instance, perceiving that the ashtray needs to be emptied, which is a noematic feature, might correlate with my noesis element of reaching it to drop its contents inside a box under the desk. Note that the object pole is not equivalent to the ashtray as a physical object standing on the table. What we usually intend as “physical object” or the “object in itself” is a thing that we constitute as a detached observer of properties (e.g., that white object with circular shape made out of ceramics); an object as-such is for the most part a noema that we experience in this kind of detached observation, which is one among many other possible intentionalities we may experience, such as the one embedding our recognition that the ashtray needs to be cleaned.

Correlations between acts and objects can be of many types, such as perceptions, recollections, imaginations, and so on. The ashtray that I remember or the one I’d like to have are distinct noemas correlated with differing noetic components, e.g., the ashtray I’d like to have might correlate with the act of drawing it on paper. Perceptions are primary because they constitute points of reference to study all other act-object correlations. Husserl emphasized that in perception the object is only partially given: visible from this or that side, kept in the closet or thrown in the garbage, within reach or out of reach, and so forth. A perceptual object is never known absolutely, it remains forever open to hitherto unrealized possibilities and features. At the same time, we normally examine something from different sides and conditions (e.g., low and high intensity of light) with a strong experiential sense that in spite of all the differences that we perceive, they all describe “the same thing”. The thing that we perceive is, as Husserl was prone to say, “an X”, a variable-like unknown that remains the same X, regardless of its countless particular appearances. One aspect of the constitution of the “same X” is body motion or kinesthesia: the object seen from here is the same as the one seen from there, in part, because if I moved there I would see it again as I have seen it over there (Gibson, 1979; Noë, 2004). In other words, perceptual differences can be neutralized or cancelled by kinesthesia.

How can we conceptualize the act-object correlations in the case of imagination? The question is extremely complex, if for no other reason, because we imagine all kinds of events or things in extraordinarily diverse circumstances. Consider one of the many examples Husserl elaborated on:

If I am imagining a centaur I cannot help but imagine it as in a certain orientation and in a particular relation to my sense organs: it is “to the right” of me; it is “approaching” me or “moving away;” it is “revolving,” turning toward or away from “me” — from me, i.e. from my Body, from my eye, which is directed at it. (Husserl, 2005, p. 62)

What are the noesis and noema for this act of imagining a centaur? We can infer that this noesis entails bodily activities, such as organ displacement and tuning (e.g., moving one's eyes, focusing them at different distances, even with the eyes closed); emotional expressions (e.g., facial expressions associated with being surprised or threatened); and being primed to different perceptual qualities (e.g., being primed or 'ready' to see white if the imagined centaur is white). With regard to the correlated noema, Husserl called it a "phantasm"; his centaur, like all other *imaginary* noema or object-pole, was a phantasm. If perception were to be taken as a point of reference, we might ask: How is, say, a horse that we see in front of us different from a centaur we imagine? Aside from the obvious anatomical differences between horses and centaurs, it is relatively straightforward to point out qualities that the phantasm lacks. For instance, as opposed to the visible horse, the centaur is not there "in person"; the centaur is experienced "as it were", the centaur might be blurred and under-defined, or, alternately, precise and detailed, and so forth. This line of analysis tends to highlight what a phantasm is not, which conveys the sense that ultimately a phantasm is a nothingness:

In relation to sensations, phantasms are like nullities. They are unreal. They are taken to be nothing by themselves (...). But a great difficulty arises here. The evidence of the *cogitatio* certainly teaches me that phantasies, and, accordingly, phantasms as well, are actual lived experiences. (Husserl, 2005, p. 84)

In other words, phantasms, being actual lived experiences, must have positive qualities that distinguish them from nothingness. We attempt to address this issue — the positive qualities of phantasms — by invoking the notion of *emptiness*. A cup defines an interior that has a certain shape, location, and potential to be filled up by certain substances and not others (e.g., hot water can melt the cup). The emptiness of a cup is not a self-standing object "in person"; it is a being derivative from the cup, but it has noematic features correlated with noetic ones. For example, my thirst and hand motion grabbing the cup to fill it up with water are correlated with noticing the emptiness of the cup. It is clear that emptiness is not to be identified with nothingness. The emptiness of a cup has particular features and potentials correlated with numerous traits of one's act-poles. Emptiness, as we understand it, is a type of intentionality, not a self-contained material fact "out-there". One can intend the emptiness of a certain cup regardless of whether it happens to be full of water, sand, or whatever. One can look at a drawer full of stuff, striving to assess whether its emptiness might be suitable for something else. Or we can, as we often do, try to imagine how a room would look without a piece of furniture currently there. The piece of furniture is crucial to envision its correlated emptiness that might be going to be occupied by something else or not. Our perception of the piece of furniture provides a sense of the shape, volume, emphasis,

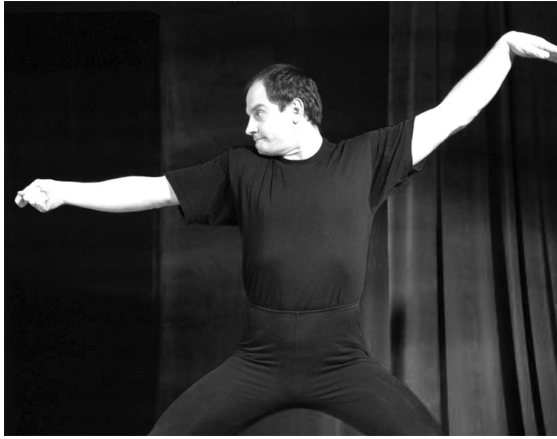


Figure 2. Sword phantasm. Public domain image obtained from http://commons.wikimedia.org/wiki/File:2007_FoC,_Ireneusz_Krosny_001.jpg. Accessed November 3, 2012.

and luminosity of its emptiness, which is sometimes something quite difficult to achieve, leading to common experiences of surprise after the piece of furniture in question has been removed.

If we are to describe phantasms as emptiness, the example of the cup prompts us to ask: What plays the role of the cup or the piece of furniture in the case of a phantasm? Our response: the body. Living bodies are uniquely capable of generating the kind of emptiness that we experience as phantasms. For example, pantomime is a type of public performance that involves the constitution of phantasms as “actual lived experiences” for the mime and his audience. In Figure 2 a mime is holding a sword phantasm as if ready for combat. Note the multiple strands of bodily activity that participate in his miming: gaze, arm and hand motion, finger motion, breathing, posture, facial expression, stance, and so forth.

His active body creates an emptiness around him that seems suitable for containing a sword in different states. The absence of a perceptually present sword does not preclude us from noticing an as-if presence indirectly manifested by his body, an experience that we commonly call imagining. Artistic pantomime is a special case because the mime works to constitute the phantasm with a degree of detail, explicitness, and emotional infusion that is not characteristic of the great majority of situations in which we imagine. Nevertheless, while overtly larger-than-life, some of the qualities of pantomime are inherent in the everyday constitution of phantasms: bodily creation of an emptiness infused with emotional values and woven in the flow of lived time.

Gestures, when they participate in the experiential constitution of the imaginary, create an emptiness where the intended imaginary dwells; this emptiness is *not* nothingness because it is bursting with intended traits, such as shape, color,

beauty, smell, opacity, and so on, which are derivative from the actions of the speaker (i.e., moving hands, facial expressions, etc.). Constituting the imaginary entails bringing to quasi-presence what is not there. When, for example a speaker makes a “gun” gesture with extended index finger and thumb the speaker constitutes an emptiness with certain features (e.g., shape, weight, threat, humor) that perhaps could be occupied, although it is not, by a gun. It is crucial for the speaker and his listeners that there is no gun there, just an emptiness with some of the qualities of a gun, which is what makes everyone aware that they are imagining. Often we imagine without overt bodily activity: a relatively quiet body may experience rich and complex phantasms while preventing its emptiness-generating activities from reaching the periphery of the nervous system.

In what follows, we further articulate this account of representational gesture through the development of a micro-analytic case study. We first describe our methods of data collection and analysis. We then illustrate and further elaborate on the notion of phantasms with a case study from an interview with a mother-child dyad following their interaction with a mathematics exhibit in a science center. The case study is organized in three sections. The first analysis section details an instance of what we describe as the gestural constitution of a phantasm during a process of collective imagining. In the second section, we selectively draw on notions inspired by cubist painting to further elaborate on how gesturally-produced phantasms mark profound transformations — not mere simulations — of participants’ histories of perceptuomotor activity. In the third section, we explore how gesturally constituted phantasms and their transformative qualities can form the basis for novel insight.

Methodology

Data collection

As part of a larger research project related to learning mathematics in informal environments, visitors to a science center were observed while they interacted with a mathematics exhibit called *Drawing in Motion*. *Drawing in Motion* is an interactive exhibit that requires the collaboration of two visitors. Each visitor controls the motion of a handle along a 3-foot linear scale, corresponding to a graphical vertical or horizontal axis (see Figure 3).

A large LCD screen displays a cursor controlled by the two handles that determine their x and y coordinates. The two participants jointly draw on the screen by moving the handles. The exhibit includes three challenges as well as a free drawing mode. In all modes, the graphical display includes a vertical and horizontal line

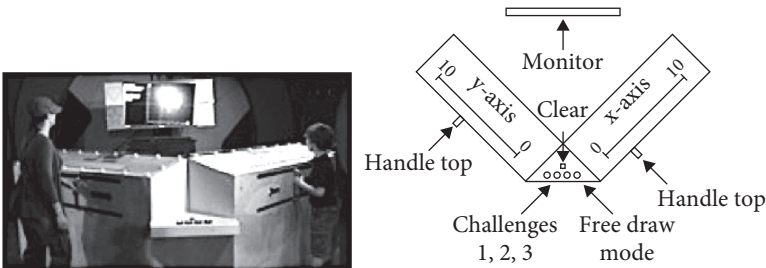


Figure 3 Image and diagram of *Drawing in Motion*.

through the point represented by the cursor; these lines move as the cursor moves and aid in ascertaining the x - and y - coordinates of the cursor (see Figure 4).

Drawing in Motion was installed in a secluded area of a science center, to which only research staff and study participants had access. Data were collected from 17 different visitor groups, including both adult participants and children as young as 5 years old. While some visitor groups included only adults, other groups consisted of a child-parent dyad or sibling pairs accompanied by parents. Each visitor group was invited to engage with *Drawing in Motion* for as long as they liked, with exhibit experiences ranging from 4 to 23 minutes long. Following their exhibit experiences, visitor groups collectively participated in an informal stimulated-recall interview with one of the researchers. Interviews were video-recorded and ranged from 8 to 23 minutes long. All participants provided informed consent and assent

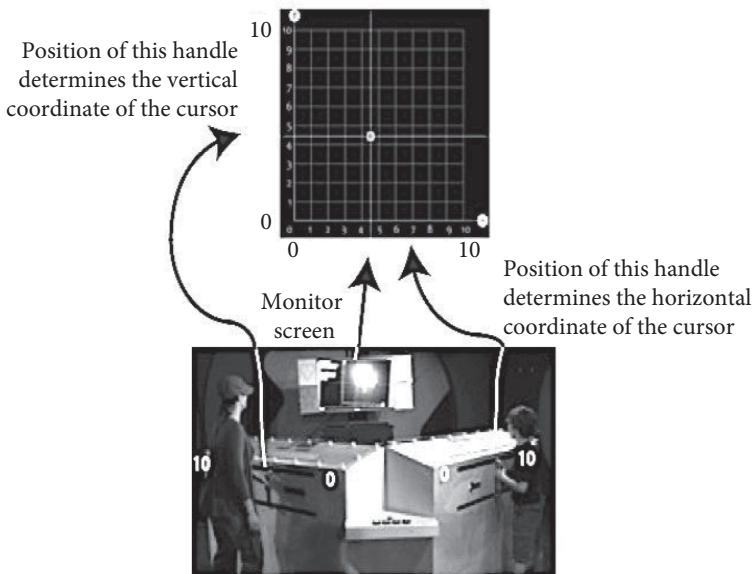


Figure 4. *Drawing in Motion* screen without drawing in free drawing mode.

where appropriate, and all data collection and analyses were done in compliance with IRB requirements.

The research team collected a video screen capture of everything displayed on the LCD-monitor of the exhibit throughout the visitors' entire engagement with the exhibit. The video screen capture was made available throughout the subsequent interview, and much of the interview consisted of stimulated recall using the video screen capture. Participants were asked to offer explanations for the appearances of their various graphical productions, as well as to reenact or describe the necessary handle movements to reproduce them or to create novel graphical images.

In the following microanalysis, a boy we call Silas (age 8), and his mother we call Janene, attempt to explain the necessary handle movements and the corresponding speeds required to produce a circle with *Drawing in Motion*. We selected this episode because the mathematics of drawing a circle with the exhibit are non-trivial, and because the episode was marked by the frequent production of highly complex co-speech gestures.

Data analysis

The overarching methodology for this study derives from microethnography, a collection of techniques that focus on the fine-grained analysis of bodily and situated activity. Microethnographic techniques may trace, inter alia: talk, gesture, facial expression, body posture, inscription, tool use, pace, and gaze (Erickson, 1996, 2004; Goodwin, 2003; Hall & Stevens, 1995; Stivers & Sidnell, 2005; Streeck & Mehus, 2005). We appeal to Husserl's (1991/1893–1917) phenomenological framework for experiential time in order to further detail the kind of microethnographic approach taken in this study. According to Husserl, all temporal experiences are extended or have duration — for example, the experience of hearing a particular melody — consisting of an ongoing flux of *retentions*, *now phases*, and *protentions*. For instance, Husserl observes that the perception of a single note in a melody is constituted by (a) the presently sounding tone, (b) the retention of prior notes, and (c) the protention, or anticipation, of notes that are about to sound.

Our analytic method produces a rich phenomenological interpretation of participants' unfolding experiences through the careful construction of a detailed account of this ongoing flux of retentions and protentions as they unfold over the course of a small period of time. Thus, our account of the following episode is based on utterance-by-utterance scrutiny geared towards inferring shifts in the ongoing evolution of retentions and protentions. For example, the performance of a gesture or the shift of eye gaze were considered evidence of a noteworthy change in a participant's experiential present. While it is the case that we examine in detail the events that take place within the period elapsed by a single gesture

or utterance, this micro-examination is always conducted in light of the gesture/utterance it is part of. Based on this fine-grained scrutiny we develop possible descriptions of the retentions and protentions constituting that particular experiential present for the participant.

In our view, a micro-ethnographic approach is not antithetical to the examination of events along “macro” timescales because there are no fixed correspondences between certain timescales and the possibility of contextual understanding. For instance, one may be very familiar with the life history of someone over decades and yet, not be able to make sense of a particular utterance he or she produced in interaction with others at a certain time. Utterances have their own local contexts that incorporate many slices of life and culture across years, centuries, and beyond (e.g., Janene is the mother of Silas, they speak English, the exhibit uses Cartesian graphs, they are at a science museum, and so forth). The slices of life and culture incorporated by Silas’ and Janene’s utterances are assumed to be recognizable for the reader (e.g., mother-son relationships in middle-class California, science museums as public institutions); if they weren’t, it would be necessary to be acquainted with a major body of cultural ethnography. But if this broad familiarity can be assumed, the local context of an utterance is particular to its circumstances and gets embedded in the specific retentions and protentions lived by the participants, which is the focus of our analytical work. The time that counts for a phenomenological analysis is the lived time: the stream of retentions and protentions that permeate the flowing “now” of the participants. The segmentation we pursue is not based on the number of frames per second registered by a video record, but on the rhythm and pulsations of the shifting “now” lived and expressed by Silas and Janene. The local shifts marking the temporal flow of lived experience, routinely expressed in vocal inflexions and gestural movements, ordinarily take place over fractions of a second, which is the rationale for micro-ethnographic work.

Woven in the development of rich microethnographic descriptions, interpretations arise. Fully developed interpretations trace how a certain utterance is, for example, a case of an emerging theoretical concept. However, the process of coming to articulate this is far from straightforward because it meshes microethnography of recorded events with the complex emergence, on the part of the research team, of the theoretical idea itself. They are inseparable because what an utterance can be “a case of” is not pre-defined, but it grows organically from the immersion in the bodily-situated details of the utterance. As opposed to coding according to certain operationalized categories, our interpretive approach strives to bracket assumptions in an effort to let unanticipated perspectives appear from the close examination of the participants’ utterances.

In addition, we feel that it is important to explore in depth those aspects of multimodal utterances that resist a single interpretation. Communicative ambiguity is

a common phenomenon that runs the risk of escaping traditional methodological approaches based on coding schemes. Thus, at times we offer multiple conflicting interpretations of an utterance in the event that, even after extensive discussion by our research team members, several interpretations of the data remained viable.

Microanalysis: Silas and Janene imagine producing a circle

In this paper we trace Silas’ and his mother Janene’s multimodal utterances to document instances of collective mathematical imagining. These interactions took place in the context of an interview with one of the researchers following the participants’ experience with the exhibit. In the episode we present, the participants generated spontaneous, insightful, and innovative ways of imagining the use of *Drawing in Motion*. Below is a verbal transcription of the episode that began just after the interviewer posed the question, “What do you have to do with speeds for a circle?” Prior to this question, the group had been discussing the speeds and relative speeds of manipulating the handles of *Drawing in Motion* to produce a variety of images.

Numbers in parentheses indicate pause duration in seconds. Bolded speech indicates speech overlap. The transcript includes three demarcated segments on which our analysis focuses:

0. S: it’s hard to understand but like the (0.6) up and down one (0.2) would kinda go slowly
1. S: so then it kinda makes a little **diagonal**

2. J: **yeah**

3. (0.4)

4. S: **and**

5. INT: **mm hmm**

6. (0.3)

7. S: then you then the um

8. J: and then once it curves

9. J: then the up and down would have to go faster

10. S: no
11. the up and down might have to go kinda right, like (0.4) left
12. so it kinda goes

13. like this and I would go (0.6)

14. J: yeah **and then you have** to go right

-
- | | |
|-------|--|
| 15. | S: so |
| <hr/> | |
| 16. | (0.4) |
| 17. | INT: alright okay, sounds like you guys |
| 18. | J: it'd be a lotta work |
| 19. | INT: got a good idea of how |
| 20. | S: yeah |
| 21. | INT: how to do that |
| <hr/> | |
| 22. | S: kinda go like |
| 23. | diagonal |
| 24. | mostly |
-

Producing an image with *Drawing in Motion* that even somewhat resembles a circle is a difficult task that requires not only coordinating the direction each handle should be moved simultaneously, but also the constantly varying rates at which they should be moved. For example, drawing the very top or bottom part of a circle requires the horizontal handle to move quickly relative to the vertical handle, while drawing the very left or right sides of the circle entails vertical movement that is relatively faster than the horizontal movement.

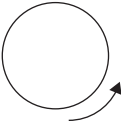
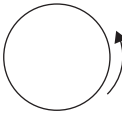
The difficulty of the task is reflected in the complexity of this episode. For example, before Silas discussed the speeds of the handles, he first attempted to work out how the horizontal and vertical (i.e., “the up and down one”) handles would have to be moved to generate the circle. Silas and his mom then tried to coordinate the handle movements for specific parts of the graph with their corresponding handle speeds. The episode ends with Silas positing how the circle is “mostly” diagonal (i.e., most of the time both handles are moving simultaneously).

The 56-second episode we analyze below is part of a larger portion of Silas’ and Janene’s interview that we microanalyzed. Within the selected episode, we highlight three segments where critical components of our theory emerged from the microanalysis. In the first segment (lines 1–10) we provide an exemplar of the gestural constitution of a phantasm and its collaborative enactment by multiple parties. Segment 2 (lines 12–15) illustrates the transformative nature of gestural imagination through an explication of our notion of cubist compositions. Finally, in the last segment (lines 22–24) we show how gestures may enact novel categorical insights about the particular objects brought into quasi-presence.

Analysis Section 1: Gesture and the collaborative constitution of phantasms

In this section we illustrate the gestural constitution of a phantasm through an analysis of segment 1 in the above transcript.

Silas and Janene enact a circle phantasm. We micro-analyze the following transcript excerpt from our case study, which began right after Silas had begun to discuss the motion of the vertical handle in the process of creating a circle with *Drawing in Motion*. We analyze this segment line by line. Parenthetical remarks in *italics* describe embodied actions, including gesture. Images are annotated with solid arrows, indicating movement trajectories, and dashed arrows, indicated inferred direction of eye gaze.

Transcript	Clarification
Right before the transcript excerpt begins Silas had stated that “up and down would kinda go slowly”	If the circle is being drawn from below, at first the vertical handle will go slowly probably because most of the corresponding displacement is horizontal
	
<i>Transcript begins:</i>	
1. S: ...so then it kinda makes a little diagonal	Silas describes the initial lower right arc of the circle as being “diagonal”. Janene agrees.
2. J: yeah	
3. (0.4)	“and then” marks a transition where Silas signals to Janene to contribute.
4. S: and	
5. INT: mm hmm	
6. (0.3)	
7. S: then you, then the um	
8. J: and then once it curves	Janene adds that in this curved phase the vertical
9. then the up and down would have to go faster	handle (i.e., “the up and down”) will have to go faster probably because most of the corresponding
10. S: No the	displacement is vertical. Silas questions her account.

Lines 1–2: initial lower right arc of the circle as being “diagonal”.

- 1.S: ...so then it kinda makes a little **diagonal**
- 2.J: yeah ((*Silas slowly traces a curve with his right hand that moves upwards and to his right.*))



Figure 5. Silas says, “...so then it kinda makes a little diagonal”.

In these two lines Silas traces with his right hand the “little diagonal” of the lower portion of the circle in question (see Figure 5). It is possible that he qualified the diagonal as being “kind of” because its curviness made it somewhat different from a typical diagonal assumed to be straight. The second qualifier (i.e., “little”) might have expressed his recognition that the initial tracing of the circle barely departs from the horizontal. Silas’ verbal description in Line 1 might have played the role of preparing his upcoming right hand gesture tracing the initial arc of the circle. Silas’ talk and gesture has constituted a phantasmic circle in his peripersonal space, bringing it into quasi presence not only for himself, but also for Janene and the interviewer. Note that while his talk and gesture articulates traits of a particular arc, we propose that it made quasi-present the whole circle of which the traced arc is a part. This is because the entity Silas constituted is an emptiness he and others imagine. An emptiness is indirectly suggested by partial traits the speaker names (i.e., “it kinda makes a little diagonal”) and/or is responsive to (i.e., Silas’ hand adopting the shape of a lower arc). While a perceived object is typically available as a complex entity *of which* one of many circumscribed qualities can be pointed out, an imagined object is derived *from* the pointing out of circumscribed qualities bringing to quasi-presence the emptiness in which the complex entity as a whole (i.e., the full circle) dwells. Note that the size of the circle Silas’ traced is not necessarily correlated to the actual size it would have on the computer screen; rather, its size is sensible to the overall dimensions of his peripersonal space and how hands and arms move naturally (e.g., without having to stretch his torso sideways) and clearly (e.g., the curvature of the arc is clearly recognizable from his hand trajectory). In Lines 1 and 2 Silas enacts noetic aspects (e.g., saying “diagonal”, curving his right hand) correlating with noematic features of the phantasmic circle (e.g., circular curvature, being on a plane parallel to his torso, etc.)

Lines 3–7: Transition towards the subsequent arc of the circle.

3. (0.4)
4. S: and

5. INT: **mm hmm** ((Silas lifts his left arm and moves his hand toward the base of his right palm. He then makes a pinching gesture with two fingers in the air near his right palm.))



Figure 6. Silas says, “and”.

6. (0.3)

7. S: then you then the um ((Silas quickly moves his left hand away from his palm, back towards the left, forming a fist on the way. He then quickly moves his fist laterally to the right before using both hands to point towards Janene.))



Figure 7. Silas says, “then you then the um”.

The pauses (Lines 3 and 6) are likely to reflect Silas undergoing a transition which he also expresses verbally (“and”, Line 4). There is not sufficient evidence to infer what exactly Silas intended to transition towards, and it is quite possible that it was an expression of uncertainty, but it seems there are at least two other possibilities: Silas expects Janene to enact the movement of the vertical handle needed for the “little diagonal”, or he expects her to account for the arc to be traced right after the initial “little diagonal.” We do not know what noematic aspect correlated to Silas’ pinching gesture in Line 5 (see Figure 6 right) but it was part, we think, of his transitional efforts to figure out a sensible way of describing the motion of the vertical handle for either the current arc or the next arc. In Line 7 Silas turns his attention to the movement of the handle: he moves his left hand to his left side forming a fist, which was characteristic of the hand grabbing the handle, then clutches the handle by bringing his fingers in towards his palm as if making a fist (see Figure 7).

These noetic features correlated with the noematic trait of the cylindrical shape of the handle. This movement of the left hand to his left side is likely to have been preparatory: he then moves the phantasmic handle from left to right, as part of his effort to figure out how the vertical handle had to move for the “little diagonal”. This quick, abbreviated enaction of the handle may indicate that Silas wanted Janene to enact the movement of the handle for the little diagonal section he spoke of. Most of the time Silas and Janene had spent using *Drawing in Motion*, Silas was in charge of the horizontal handle which, added to the fact that the graphical effect of the horizontal handle is more intuitive in the sense that it “goes” with the x-coordinate (i.e., the x-axis handle is moved horizontally and affects a horizontal movement in the graph, whereas the y-axis handle is moved horizontally but affects a vertical (“up and down”) movement in the graph), suggests to us that his ongoing imaginary effort to sort out the motion of the vertical handle for the circle was challenging for him. While the horizontal handle reaches higher coordinates values on the right side, the vertical handle obtains higher values on left side (see Figures 3 and 4). This might have been the recollection that prompted Silas to move *up* the cursor drawing the circle by pushing the handle to his *right* side, instead of to his left. Note that Silas gestured: 1) the handle (left hand) and the computer display (right hand) on the same plane in front of him (i.e., the two hands acted on the same plane), and 2) the range of motion for the handle (traversed by left hand) was roughly similar to the size of the circle (suggested by the right hand). Neither of these was the case in using *Drawing in Motion*. Silas ended Line 7 by “dropping” the phantasmic handle and circle in order to point with both hands and gaze towards Janene. The whole transition that Silas attempted to realize in Lines 3–7, culminated in inviting Janene (“you”, Line 7) to enact the motion of the vertical handle for the current arc and perhaps for the subsequent arc. It was Janene, after all, the one who had been mostly responsible for the vertical handle.

Line 8: Janene traces the right side of the circle.

8. J: and then once it curves ((*Janene lifts her right hand upwards and rightwards, palm facing medially. Then Silas looks at Janene and raises his right hand in a shape similar to that of Janene's.*))



Figure 8. Janene says, “and then once it curves”.

In Line 8 Janene takes on the leading role in addressing the question of the motion of the vertical handle to trace the subsequent arc. She raises her right hand up and to the right, using the same palm gesture as Silas had in Line 2 and beginning to trace the section of the contour of the circle near where Silas had stopped tracing the “little diagonal” in front of him (see Figure 8). Looking at Janene, Silas silently enacts again the palm gesture of Line 2. In this moment we recognize two phantasms inhabiting the peripersonal spaces of Janene and Silas. The phantasms echo each other, such as Janene’s re-enacting Silas’ palm gesture, and Silas responding by re-enacting the same. While they echo each other, they are not identical. For example, Janene’s left hand continues to rest on her leg while Silas’ is active in the constitution of his phantasm. We propose that phantasms constituted by gestures unfold from within the respective peripersonal spaces of the conversants while, at the same time, they experience a sense that they are all enacting the same phantasm. Phantasms echo and refract across the peripersonal spaces of the speakers — they condition each other in emulation and diversity — making possible the growth of interpersonal imagination whose roots and origins cannot be attributed entirely to any single participant.

Lines 9 and 10: Janene describes the vertical handle as moving faster.

9. J: then the up and down would have to go faster (*After a momentary pause in the vertical movement of Janene’s right hand, she raises her right hand higher. In one quick motion, Silas brings his left hand to the base of his palm and then moves it back to his left. As he moves his hand back to the left, he curls his fingers in towards a fist. As Janene’s hand continues to rise, her fingers slowly begin to bend towards her palm, forming a more pronounced arc after she finishes saying, “faster.”*)



Figure 9. Janene says, “then the up and down would have to go faster”.

10. S: No

Instead of creating a phantasmic axis handle with her left hand, as Silas had done, to enact how the handle would have to be moved to create the arc on the right side of the circle, in Line 9 Janene moves on to talk about the speed of the handle as she rounds the right portion of the phantasmic circle (see Figures 9 and 10).

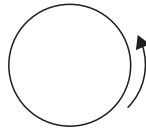


Figure 10. The right, more vertical portion of the circle.

As she says “then”, she momentarily pauses the upward movement of her right hand to stress that this motion corresponds to the vertical handle (“the up and down”). Then she continues to trace out what appears to be a more vertical contour with her hand. Janene completes her idea: the y -axis handle would have to move faster as it traces the more vertical section of the circle. It is not explicit whether it would be faster with respect to its own previous motion or to the simultaneous motion of the x -axis handle, but since she is describing “her” axis, the former is more likely. Janene juxtaposes gesturally and verbally the tracing of the circle with the motion of the y -axis handle.

While Janene began enacting her phantasmic circle where Silas had initially left off on his, she continued from there to describe the speed at which subsequent parts of the circle would be formed. This seems to be contrary to what Silas had in mind. It appears that Silas wanted to attend explicitly to the movement of the phantasmic vertical handle. As Janene finished saying “once it curves” in Line 8, Silas had begun to shift his eye gaze to the front of his body. We suggest that eye gaze is another constitutive element in the bodily enactment of the circle phantasm. Bringing his gaze in front of him, Silas attempts to envision the imagined circle in his peripersonal space while his closing of the left hand corresponds to grasping a handle. Had Janene paused to enact the handle movement, we conjecture, Silas would not have shifted his gaze. Silas’ reaction is evinced in Line 10 where Silas says, “no”, then continues to talk about handle direction.

Analysis Section 1 summary. The focus of our interpretive commentaries for Segment 1 was the gestural constitution and co-creation of a phantasm. Lines 1–2 include Silas’ account of the initial tracing of the lower right arc of the circle. In these two lines Silas generated what we called the “palm gesture”, shaping his hand as if he were touching the arc with his palm. Lines 3–7 encompass Silas efforts to transition towards the corresponding motion of the vertical handle for the subsequent right arc. Feeling lack of closure, he invited Janene to do it. In Line 8 Janene responded by enacting the tracing of the right side arc of the circle by means of the palm gesture. In Line 9 Janene juxtaposes the palm gesture tracing the circle upwards with the vertical handle “going faster”. Silas, seeing that Janene’s phantasmic enactment was not addressing the issue of the direction of motion of the vertical handle, shifted his gaze away (“no”) and tried to ascertain it. We stressed in our commentaries that the peripersonal spaces of the conversants are where

gesture-based phantasms dwell, so that phantasms adopt the bodily symmetries, sizes, and reach of the peripersonal spaces they inhabit. We proposed that multiple phantasms are constituted throughout interpersonal transactions, and that in many cases, such as the one of Silas and Janene, these multiple phantasms are “of” the same “thing”. This is not unlike, we suggested, the ways in which speakers may utter differently (e.g., with a different tone of voice) the name of a person they talk about, stemming from each of their own vocal apparatus and facial expressions, but with a shared sense that they are all talking differently about the same person. Silas’ and Janene’s phantasms echo and refract each other across the peripersonal spaces they inhabit.

Analysis Section 2: Cubist composition and the creative role of gesture in imagining

In Section 1 we explored gesture in the collaborative constitution of the circle phantasm. In our introduction we alluded several times to the ways in which simulation accounts of representational gesture appear to under-emphasize the transformative nature of gesture in favor of underscoring its imitative relations with actual or simulated perceptuomotor events. In this section, we explicate our notion of cubist composition as an alternative way of understanding the transformative or creative aspects of gesture and imagination.

European paintings were primarily perceived until the 20th century as windows letting the viewer see whatever was on the other side, whether it was an actual or made up scene. While Cezanne, the impressionists, and many other painters created styles in which the window seemed to distort somehow the view of the other side, it was the early-20th-century cubist movement that most directly departed from the notion that paintings are windows into a viewed scene. We identify three primary ways in which this rejection of the painting-as-window manifested in cubist paintings: *flattening*, *juxtaposition*, and *prominence of the canvas*. To illustrate them, we will refer to a 1919 painting by Juan Gris entitled *Still Life with Guitar, Book, and Newspaper*, reproduced in Figure 11.

First, in *Still Life*, a book is visible in the painting by means of several layers cut in irregular forms and resting on each other. Some pages of the book seem to lie underneath the journal and others on top of it. The guitar’s neck is flat. The tabletop holding the guitar, book and journal is only apparent as a flat irregular surface. The journal is split between a rectangular piece partially on the table and partially on the book; while a sheet of paper can be “truly” flat, Gris cut it in sections interposed between other layers. Cubist paintings removed foreshortening or illusory depth along different viewing directions or faces, a phenomenon we refer to as



Figure 11. *Still Life with Guitar, Book, and Newspaper* by Juan Gris, 1919. Public domain image accessed from http://commons.wikimedia.org/wiki/File:Juan_Gris_004.jpg Access date October 31, 2012.

flattening. A cubist would paint elements disregarding depth, so that the size of an object comes to be unrelated to how far or close it might have been to the viewer.

Second, in *Still Life*, fragments of objects, as seen from different angles, are *juxtaposed*. We visually note juxtaposition because the relative positions and orientations of these fragments do not correspond to a possible arrangement if they were “on the other side” of the window/canvas. The guitar’s neck is set at an angle with respect to the body of the guitar. The tabletop seems more or less vertical, how could it hold the guitar and the journal? We only see part of the book when, had it been on top of the journal, it would be more fully visible. Against the expectation of a realistic scene illusorily presented across the canvas, such juxtaposition unsettles our visual experience disallowing closure and foregrounding relative incongruence.

Finally, for the most part, the space in which the different depicted objects and fragments reside lacks depth. They seem to slide in and out from a pile of planar layers. While *Still Life* depicts entities that could reside behind the canvas, such as a tabletop or a book, the composition of the whole resists the perception of a scene lying beyond it. The space of *Still Life* is the canvas itself. After centuries of sophisticated artistic craft striving to put the canvas “out of sight”, to emulate the invisibility of a transparent window, cubist painters treated the planar canvas as a flat milieu onto which parts of objects get juxtaposed. It is hardly surprising that collage emerged as an art medium simultaneously with cubism. Cubist compositions created new demands for the viewer: rather than seeing *through*, *Still Life* calls for seeing *at*. Cubist painters stopped fighting against the constraints of a flat canvas, such as the impossibility of a painted entity to put another one under its shadow, and made their art out of experimenting with these constraints.

In the case of a gesturer we think of the human body as a kind of canvas. In this paper we propose that rather than simulating action, a gesturer transforms action by creating a cubist composition: The gesturer experiments with his body in ways that do not put it “out of sight”, in a futile effort, as it were, to conceal the constraints of the body; rather, they juxtapose and flatten elements in their peripersonal space in ways that do not necessarily depict how far apart, asynchronous, and occluding they might have been in the situation they imagine.

Silas and Janene imagine a circle through cubist composition. After Janene says, “the up and down would have to go faster”, Silas responds, “no the up and down might have to go kinda right, like (0.4) left”. He refocuses the conversation on the direction of handle movements as opposed to the speed of movement highlighted in Janene’s prior turn. He hesitates and self repairs, saying first that the vertical handle will need to go right, then saying instead that it will need to go left. The utterance we analyze here picks up where Silas is continuing to elaborate on the movement of the vertical handle in relation to the drawing of the circle.

Transcript	Clarification
12. S: so it kinda goes	Silas traces of the right side of the circle
13. like this and I would go (0.6)	Silas restarts enacting the drawing of the circle from the right side but now focused on the motion of the horizontal handle
14. J: yeah and then you have to go right	Janene confirms that the horizontal handle would have to go from left to right
15. S: so	

Line 12: Flattening.

12. S: so it kinda goes ((*Silas has both hands lifted with the palms facing one another. He gradually raises his right hand up, and curls his right fingers in a little while he briefly relaxes his left hand then raises it again to his right elbow.*))



Figure 12. Silas says, “so it kinda goes”.

In this line, the morphology of Silas' right-hand gesture echoes the hand gesture collaboratively produced in Segment 1. Silas keeps tracing — or imaginatively touching — the phantasmic circle with his right hand (see Figure 12). The detailed morphology of this gesture is not an impoverished replica of the participants' previous experience with the exhibit but a transformation; notice, for example, how Silas' gesture produces the circle phantasm proximal to his body. During the actual use of the exhibit, the circle was a distal object displayed on a monitor that was well out of reach. But Silas' gesture here constitutes a nearby entity whose edges can be palpated with the palm of his right hand. This imaginative transformation that turns a previously distal and untouchable object into something proximal and palpable exhibits the quality of *flattening* first outlined in the introduction. In other words, analogously to how cubist paintings collapsed depth, Silas' gesture here brings a circle into quasi-presence through a flattening of the distance between himself and the computer screen as it was experienced with the actual use of the exhibit.

In invoking the notion of flattening, we intend to point to a phenomenon that we see as more than the mere byproduct of anatomical or spatial constraint. While Silas' gestures are indeed delimited by factors such as arm length or the structure of the interactional space, there remains a tremendous amount of expressive freedom within those delimitations. For example, it would be entirely possible for Silas to produce a gesture that represents the imaginary circle as more distal from his body, say by more fully extending his arm, even though physically all his gestures are necessarily at arms length.

Line 13: Juxtaposition.

13. S: like this and I would go (0.6) ((*Silas moves his left hand to the right of his right hand, crossing his left arm over his right and curling his left fingers inwards. He positions his hands so that the backs of the hands are touching or nearly so. Silas moves both hands to the left, curving his right palm down.*))



Figure 13. Silas says, “like this and I would go (0.6)”.

As Silas continues to trace the circle with his right hand, he constitutes and grasps a handle with his left hand (see Figure 13). Adjoining the backs of each of his

hands, he simultaneously traces the circle with his right hand while he imaginatively enacts a corresponding handle movement with his left hand. Imagined motor actions with the *x*-axis handle are intricately blended with corresponding perceivable changes in the location of the cursor along the circle. Proximal manual actions (i.e., handle manipulation) and distal visual events (i.e., the circle being drawn) characterizing the actual use of the exhibit are here collapsed together in Silas' peripersonal space as two entwined imaginary objects. Because of this, this gesture exhibits the quality of *juxtaposition*, the imaginative bringing together of disparate objects in ways that violate or distort "actual" or "possible" spatial arrangements.

Lines 14 and 15: Prominence of the canvas.

14. J: yeah **and then you have** to go right
15. S: **so** ((Silas continues to trace a circle with his right hand, always curving the palm to face roughly towards the circle center. He moves his left hand down and to the left, keeping the fingers curled in. As Janene says "to the right" he turns his gaze towards her.))



Figure 14. Janene says, "yeah and then you have to go right".

As Silas continues to trace the circle with his right hand, he displaces his left hand that has been depicting the handle movement downward in order to make room for the circle's completion (see Figure 14). While in *Drawing in Motion* the handle moved only horizontally, holding the left hand at constant height would "get in the way" of the right one. In the original use of *Drawing in Motion* the circle drawn on the computer screen does not impede the free motion of the handle, but in his gestural juxtaposition of both it did. This illustrates what we call the *prominence of the canvas*. Just as cubist paintings encourage the viewer to see *at* the canvas and all its practical and expressive constraints, Silas' gestural enactment here makes prominent the constraints of the body as the constitutive medium of the imagined.

Analysis Section 2 summary. Our commentaries in this section addressed the thesis that phantasms are not constituted by partial replicas of past or future actions, but by their transformation. Silas' gestures in this segment illustrate, we propose,

the nature of these transformations according to which phantasms are created in ways that remind us of cubist compositions of past or future actions.

Analysis Section 3: insights from the imaginary

In this section we elaborate on how the gestural constitution of phantasms can be a source of insight. In the midst of enacting phantasms, Silas recognizes anew that a circle involves, mostly, “diagonal” traces. We strive to illustrate how our ideas about the relationship between gesture and imagination open up rich avenues for creative realizations in ways that are poorly accounted for by a simulation-based perspective. Our ideas in this section connect closely to those articulated by Hutchins (2010). Embedded in a critique of computational perspectives on imagination, Hutchins discusses the origins of insight through a case study of a navigator coping with a failure of his ship’s gyrocompass:

The processes that underlie the “Aha!” insight remain invisible to a computational perspective in part because that perspective represents everything in a monomodal (or even amodal) system. A careful examination of the way a navigator used his body to engage the tools in the setting, however, helps to demystify the discovery process, and to explain why and how it happened when it did. The insight was achieved in, and emerged out of, the navigator’s bodily engagement with the setting through enacted representations. (Hutchins, 2010, pp. 436–437)

A close analysis of the navigator’s bodily engagement with tools and maps leads Hutchins to envision perceptuomotor activity as inherently creative: “Bodily experience in the form of unusual muscular tension, for example, can be a proxy for important concepts such as the realization that an atypical distance is being spanned” (Hutchins, 2010, p. 432).

There are differences and commonalities between the case of the navigator and of Silas’ episode in this section. A difference is that the tools and symbols enacted by Silas are themselves phantasmic. A commonality between both cases is that the navigator’s and Silas’ insights involved the enactment of a category that had previously been “out of sight”. In the case of the navigator, the category in question was a type of measurement called “Deviation”. Deviations are small errors induced by the local magnetic environment, which have to be measured at each locale. As we will illustrate, in the case of Silas the categorical realization involved his recognition that circles are a class of curves that, for the most part, exclude purely horizontal or vertical segments.

Many insights implicate the enactment of new categories. The emergence of new categories from ongoing perceptual and motor engagements resonates with Husserl’s theses about “categorical intuition”. Husserl (1970) proposed that we

perceive not only individual entities but also categories that subsume them. In other words, that the notion of a class is not derived from an intellectual grouping of individual instances — the latter presumed to be the only ones perceptually accessible — but of direct intuitive grasp. One example we find useful to understand this idea is the situation of looking for something of a certain color; we are told, say, that a missing book “is blue” and in our efforts to find it we identify all the blue things in sight. This quality of blueness is not of a specific tone of blue unique to the missing book; rather, we survey our surroundings from which a certain color-based class of books becomes prominent and segregated in perceptuomotor ways.

Silas has the insight that the circle is “mostly diagonal”. After Janene says, “yeah and then you have to go right”, there is a half-second pause in the conversation after which the interviewer offers the assessment that Silas and Janene appear to have a “good idea of how how to do that”. Janene simultaneously notes that drawing the circle would “be a lotta work”. In this section, we analyze the transcript segment that happens next, in which Silas says, “kinda go like diagonal mostly”.

The design of *Drawing in Motion* makes prominent the difference between, on the one hand, horizontal or vertical lines, and on the other hand, “diagonal” lines that are neither horizontal nor vertical. While the former type of line requires that only one user move at a time, the latter can only be produced when both users move simultaneously and in a coordinated fashion. In this segment Silas makes a general statement about the circle: mostly it “goes” diagonal, as opposed to going vertical or horizontal. In Section 2 we explored the transformative qualities of representational gesture in the context of Silas’ multimodal utterance and the ways in which it demonstrates the cubist qualities of flattening, juxtaposition, and prominence of the canvas. In the present analysis, we further highlight how the creative, transformative aspects of Silas’ gesture contribute to a novel insight about the circle he and Janene have been collaboratively imagining.

Transcript	Clarification
22. S: kinda go like	Silas moves his right hand as if it were tangent to a circle on different points. He concludes that most of the circle gets traced “diagonally”, that is, neither horizontally nor vertically.
23. diagonal	
24. mostly	

Line 22: A new question.

22. S: kinda go like ((*Silas lifts his right hand then moves it to the left, extending his wrist so that the palm faces left and upwards.*))



Figure 15. Silas says, “kinda go like”.

As opposed to the palm gesture described at the beginning of Segment 1, Silas uses now the back of his hand to face the center of the phantasmic circle (see Figure 15); in addition, the trajectory of his right hand, instead of tracing the circle continuously, seems to touch it here and there. He is imaginatively engaged in a different question: not in how to trace the circle, but in ascertaining the presence of diagonal pieces on its full shape. This was a spontaneously generated question that prompted him to explore the phantasmic circle anew.

Line 23: Working with the imaginary.

23. S: diagonal ((Silas raises his right hand, extending then flexing his wrist. As he finishes saying “diagonal” he moves his right hand upwards and to the right, extending his wrist so the palm faces upwards.))



Figure 16. Silas says, “diagonal”.

Silas continues to touch the circle. He extends and flexes his wrist producing a kind of undulating movement with his right hand (see Figure 16). As he produces this gesture he says the word, “diagonal” to refer to the way in which the circle must be drawn. The phantasmic circle that has been collaboratively produced through the participants’ talk and gesture is now serving as a resource that supports Silas’ conclusion that the circle is “diagonal”, indicating the need for both parties to move their handles simultaneously in the course of drawing it. In other words, once

participants bring the objects of imagination into quasi-presence through talk and gesture, those objects in turn become available for further scrutiny.

We further clarify why this perceptuo-motor activity is original or primary, rather than simulatory or derived: there is no reason to assume that actually producing a circle on the video display with *Drawing in Motion* would allow Silas more accurately or completely to assess the diagonality of the circle. On the contrary, generating a “good” circle with *Drawing in Motion* is actually difficult, beyond the capabilities that Silas and Janene had developed at this time, and would entail practicing a multitude of details only indirectly related to diagonality. Furthermore, even a circle drawn on paper made accessible to him would not necessarily add anything to his perceptuomotor judgment. Instead, Silas’ gestures on and around the imaginary circle focused exclusively on the property of interest (i.e., diagonality). This exemplifies our thesis that gestural enactments can be an enrichment of actual experience rather than an impoverished replica of the past, because that past experience becomes transformed allowing for new inquiries, in this case, the predominance of diagonality for a circle.

Line 24: The circle as a type of curve

24. S: mostly ((Silas continues to trace a circle in the air with his right hand, moving it right and down. He brings his wrist to near maximal extension so that part of the curvature is captured by the angle of his wrist to his forearm. As he finishes saying “mostly” he returns his hand to his lap.))



Figure 17. Silas says, “mostly”.

We propose that the verbal utterance, “mostly”, indicates that it is diagonal for the most part, but not always. Through this improvisation, Silas expresses an innovative insight. The judgment that Silas completed in Line 22 — the circle being mostly diagonal — corresponds to what Husserl called “categorical intuition” (Husserl, 1970). It is *intuitive* because Silas perceived it directly in visuo-tactile ways, as opposed to being told about it or inferring indirectly that that must be the case. It is *categorical* because it concluded his efforts to locate the circle on the diagonal “class” of curves; in other words, it solved the question of categorizing the circle on

a diagonal/vertical-horizontal taxonomy. The taxonomy itself is richly grounded in his recent experience with *Drawing in Motion*, which had made so prominent the difference between moving the handles individually or in concert. But the attribution of diagonality to a circle is a new insight whose originality leads us to expect him to know, in advance of further interaction with *Drawing in Motion*, that to draw a circle he and Janene *would have to* move mostly in simultaneity.

Analysis Section 3 summary. Our commentaries in this segment are a tiny pointer towards a huge theme: What is the relationship between imagining and conceiving of necessary consequences? As it is well known, empirical observation cannot serve as a basis for logically necessary conclusions. In our case, the mere practice of drawing circles with *Drawing in Motion* cannot sustain the idea that it is *impossible* to do it with individual movements on each handle, at most it can lead to the observation that, as much as we tried, we were unable to do it. It seems that imagination — the lived constitution of phantasms — is required for the emerging sense of logical necessity, and this must be, we believe, not because of the simulative but of the transformative relationship between real action and phantasms; otherwise, there would not be crucial and enriching differences between engaging with actual objects and with phantasms. We leave this as a matter for future work.

Discussion

In Section 1 we examined the collaborative, multimodal constitution of an imaginary circle being traced by Silas and Janene with *Drawing in Motion*. Our analysis aimed to clarify both (a) the noetic and noematic aspects of the gestural constitution of phantasms and (b) the joint participation of multiple parties in processes of imagining. For instance, regarding the former, the curvature of Silas' "palm gesture" in lines 1 and 2 is a noetic feature of his multimodal utterance that correlates with the noematic quality of the circle's lower right quadrant being "a little diagonal". In enacting this feature of the circle, Silas brings to quasi-presence the imaginary circle as a whole, making it available for himself as well as his co-participants, just as the mime's gestures in Figure 2 bring about the as-if presence of the entire sword. Regarding joint participation, we suggest ongoing phantasmic echoes and refractions across the peripersonal spaces of the participants.

In addition, our analysis of segment 1 addresses what we see as a particular shortcoming in the gesture-as-simulated action account of representational gesture. We have argued that simulation theory is ambivalent towards mentalism and hence continues to fall prey to the long-standing inner-outer-dichotomy that we think embodied cognition should dissolve. This residual Cartesianism is, perhaps,

most succinctly manifest in a figure published by Hostetter and Alibali (2008) as an illustration of the gesture-as-simulated-action framework. We have redrawn the figure below:

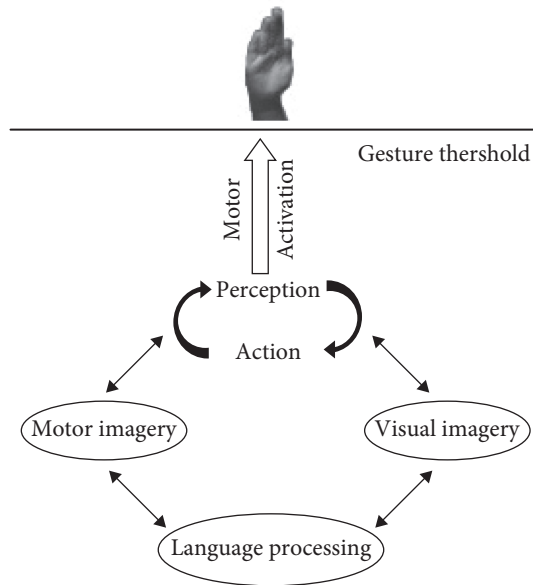


Figure 18. Redrawn from Hostetter and Alibali, 2008, p. 503.

In this figure, a web of cognitive processes and representations lurk underneath the hand that represents their bodily manifestation. In the case of imagination, we can interpret this diagram as locating the objects and processes of imagination in some interior mental realm, while relegating the activity of the hand to a kind of secondary, motoric byproduct of cognitive activity. Yet, as we have illustrated in this segment, the phantasms that Silas and Janene constituted can be recognized there, in front of them, for the most part in their peripersonal spaces. That is, the participants speak and act in ways that treat the objects of imagination as, to a certain extent, palpable and available to joint scrutiny and elaboration.

Our point is not that there is no covert or publicly unavailable bodily activity. This would be inconsistent with the common experience of imagining without overt body activity. What we propose is that covert activity, while condensed and abbreviated, is of *the same kind* as gesture, gaze, and talk. It is on this basis that we describe covert activity as inhibited, and also that we come to understand why it is so “natural” to gesture, make facial expressions, and so forth when we imagine with others, to the point that it is difficult not to do so. In sum, rather than conceiving of a mental realm different in kind from talk and gesture, and in which multiple types of computational, representational, and cognitive processing take

place, we propose that what we often refer to as “mental” consists of inhibited and condensed bodily activities engaging the same kind of perceptual and motor events that others could echo and refract, if allowed to expand and reach the periphery of the nervous system.

Another contribution this paper strives to make is to contemporary reconceptualizations of imagination as an embodied, social process. Our analysis resonates with Murphy (2004, 2005), Alač (2005, 2008), Alby and Zuccheromaglio (2007, 2008), Hutchins (2010), Alač & Hutchins (2004), and Nemirovsky & Ferrara (2009), in locating the activity and objects of imagination in multimodal and multiparty interaction. At the same time, we hoped to further this line of work in at least two ways. First, by drawing on the phenomenological tradition we investigated how processes of distributed imagining are lived or experienced by the participants. For example, when Murphy describes imagining as “perceiving in the hypothetical mode”, or when Alby and Zuccheromaglio (2007) refer to “materialization practices”, we take these authors to be referring to the quasi-present nature of imagined objects and ask, how is quasi-presence lived? In partial response to this type of question, we suggest that imagined objects can be understood as phantasms: the noematic correlates of representational gestures that generate and shape an emptiness that can be present and available to the participants yet collectively understood as materially absent. Second, through a close focus on the ways in which Silas and Janene’s gestures both echo and differ from one another, we highlight how intersubjective processes of imagining involve both the qualities of shared-ness and heterogeneity: while participants orient to and produce the objects of imagination as shared public resources, they simultaneously evoke multiple instantiations of those shared objects through the particularities of their individual utterances.

Our analysis of segment 1 generates a number of possible avenues for further inquiry. For example, future work might explore the observation that collective imagining may serve a variety of purposes, including imagining hypothetical actions, past events, or future possibilities. How might representational gestures function differently when, say, participants are imagining an object they plan to create in the future, versus when they are imagining something hypothetical or impossible?

In Section 2 we explored the transformative quality of representational gesture in processes of imagining, a quality we feel is too readily left behind by simulation accounts of gesture that foreground the imitative relations among gesture, imagery, and actual perceptuomotor events. To better understand the transformative nature of gesture during acts of imagining we traced how Silas’ multimodal utterances exhibited the qualities we call flattening, juxtaposition, and prominence of the canvas. In line 12, Silas’ gesture collapses — or flattens — the actual distance

between himself and the computer screen. Adding to this in line 13, his bimanual gesture juxtaposes imagined manual actions on the exhibit's handle with the graphical tracing of the circle. And the physical-logistical constraints that Silas works around in lines 14–15 bring to the fore the body — or canvas — as a genuine constitutive medium of the imagined.

Our notion of cubist composition may be related to the literature on gestural viewpoint. One interpretation of lines 13–15 is that Silas' bimanual gesture expresses dual viewpoint (McNeill, 1992; Parrill, 2009). His right and left hands blend character (e.g., grasping the handle) and observer (e.g., tracing the associated visible trajectory of the graph) into a single imaginative enactment of the drawing of the circle with *Drawing in Motion*. However it is not clear whether the act of drawing falls under the “observer” viewpoint. Rather, we suggest that an interpretative framework suggested by cubist composition adds nuance to extant research on dual viewpoint gesture by detailing the transformative contributions of flattening, juxtaposition, and prominence of the body-as-canvas, leading to the constitution of gestures that do not seem to be simple combinations of character and observer perspectives.

The quality of juxtaposition characterizing Silas' bimanual gesture in lines 13–15 also bears on recent developments on the relationship between gestural viewpoint and mathematical understanding. Gerofsky (2010) analyzed data collected from interviews with secondary students who were asked to describe through gesture the graphs of a variety of polynomial functions. The author found that students who used gestures with a character viewpoint tended to perform more highly — according to teacher assessments — in their mathematics class than did students using observer-viewpoint gestures. Although Gerofsky's analysis emphasizes the value of character viewpoint gesture, we wonder here about the importance of Silas' gestural juxtaposition in lines 13–15 to the novel categorical insight that he expresses in the subsequent utterance. In what ways do gestural cubist compositions participate in novel mathematical insights? We elaborate on this further in our analysis of segment 3.

We think that having completed the drawing of the phantasmic circle in Lines 14–15, it became available as a whole for Silas to scrutinize anew. He imaginarily touched it tangentially at different points ascertaining overall diagonality, making salient that it is neither horizontal nor vertical. This sense of diagonality had become prominent through the use of *Drawing in Motion* because it demanded the kinesthetically remarkable feature that both handles had to move simultaneously. The virtual permanence of the phantasmic circle in front of him for further examination is an important aspect of the constitution of phantasms. It is as if the phantasm stayed there, populating Silas' peripersonal space as a “left over” entity organizing, in turn, subsequent inquiry. The continued presence of the phantasmic

circle can be conceptualized as temporal flattening of the recent past, in other words, overlapping (i.e., making simultaneous) what had been traced over time, very much in the same way that drawing a circle on paper can lead to a subsequent temporal flattening of the process of drawing it.

In the course of tangentially touching the phantasmic circle, Silas experienced a categorial intuition: the circle is mostly diagonal. In contrast to, say, a square formed by horizontal and vertical sides, the circle belongs to a different category. Given that perceptual observations cannot exclude the possibility of the not-yet observed, categorial intuitions seem to require working with the imaginary. This is because, we conjecture, only phantasms can be constrained to a universe of limited and known possibilities. We propose that this is the crucial sense in which gestural cubist compositions may participate in novel mathematical insights: they constitute phantasms able to prompt original categorial intuitions, which is what mathematics is made of. Obviously this is just a modest beginning for important strands of future work.

Acknowledgements

This research was supported by the “Math Core” project funded by the National Science Foundation through Grant DRL-0840320 and the “Tangible Math” project funded by the National Science Foundation through Grant DRL-0816406. All opinions and analysis expressed herein are our own and do not necessarily represent the position or policies of the funding agency.

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