

# Tracing the Development of Representational Practices

## Notes for the CSCL 2009 Symposium on Understanding Practices

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**Abstract:** Three sessions of online collaborative mathematics problem solving by a single team in the Virtual Math Teams environment were analyzed to identify how inscriptions become representations through representational practices that emerged across the sessions. This analysis was reported in a companion paper (Medina, Suthers, & Vatrappu, 2009). The present paper summarizes major points from Medina et al. (2009), comments on our analytic method of tracing practices over time via contingencies between acts, and raises theoretical and methodological issues that derive from the tension between the contingency of members' methods on the local circumstances of their production and the concept of *practices* as recognizable generalizations that can be enacted in multiple ways. The theoretical tension is resolved in part by separating epistemological and ontological aspects of the temporality of "context," but some methodological issues remain.

### Introduction

This note comments on an analysis of the work of students in the Virtual Math Teams (VMT) Spring Fest 2006, based on data provided by Gerry Stahl for the CSCL 2009 symposium on Understanding Practices (Stahl, 2007). The analysis is published and presented at CSCL 2009 in Medina, Suthers & Vatrappu (2009).<sup>1</sup> Please refer to that paper for presentation of the analysis itself. This note is not primarily concerned with the specific results of that analysis, but rather with theoretical and methodological issues relevant to the symposium's objective of "engender[ing] discussion about methods and frameworks for studying the practices of producing understanding within online environments." Specifically, we outline our method for tracing how practices are developed and recur over time, and explore the relationship between the notion of "practices" and certain ethnomethodological policies for studying practice (Koschmann, Zemel, & Stahl, 2004).<sup>2</sup> The Medina et al. (2009) paper:

- Briefly introduces a two-level analytic approach that finds relevant prior episodes through persistent inscriptions and other contingencies, and then applies microanalysis to uncover the representational practices that were developed and enacted in those episodes.
- Identifies some representational practices employed by participants in the sessions being analyzed.
- Shows that the inscriptions employed in these practices become representations for the group's problem solving through participants' interactions.
- Shows that the group's problem solving draws upon their prior practices as resources (i.e., their group cognition is historically situated), and that persistent inscriptions play a role in enabling this temporal extension of group cognition.

The present note and the associated symposium presentation will elaborate on the first and last points above, with implications for theory and analysis. First, we summarize a relevant line of reasoning from Medina et al. (2009) that shows how group cognition is temporally

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<sup>1</sup> Nominated for Best Paper and Best Student Paper, and to be presented in Paper Session 1 on Wednesday, immediately following Chuck Goodwin's keynote

<sup>2</sup> Note to discussant: our conversations on these issues are ongoing. If we make progress, it will be reflected in the final presentation.

extended across sessions through the re-enactment of representational practices. Then, we elaborate on the analytic approach taken. Finally, we pose theoretical and analytic issues that lurk in this analysis. In particular, practices may be enacted in various ways: what is recurring across these locally contingent accomplishments? And how might we find recurring practices if their instantiations vary?

### **Understanding Group Cognition as Temporally Situated**

At this point, readers unfamiliar with the analysis of Medina et al. (2009), “Inscriptions Becoming Representations,” are advised to read or skim that paper. The following section summarizes one line of reasoning from that paper that is our departure point for the commentary of this note. Line numbers in brackets refer to transcripts in Medina et al. (2009), or time stamps in the original data not published in that paper.

In the third of four VMT sessions that took place on separate days, Aznx (a self-selected pseudonym) says, “I think I have an interesting way to look at this problem” [4009], and briefly describes an innovative representation of the problem at hand. This representation enables decomposition of the problem into mathematically simpler sub-problems, one of which was solved in the first day's session. Aznx alludes to the problem decomposition and its relationship to prior work only very briefly ([4016] and other chat messages in 19:35:45-19:36:21). Yet, Aznx's partner Bwang indicates that he understands [4067], supplies the actual visualization of the problem representation, and summarizes the problem decomposition that it supports [4096].

We undertook our analysis to explore this event in comparison to Stahl's (2007) definition of group cognition as thought-like processes that take place *through group interaction*. The definition implies that a group must interact each time it “cogitates” about a given problem, but the amount of work visible in the immediate episode of interaction does not seem sufficient to account for the complexity of problem solving being accomplished by the group. We wanted to find where the work was being done. It was not sufficient to assume the work was done in Aznx's mind alone, because that would not explain how the others were able to appropriate the solution so quickly. But the methods of problem representation and decomposition that the group applied were not locally produced.

The resolution is straightforward, yet has implications for analysis and theory. Just as people are not “judgmental dopes” (Garfinkel, 1996), likewise they are not amnesiacs. Members of a group can draw on their prior interactions and on the products of those interactions as resources, and so need not work out their methods anew each time. That learners draw upon prior experience is well known, but microanalytic research in CSCL has tended to focus on short isolated transcripts. The Medina et al. (2009) paper shows that the ‘interesting way of looking’ is understood quickly by participants because of their shared history. Similarly, we as analysts need to understand the present in context of its history. To do microanalysis right one must remove temporal blinders, look back in time, and identify ways in which the current episode is contingent upon prior episodes. We turn briefly to how we do this.

### **How To Look Back In Time**

Our method of analysis helps to uncover how the immediate intersubjective meaning-making of a group is contingent on prior episodes (Medina & Suthers, 2008; Suthers, Dwyer, Medina, & Vatrappu, 2007, 2009; Suthers, Dwyer, Vatrappu, & Medina, 2007). When an analyst encounters an episode that seems to draw upon resources beyond those that are immediately apparent, the method calls for a shift to a different granularity that seeks relevant prior episodes in which these resources are constructed, and then a return to microanalysis within these episodes to show the constructions. A good clue that it is time to do this is when

more is being accomplished than is accounted for by a distributed cognition analysis of the visible interaction.

One aspect of this method was not detailed in the Medina et al. (2009) paper. We distinguish two kinds of relationships between acts (or episodes of acts, depending on the granularity of analysis): “uptake” and “contingencies”. Our ultimate interest is in *uptake*: the relation between two acts (or episodes) in which the chronologically later act takes up some aspect or product of the prior act as being relevant for present purposes. But uptake is not always directly apparent and cannot be assumed: it must be demonstrated. The demonstration is grounded in observable relationships between two acts or episodes of acts. *Contingencies* are the observable ways in which one act potentially draws upon another. Contingencies span the “many metaphysical shades between full causality and sheer inexistence” (Latour, 2005). The Medina et al. (2009) paper relies primarily on inscriptional contingencies: we search back for where referenced inscriptions or similar ones were constructed and construed as resources for problem solving. (Persistence is an important property of the VMT medium for the development of representational practices because it makes these practices meronymically available through their surviving inscriptions.) We also rely on other kinds of contingencies. Recurring lexical items (for example, see [182] in Session 1: “you can divide the thing into parts” and [1777] in Session 2: “divide them up into levels”) is another form of contingency. The most ubiquitous contingency is temporal contiguity: adjacency pairs are based on the assumption that an utterance is contingent upon the immediately prior utterance, unless otherwise marked. (Temporal contiguity is applied within the microanalysis of an episode rather to find prior episodes.) Once a contingency identifies a relevant prior act (possibly in a previous day's session), an episode is formed around this act as a seed as described in Medina et al. (2009), and microanalysis is applied to that episode. In summary, contingencies help find relevant acts and episodes, and microanalysis is applied to expose specific forms of uptake.

## Issues

The Medina et al. (2009) analysis identified several representational practices by which the problem solving practice of *problem decomposition* is realized: *inscribe-first, solve second; modulate perspective; and visualize decomposition*. Theoretical and analytic issues derive from the reapplication of practices. The term *practice* has multiple senses reflected in dictionary definitions. Many of these include a notion of repetition or recurrence, whether explicitly (e.g., a habitual or customary way of doing something; the repeated performance of an activity in order to perfect a skill) or implicitly (e.g., the exercise of an occupation or profession; the act or process of doing something). Similarly, a *method* is understood as a means or procedure for accomplishing or approaching something, especially a systematic or established one.<sup>3</sup>

Medina et al. (2009) demonstrated that the observed uses of inscriptions were practices by showing that they recurred. We demonstrated that they were distinct practices by showing that sometimes one was enacted without the others. Most important for the present discussion, we demonstrated that a given practice could recur in different manifestations. For example, “visualize decomposition” was first enacted in this data by Bwang in the first session, who said [182] “you can divide the thing into parts” and then drew horizontal and vertical lines separately. In the second session, after Bwang says [1777] “divide them up into levels”, Quicksilver uses color to visualize the decomposition of a pyramid into layers [during 1824-1882]. In the third session, Quicksilver asks Aznx to use coloring similarly to

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<sup>3</sup> Discussion of the relationship between ethnomethodology's “method” and community of practices' “practice” would be an interesting tangent.

visualize the decomposition of a figure into the part that grows, but Aznx enacts this request by drawing a line [3950], demonstrating that it is the decomposition, not the particular inscriptional device, that mattered to participants.

The practice of visualizing a decomposition is enacted through three different inscriptional means in these examples. What is the “practice” that is being applied across these sessions? What is taken up when practices are reinvoked? Calling these diverse enactments the “same” practice seems to imply that the practice is abstract: that which is taken up and re-applied is a generalization of or abstraction from enactments “performed/achieved locally in the circumstances of their production” (Koschmann et al., 2004). Is the concept of “practice” incompatible with the ethnomethodological policy of “contingently-achieved accomplishment”? And does postulating recurring practices as abstractions contradict ethnomethodological relevance, or do participants orient towards these abstractions?

To address the latter question first, the data shows that the practices we identified are not merely etic constructions. Participants orient towards strategies that are repeated (e.g., [1459], [1466], [1473]), and display understanding that a given strategy can be enacted in different ways (e.g., the different enactments that follow the suggestion to “divide”; the multiple manifestations of *visualize decomposition*).

There are two related facets of the apparent tension between practice and contingency to address: the role of abstractions such as strategies, and the temporal extent of the “local” circumstances of production. First, strategies can be resources to be drawn on (rather than deterministic structures; Suchman, 1987), and members who share a practice can recognize contingently produced application of such strategies (as noted in the previous paragraph). Second, the apparent tension between actions as contingent on the present situation and practice as involving something from the past may derive from an artificial dichotomy in our understanding of the situation or context. Conversation analysis views action as simultaneously context-shaped and context renewing (Goodwin & Heritage, 1990). The history of interaction shapes the present in an obvious way through persistent artifacts, but also because historical ways of seeing and acting remain available to participants as part of this shaping context. Analysts may need to look back in time to uncover something we cannot otherwise see, but our epistemological necessity should not be confused with participants’ reality. For participants, the current context is already constituted partly by their history, from which elements such as prior practices can be reinvoked without explicit description (e.g., through metonymy or meronymy).

This theoretical resolution leaves us with a methodological issue: how we might go looking for recurring practices (particularly in the large data sets characteristic of online interaction) if their instantiations vary? We have already discussed a strategy for finding relevant episodes by following contingencies, but it relies on the ability to identify “identical elements” (Thorndike & Woodworth, 1901) over time. Workspace manipulations that revisit previously constructed inscriptions and literal recurrence of terms (e.g., “divide”) make it easier to identify relevant prior episodes, but it may be more difficult to find recurring practices that vary more dramatically in their instantiations. We are seeking opportunities to explore these analytic issues further with other data.

If microanalysis of practices is to be relevant to the practices of CSCL, then we must understand how participants’ accomplishments are contingent or draw on temporally extended practices associated with the resources of the designed environment. Such work is particularly needed at present to balance forms of CSCL that see technologies primarily as means for temporally immediate interventions (e.g., coaching and scripting) that (re)enforce desired practices while neglecting how practices can develop and accrue as socio-technical capital through temporally extended meaning-making.

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