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CALIBRATING PROFESSIONAL PERCEPTION THROUGH TOUCH IN GEOLOGICAL FIELDWORK

Charles Goodwin and Michael Sean Smith

1. Introduction

The interest in multisensoriality in social interaction has grown in ethnomethodological and conversation analytic research, with attention devoted to investigating how practices and resources constituted through senses outside the aural/visual field are mobilized by actors for building action. The focus of this chapter is on how tactility – as one form of sensoriality – is provided as both a problem and a resource for participants in building intelligible action in their situated work.

Touch constitutes a fundamental modality for how we as humans experience the co-present world – both individually and collectively with others – in interaction. Domains of touch, whether that be tactile, kinesthetic, or proprioceptive, have long been an underinvestigated form of sensoriality in interactional studies, however, especially when compared to that accomplished in the aural-visual fields. This gap in research is currently being addressed by a growing body of work in two domains: 1) intercorporeal touch, that is, persons touching one another, and 2) object-centered interactions. Intercorporeal touch has been investigated in 1) domestic settings with the interactive organization of hugs (C. Goodwin 2017), with parents physically guiding or “shepherding” their children (Cekaite 2010; Goodwin and Cekaite 2013, 2014), and with haptic practices caregivers use for soothing distressed children (Cekaite and Kvist Holm 2017); 2) in health-related activities (La 2018; Nishizaka 2007; Nishizaka and Sunaga 2015; McArthur 2018); and 3) within interactions between tactile sign language users (Edwards 2012, 2014; Iwasaki et al. 2018; Willoughby et al. 2014). Parallel to this work is a growing body of literature investigating object-centered interactions, that is, interactions centered on or organized around participants’ handling or manipulating of objects (see the recent edited volume: Nevile et al. 2014). Objects from this perspective center in the organization and shift between multiple activities (Brassac et al. 2008; Fasulo

and Monzoni 2009). The ways in which objects are (re)constituted via their handling and manipulation in interaction play a central role not only in facilitating the participants' situated work (Fox and Heinemann 2015; Gåfvæls 2016a, 2016b; Lindström et al. 2017; Mikkola and Lehtinen 2014) but in the construction of basic actions (Mondada 2019a) and in the maintenance of social relationships (Licoppe et al. 2017). Manipulation of objects has an important sensorial dimension (Mondada 2018b, 2019b). Particularly relevant to the current chapter are those studies that investigate the co-operative use of objects in interactions with blind participants (Due and Lange 2018a, 2018b; Kreplak and Mondémé 2014; Kusters 2017), where the tactile (re)constitution of objects comes to the forefront of the interaction and the participants' mutual orientation, as participants attempt to articulate for one another the sensory experience of what touching a particular object is like.

While the interactive practices described in both bodies of literature are undoubtedly constituted through haptic, tactile, and/or kinesthetic modalities, the sensory aspect of touch – that is, the tactility of a given experience and its description – is rarely given explicit focus in the analysis of participants' actions and orientation (see, however, Kreplak and Mondémé 2014; Mondada 2016). As a result, while we are more likely to treat intercorporeal touch as being inherently social, since it consists of participants touching other participants, we tend to treat the tactility of objects and materials as a privately organized as opposed to an interactionally organized experience and as a result regard this type of touch more for what it provides the single actor than his or her interlocutors as a form of public action. This is a challenge to interactional work, as there exist a range of settings where practitioners collaborate with the presupposition that 1) the objects and materials they handle and otherwise engage with more or less “feel” the same to each participant; and 2) they can come to some publicly ratified agreement as to what the tactile or proprioceptive properties are for those objects and materials – whether that be their texture, coherence, weight, and so on – and, moreover, 3) they have access to practical methods for conducting those deliberations, whether that is via talk, embodied action, or other medium.

The intent of this chapter is to investigate 1) how interactants invoke touch in an interactionally meaningful manner in communicative practice in geological fieldwork and 2) how practitioners make action within that sensorial modality accessible and accountable to one another in interaction. Field geology is inherently multisensorial work. Practitioners make use of the full array of their senses, beyond just sight, whether that is in identifying minerals or types of rock or describing the composition or coherence of different strata or bodies of rock in the landscape. While most equate observation with vision, Geerat Vermeij, a renowned paleontologist and evolutionary biologist who is blind, describes in great detail the information geologists gain in the field through touch:

we differentiate between the textures of sandstones and shales through touch, and note the greasy feel of serpentine and the soapy texture of talc. We pick up rocks all the time to determine angularity and rounding or degrees of

weathering and fresh surfaces. . . [and while] . . . the shape of a shell's ridges may vary with visual perspective. . . [it] . . . is much less ambiguous to the touch where fine details may readily be differentiated and described.

(Pestrong 2000, 334)

The tactile attributes of geologically relevant features in the landscape (e.g., its texture, perceived weight, coherency, hardness, etc.) are diagnostic for its identification, differentiation, measurement, and description, making touch a diagnostic tool for practitioners and thus indispensable for geological practice and reasoning. For the geologist, “the hand can often see more than the eye can visualize” (Manske 1999, 213). The activity of geologists collaboratively deliberating over the touch and feel of various geological features provides a perspicuous setting for investigating tactility as public resource for building action. We expect touch, whether that be tactile or proprioceptive, to be made publicly accessible as geologists jointly reason about the nature of various objects in collaboration with one another.

2. Data and methods

This corpus is drawn from four separate video-documented ethnographic trips to geological field projects in wilderness settings. The study participants typically ranged from late- to early-career geologists, graduate students, and advanced undergraduate students participating and learning in active research projects or collaborations. Additionally, two of the field studies included computer, information, and social scientists who participated as part of a multidisciplinary collaboration with geo-scientists. Each of these visits was video-recorded by the authors who accompanied the study participants in the field documenting how they interacted as they moved through the landscape, found locations of interest, investigated features in the surrounding terrain, made field-notes and stratigraphic drawings, and collected samples of geologically relevant objects and/or materials. The videos were transcribed and analyzed with a focus on the participants' use of talk and embodied practices using conventions developed for representing talk (Jefferson 2004) and multimodal, embodied action (Goodwin 2000, 2010; Mondada 2013, 2018a).

In the subsequent excerpts, we analyze a range of tactile actions (typically a manipulation performed via hand or tool) that the speaker uses for depicting various attributes of a given feature in the landscape for interlocutors – attributes that are 1) not readily seen on the surface of the rock and thus 2) not readily accessible prior or subsequent to the action. While much of the work that goes into making tactile actions salient to recipients is also provided for via talk, where the feature is described, assessed, and typified, as well as the larger sequential environments and participant frameworks that motivate the work, we nevertheless see recipients routinely coordinating their responses on the production of their interlocutor's tactile work and how that substantiates the attributions being made about the feature. Tactile actions are, moreover, given form in large part via the physical object being operated on – that is, a less competent rock will crumble more readily than

a more competent rock. As a result, tactile depictions can take on numerous forms even within a single excerpt, where they are deployed in discursively complex ways and juxtaposed against one another so as to discriminate numerous, qualitatively different structures in the rock. Participants in turn operate on series of depictions through multiple iterations over the course of an interaction – even in instances where the quality being depicted is not actually articulated in the talk. Furthermore, participants orient toward these iterations for their perceived stability and accordingly launch remedial work where they differ too much from either quality being depicted or the feature’s geological classification. Ultimately, the manner in which these tactile actions articulate various attributes of the features being described, though complementary, are argued to be distinct from how these features are formulated via other embodied actions such as gaze or gesture. While the speaker might outline the visible extent of a structure through gaze, pointing, or gesture and can make attributions about the rock via talk, it is the tactile action, where the speaker attempts to manipulate and alter the rock, that participants treat as substantiating the material qualities being attributed. This domain of embodied practice exploits tactility to provide practitioners a means for perceiving physical structures – for example, texture, weight, coherency, and so on – that are not readily visible to numerous participants simultaneously.

3. Analysis

Geologists describe features in the landscape using multiple sensorial-modalities, all of which are deployed and oriented toward progressively revealing features or materials in the landscape as classifiable objects relevant to their work within a community of practice and particular domains of knowledge. In Excerpt 1, a novice (Austin), in responding to a lead investigator and instructor on this field project (Dave), attempts to describe the various structures he sees in the road-cut. As the interaction unfolds, how the rock is manipulated by Austin (that is, picked, pinched, or otherwise prodded at) will be critical for his success in describing and depicting the structures. On the day of recording, a group of senior and novice geologists driving into Yellowstone National Park stopped on the roadside to look at a road-cut. During the stop, Dave, one of the senior geologists and instructors, holding a video camera, walks between the students inquiring as to what they are noticing in the rock. The interaction begins as Dave asks two undergraduate researchers, Matt and Austin, “So what are you guys seeing?” (line 1).

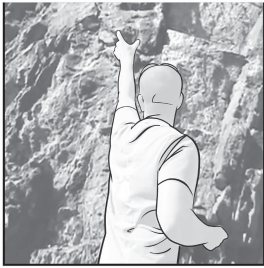
Excerpt 1a – “Coarse”

```

01  Dave:   so what are you guys seeing.
02          (1.2)
03  Austin: [(well)
04  Matt:   [a lot of mica. schist=
05  Austin: =we- we've found one of those boud@inage structures
           a:                                     @.....>
06          @#right here
           a:  @traces--->
           fig: #fig.12.1

```

07 (1.0)#@ (0.4) @ (0.2)
 a: -->@,////////,@.....>
 fig: #fig.12.2



12.1



12.2

08 Dave: [there you go]
 09 Austin: [()]
 a:>
 10 @pinched- pinched off at the@ top@
 a: @point-----@,////@
 11 Dave: @yeah=
 a: @...>
 12 Austin: =and then @we've got@ this piece@ of uh@:::m@
 a:>@point----@,////////,@.....@palm@
 13 Dave: @see@ that big ol' canoe:: in there:::
 a: @,////@
 14 Austin: (looks like) granuli:::te
 15 what's that?
 16 Matt: [(canoe,)]
 17 Dave: [yea:::h
 18 Austin: @and it's pi@nch:ing: o:ff:@ in this direction@
 a: @.....@thrust-point--@push-----@
 19 Dave: yeah

Austin's response to Dave is embedded within a series of initiation–response–evaluation (IRE) sequences (Koshik 2002; Zemel and Koschmann 2011). After Dave's initial question (line 1), Austin responds, stating that he and Matt found “a boudinage structure”. He produces the talk as he shows it in the rock (lines 5–6 and 9–10). Dave confirms with “there you go” and “yeah” (lines 8 and 11). Austin's description is articulated in both his talk and environmentally coupled gestures, with each mutually informing the other (Goodwin 2007): Just after he finishes stating their having found, “one of those boudinage structures” in line 5, he locates it with his deictic “right here” while tracing its outline using a pincer-like gesture in a downward motion (Figures 12.1 and 12.2 in lines 6–7). He then directs Dave to where it is “pinched off at the top”, pointing to its location on the rock.

Austin's description of the rock continues in the subsequent talk, where in responding to another question from Dave, Austin begins manipulating the rock in describing it.

Excerpt 1b – “Coarse”

30 Dave: so what's the rock type?
 31 (2.0)
 32 Austin: well, we got some granulite right?
 33 and (some) other @uh::m
 a: @.....>

```

34         @a lot more felsic stuff
          a: @prodding----->
35         (3.1) @
          a: ----->@
36 Austin: @it's ve::ry coarse
          a: @pinches----->
37         (0.8)
38 Dave: #that@ o:ne i:s.
          a: -->@pick-up...>
          fig: #fig.12.3
39         (0.2)
41 Dave: @#yeah.
          a: @gaze->
          fig: #fig.12.4

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12.3



12.4

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42         (1.6) @ (1.5) @
          a: ---->@,,,,,@
43 Austin: this is the one that
44         °I was curious about°

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In order to grasp the significance of how Austin characterizes the rock here as “coarse” (line 36), Dave must take into account not so much what is visible about the rock being referred to by Austin but rather what is hidden: its structure, composition, coherency, capacity, and so on. As such, Austin’s touch becomes integral for his attempt at describing this aspect of the rock and Dave’s ability to confirm or disconfirm that description.

Austin makes two, possibly three, tries at responding to Dave’s question (line 30) before receiving any evident uptake: Austin describes the rock first as having “some granulite, right?” and then second as having “a lot more felsic stuff” (lines 32–34). As he continues scrutinizing the rock, he reaches out with his hand just prior to line 34 and begins prodding at the rock, picking at it at various points with his thumb and forefinger, before eventually working his way down to the point he had earlier described as “pinching off” (line 18). As he picks at the rock at this point while describing it as “. . . ve::ry coarse”, he begins clearly dislodging debris from the stratum (Figure 12.3, line 36). It is here where Dave begins aligning with Austin’s description. He first responds just after Austin’s “coarse” with “that one i:s.”, confirming Austin’s description while effectively limiting that to only the rock that Austin was touching at the moment. He then follows with

“yeah” in line 41. While Dave’s “yeah” seems like a continuation of his prior turn, it is also closely coordinated in time with Austin’s having picked a piece of the rock from the rock-face and brought under his gaze to closely scrutinize (Figures 12.3 and 12.4 in lines 38 and 41). In both confirmations, Dave shows himself to be closely following Austin’s tactile work and coordinating his evaluations of those actions in that modality in particular, suggesting that what Austin does with the rock with his touch is as meaningful as what he states about the rock or does toward it with his gesture.

Altogether, Austin’s description is created via the juxtaposition of multiple semiotic resources, including his talk (e.g., where he labels the structure or indexically marks significant points), his gesture (where he outlines its position and physical dimensions or locates relevant points), and his tactile action (where he reveals the particular coherency of the rock at that location). Each practice contributes to endogenous meaning-making accomplished here through their coordination in a larger semiotic complex (Goodwin 2007). Such practices allow the speaker to reveal the structure he and his participants perceive in the rock as a categorically recognizable object.

A similar instance can be seen in Excerpt 2, occurring just after Excerpt 1, where Dave approaches two more students, Mason and Nate, and asks them what they see in the rock (not shown). As we join the talk, Mason begins formulating a strata that he is “worrying about”, meaning that he and Nate are uncertain about its classification (see also Nate’s agreement in line 3). The tactile action of interest occurs in lines 20 through 21, where Mason strikes at the rock with his rock-hammer.

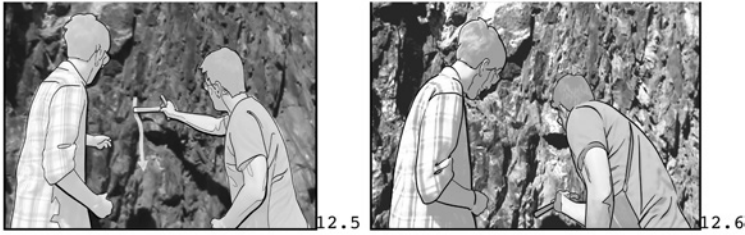
Excerpt 2 – “Super flaky”

```

01  Mason:  I'm worrying about the::se,
02          (.)
03  Nate:   yeah::_
04          (.)
05  Mason:  (probably (      ))
06          (0.8)
07  Dave:   about which?
08          (0.2)
09  Mason:  phyllite (  - ) they're almost like phyllite
10          or like a- (.) a layer but it's- maybe it's k-
11          (1.0)
12          looks like- it's this stuff:=
13  Dave:   =why don't you show me
14          *(1.2)
15          m:  *.....>
16  Mason:  *^in #here::=*
17          m:  *traces-----*
18          fig: #fig.12.5
19  Nate:   =ye[ah.
20  Dave:   [>^yea::h?
21          *(0.5)
22          m:  *repositions hammer---->
23  Mason:  s:u::per:::,
24          (0.4) #ø (0.5)
25          m:  ---->ø          (("ø" - hammer strike))

```

fig: #fig.12.6



21 Mason: ø>super< øflaøky[:::
 m: ø ø ø ((rock flakes at 3rd "ø"))
 22 Nate: [^yeah.
 23 Mason: I me*an:
 m: *scrapes-->
 (0.1)
 24 Nate: greeni*sh::
 m: --->*
 26 I mean it might even be ()

Mason's tactile depiction in lines 19 through 21 is provided as a means for making evident his assessment of the stratum as "super flaky". This description was produced as a part of a description that Austin appears to be uncertain about; he begins his utterance with the prospective indexical, "I'm worried about these" (Goodwin 1996). Indeed, at various points in his talk, we can see Mason switch to physical demonstrations in his ongoing description: in first attempting to name the rock "phyllite" in line 9, he shifts to describing its appearance, "looks like-", before shifting to simply referring it ostensively "it's this stuff . . . in here" (lines 12–15). This occurs again where Mason, in assessing the competency of the rock with "super:::, super fla:ky:::" (lines 19–21) orients toward substantiating that assessment physically with his rock hammer.

Just after Mason moves to the stratum in line 14 and traces it with the handle of his rock hammer during his increment in line 15, "in here:::", he repositions the hammer in his hand. This co-occurs with his initial "super:::" with a lengthened "r" and emphasized prosody. Instead of continuing the assessment, he delays until he is in position to start chipping at the rock during the gap in line 20 before he resumes his assessment "super fla:ky:::" in line 21, now actively chipping away at the rock.

The tactile and kinesthetic actions being performed in the ongoing description play an integral role in discursively revealing the particular physical features of the rock and thus are essential to the work performed in characterizing the rock as an instance of a given classification for the geologists. The character of the tactile action and the medium through which it operates should be qualified somewhat, however, as the tactility being depicted in the sequences is in fact only perceptible to others via sight and sound. The recipients in each excerpt only see and/or hear the rock crumbling or chipping; they do not simultaneously experience the tactile quality of the object being touched or struck with the hammer. Instead, what they do perceive in each instance is how the rock reacts to their interlocutor's manual and embodied manipulations. From there, they can infer and build consensus as to the tactile, haptic,

or kinesthetic experiences certain features or materials provide. As such, the “touch” being conveyed here is effectively depicted. This aligns quite nicely with what the paleontologist Geerat Vermeij describes as “tactile glances” (1999), or how the geologist “sees” structure through touch. What is not being depicted is something that is or might be visually available, as might be the case with an environmentally coupled gesture; what is being depicted is rather a quality of the feature or material when physically acted upon as one might with his or her hand, foot, or rock hammer. Importantly, this is not made available via talk but rather through how the speaker’s body perceptibly engages with a mutually apprehended, co-present object and how it behaves as a result. The manual, tactile, haptic, and kinesthetic features of the practices described here play an integral role for the practitioners in discursively revealing the features that constitute the given object, particularly as an instance of an analytical category.

What is disclosed through an interactant’s tactile engagement with an object not only reveals but interacts with the physical properties of that object; different objects in turn might afford different experiences which arguably could be distinguished through touch and talk on varying levels of granularity. This can be seen in the excerpt subsequently, where two geologists, Wes and Zach, explain to Chuck, a visiting social scientist, how ashfall from ancient volcanic eruptions forms the different layers of stratigraphy that they can see in the exposed rock.

Excerpt 3 – “Tuff”¹

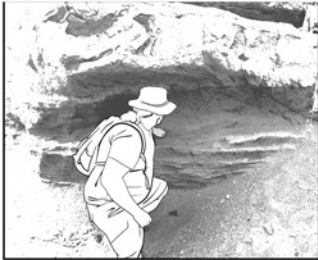
01 Wes: yeah:: so::
 02 what these other-
 03 >(°yeah/well)°< the folks in the know::,
 04 (h)i(h)hh were talking=
 06 Wes: =that these (flow::s:) up you're more
 07 .hhhhh like (.)
 08 ^that's when the things are rai::ning ou::t.
 09 Chuck: uh [huh
 10 Zach: [hhuh
 11 Wes: and more::: (.) ashfall:s
 12 =and those can get-
 13 start to be wel::ded mo::re.
 14 Zach: cool
 15 -> Wes: so: that's why
 w: +.....>
 16 -> they're +#a little bit tu::ffer.
 w:>+rubs-----+,,,,,
 fig: #fig.12.7



12.7

1 “Tuff” refers a type of rock made when volcanic ash is ejected during an eruption, deposited, and compacted into a (more) solid rock.

17 and the::n,
 18 (.)
 19 Wes: so we have tha:t ha::ppen,
 20 =and >then you can think about it<,
 21 we- (well) >you know< it's not o::ne,
 22 .hhhh con::tinu:ous thing
 23 all:: the ti::me.
 24 Chuck: [yeah]
 25 Zach: [s:ure::]
 26 Wes: [(it might] stop)=
 27 =and then we might have some rai::n,
 28 that comes throu::gh,
 29 and cuts cha::nnels through these things
 30 Chuck: mm mh
 31 Zach: huh
 32 -> Wes: +^an:d that's what they though:t,+
 w: +gaze-----+
 33 -> +(.) th::is stuff wa::s,+
 w: +.....>
 34 -> >cause::+this stuff< you can ju:st
 w: >+scrapes----->
 fig: #fig.12.8



12.8

35 -> +(2.2) +
 w: +-----+
 36 Zach: +yeah+[::.
 w: +,,,+
 37 -> Wes: [(%y'know°)
 38 -> >you can [tear it apar::t.
 39 Chuck: [I see::=yeah, yeah, yeah, yeah..

Wes's tactile depictions accomplish more than just deictically locating the referents for his utterances; rather, they ostensibly depict what the relevant criteria are for distinguishing the strata. Wes produces two tactile depictions in this excerpt, the first at lines 15 and 16 (Figure 12.7) and the second at lines 32 through 38 (Figure 12.8), at two different locations in the strata. He constructs the depictions so as to highlight differences in the rock at those points. The two layers differ primarily in their competency or coherency: whereas the first, upper "tuffer" stratum described is more "welded", more coherent, and thus less prone to breaking apart, the second, lower stratum is less welded, less coherent, and thus more prone to breaking apart. The strata are claimed to differ due to changes in the environment that occurred between the times in which they were deposited – something that Wes actively attempts to render throughout his reconstructed sequence of events.

The tactile actions Wes produces in the course of his descriptions work in highlighting the relevant perceptible differences between the strata. As he describes the first strata as “a little bit tuffer”, he reaches up to the layer and begins rubbing the rock over “a little bit” in line 16. In doing so, his recipients can see relatively little material being dislodged from the strata. This is in contrast to Wes’s subsequent depiction in lines 32 through 38. He reaches down toward the lower layer just at the end of his line 33, halts his turn-at-talk, “>cause:: this stuff< you can just”, and scrapes his hand down the length of the rock for the 2.2-s gap in line 35. He then stands up and turns toward Zach and Chuck and in lines 37–38 re-completes the turn he started in line 34: “(°y’know°) >you can tear it apart::t”.

The differences in the physical capacities of the two layers are readily made evident via Wes’s tactile depictions: Whereas his recipients might see very little material dislodged from the upper, “tuffer” stratum, they see a clearly greater amount of material dislodged from the lower stratum. The difference between the two strata is also audibly perceptible: Wes’s scrape against the upper “tuffer” stratum makes little noise, while his scrape against the lower stratum is much louder and qualitatively “coarser” in sound. He, moreover, constructs his tactile action at the lower stratum to be more prominent than the first stratum: whereas at the upper stratum, Wes makes no attempt to halt his speech or prosodically highlight his scraping at the rock, with the lower stratum, Wes actively structures his talk so as to provide space for its accompanying tactile depiction, where he emphatically “tears” against the rock, conveying how loose and unconsolidated that stratum is.

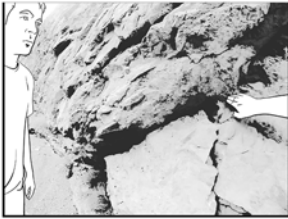
In the previous sequence, we see the speaker reveal the tactile qualities of the two strata through the observable ways in which he physically manipulates them in the course of his talk. A generic characteristic of how tactility (whether that be an object’s texture, coherence, weight, etc.) is made accessible is through the perceptible ways in which participants lift, touch, pick, prod, or otherwise manipulate objects and/or materials and how they in turn respond to these manipulations: for example, a “coarse” rock expectedly crumbles when manipulated. In short, tactile actions reveal percepts that otherwise would only be available to the participant physically engaging with the object; these in turn provide the speaker with ways for formulating those objects as coarse, flaky, tuffer, and so on. Touch is used to formulate aspects of objects and/or materials through the perceptible ways in which participants pick, prod, or otherwise manipulate them and how these in turn are altered (or not) as a result. And while the meanings conveyed are formulated via actions occurring outside the stream of speech, once produced within interaction, they become readily accessible to co-participants for subsequent use, re-use, and transformation in the interaction. This can be observed in Excerpt 4.

Here, Jack, a geologist, and Adam, a computer scientist, are inspecting a large, exposed fault in the rock. Just prior to the transcript, Jack had referred to “fault-gouge”, a loose aggregate rock one often finds in faults. Where we join the talk, Jack is outlining the direction of the gouge. At this point in the day, Jack had not yet

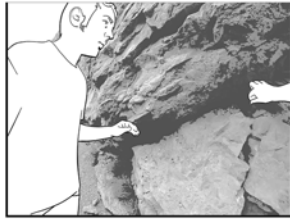
defined for Adam what “gouge” was, only that one could regularly find it at fault lines. As such, how Jack defines gouge here is for all intents and purposes its fullest description for Adam. Our focus is on how Jack’s initial tactile actions are produced and used and re-used through the subsequent turns-at-talk.

Excerpt 4 – Gouge

01 Jack: *so this is*where the ^gou::ge is coming down.
 j: *.....*traces----->
 02 >so:,* ^th:i:s:.
 j: -->*press--->
 (1.0)
 03 Jack: #s:tu::ff:?
 fig: #fig.12.9
 (0.8)
 04 Jack: .hh is the* ^fault gou::ge:
 j: ----->*picks----->
 (0.8)
 05 Adam: #yeah*::,
 j: -->*
 fig: #fig.12.10
 06 @ (0.6)@
 a: @.....@



12.9



12.10

10 Adam: it's just clay
 @#(1.4)@
 a: @press-@
 fig: #fig.12.11
 11 Adam: at this point.
 12 (.)
 13 Jack: *>yup< with::
 j: *.....
 14 *^ch#:unks* o:f::
 j: *pulls----*picks-->
 fig: #fig.12.12



12.11



12.12

16 (.)
 17 Jack: you know more intact rock.
 j: ----->

Jack's utterance in lines 1–6 is an ostensive definition: He defines “gouge” for Adam by pointing to an example, here being the rock that he and Adam are currently looking at in the road-cut. We can ask here, what is being ostensively provided for in his utterance? What is actually made accessible to Adam with this definition?

What is being ostensively provided for in Jack's utterance is accomplished as much through his tactile work as it is through his gestures or pointing. Moreover, Jack constructs his talk and embodied action to give salience to his tactile action for giving substance to the rock that he is attempting to describe. Jack locates the gouge by first tracing out where it is “coming down” and second touching it at his “this” in line 2 just in front of him and Adam. He then immediately starts manipulating the gouge, continuing to do so through the subsequent gap (line 3), his elongated “stuff” (line 4, Figure 12.9), and further (until line 9, Figure 12.10). In manipulating the gouge and easily dislodging debris from it, Jack reveals what he takes to be relevant for calling this rock “gouge”: its unconsolidated composition. He, moreover, coordinates his talk and tactile depiction, so as to preface this demonstration: He manipulates the rock during his deictic “this” and his placeholder “stuff”, as well as the interspersed gaps in lines 3 and 5 prior to his actually naming the material in line 6.

The way in which Jack manipulates the gouge ostensibly provides for its definition, and, moreover, provides for multiple parts of its definition. Fault-gouge is defined as loose, unconsolidated rock formed by the grinding of the two sides of a fault zone and consists of loose fragments ranging from 1) finer, particulate grain-sized material to 2) visibly larger pieces of intact rock. Accordingly, when Jack manipulates the gouge, he does so in two distinct ways: he first pushes against it with his fingertips, dislodging a finer range of material from the rock. He does so up until where he actually names the rock in line 6, where he then switches to picking at the gouge with his thumb and forefingers, breaking off larger pieces of intact rock. He does not explicate this distinction in his talk, but the ways in which he manipulates the gouge provide for both parts of its definition, and despite the lack of explication, we see Adam incorporating parts of this definition in how he builds subsequent action.

Adam follows Jack's turn-at-talk with “yeah::, (0.6) it's just clay (1.4) at this point” in lines 8–12. In so doing, he reaches up and presses against the gouge (Figure 12.11), similarly to how Jack first manipulates the rock. Adam's tactile depiction encapsulates a concise display of how one might manipulate clay, that is, a finely-grained and undifferentiated dirt: he rubs and presses his fingers uniformly against the surface of the gouge, dislodging material across the width of his fingers. Neither in his talk nor manipulation does Adam differentiate both aspects of gouge. As such, Adam's description might be characterized as somewhat incomplete from Jack's perspective. This is suggested as much in Zach's subsequent follow-up.

Zach's follow-up (lines 15–17) performs numerous operations on the prior talk, making relevant both what was formulated as well as what was not. It first agrees with it, “yup”, before expanding on its syntax with the prepositional “with chunks of (.) you know more intact rock”. By so doing, Jack simultaneously validates how

Adam described the gouge while also re-completing that description, reformulating the gouge as again consisting of both fine-grained clay as well as visibly larger “chunks of intact rock”, as Jack put it. Jack’s reformulation is also accomplished through the way he simultaneously manipulates the gouge. Whereas earlier, Jack both pressed against and picked at the gouge – depicting both parts of its definition – here, he only picks at the gouge, breaking off looser pieces of intact rock (Figure 12.12). As such, his tactile actions are more actively specifying that aspect of gouge that Adam had left unspecified.

Again, we see the interactants demonstrably operating on tactile understandings of the rock – its coherence or texture – that are not conveyed through the talk but through the embodied ways in which the participants manipulate the object. These manipulations and engagements in turn provide the means by which the features and materiality being observed coalesce into the analytical objects that animate both the situated discourse of the participants’ respective disciplines, as well as the overall, collaborative project. And though these tactile actions are embedded in discursive practices that consist of the coordination of successive turns-at-talk, gestural depictions, and other embodied actions, we see the physical structure of the object is made accessible through the methods the interactants use to kinesthetically engage with the tactile, haptic, or proprioceptive qualities of the object. In a multiparty interactions, multiple perceptions are iteratively gathered, reconstructed, and conveyed through multiple modalities, including sight, sound, and touch, and are made available for use, re-use, and transformation in the subsequent interaction. This work does not privilege the talk – indeed, it is rather via tactile manipulations and depictions (e.g., the rubbing, pinching, picking, scratching, and prodding) that the physical structure of the co-present features are revealed to the participants as public resources.

4. Discussion

Throughout the excerpts, we observe geological structures being revealed via the systematic practices that participants use for describing relevant features in their co-present world. We focus on one domain of practice in particular, actions performed via touch, and argue that practitioners routinely make use of tactile work for depicting different attributes of the objects or materials they are handling, making those accessible to recipients and thus consequential for their collaborative work.

Tactility is pervasive in the interactions between geologists, who must routinely articulate for one another the “feel” – the texture, composition, coherency, or competency – of the objects, features, and material phenomena they collaboratively investigate. Several components of this tactile work have been briefly investigated in the course of the analysis. First, we observe a particular class of embodied action whereby participants manipulate features within a co-present environment in order to reveal material qualities about those features for interlocutors. The meanings conveyed through this class of embodied action are not contained within the skin of the actor, with his or her concurrent talk, or even within the visibly stable

environment being referred to but are rather ultimately realized with how that environment is perceptibly altered (or not) as a result of those actions. What makes these actions particularly tactile is that the qualities attributed to the objects, for example, coarse, flaky, tuff, clay, are revealed through or manually accomplished with touch.

Tactile depictions are readily accessible to participants for use and re-use in the interaction. Participants regularly confirm and/or remediate what is depicted via touch as much as or more than they do on what is formulated via talk. Moreover, participants routinely construct their talk for the purpose of revealing the composition or coherency of a given rock as depicted via a participant's tactile action.

The geological work performed in the data is primarily ontological in its scope. It is preoccupied with formulating the presence of a given set of categories in the natural landscape. Looking at how the body, hands, and tools of the geologist, in engaging with the rock, are mobilized toward the goal of transforming observations into categories, we see the participants concerned with questions revolving around what something is: "What are you guys seeing?" "What kind of rock is this?" In turn, every rock contains many features; which ones do the geologists use in identifying the rock? Professional practice, including its perceptive foundations, provides participants with a set of categories, their associated features, and methods for applying these in work settings. As such, one needs actors who can be trusted and recognized to work appropriately with those objects.

The excerpts we examine have largely didactic or instructional purposes. As a result, a large part of the work being performed is oriented toward the question of how competent members' knowledge is (re)constituted in practice. Much of the work involved in instructing and socializing novices into being competent members of the discipline involves calibrating perception. Whether a practitioner agrees, disagrees, or withholds agreement to a formulation of the tactility of a given object is effectively the interactants' attempt at calibrating their perception of a given object, or aspects thereof. In Goodwin (1994), we see various actors using embodied, discursive practices guiding others on how to see a feature within a given category within a perceptual field. In field geology, particularly in the interactions under investigation here, we find a given feature in the landscape that the participants attempt to fit within a category, although the perception field being explored is tactile. A geologist cannot point to an object being "coarse" or "tuff", but he or she can depict it via its manipulation.

Much of the interactional work we see deployed toward co-present features operates on the tactile experiencing of their materiality. Not only is this relatively hidden from visual analyses; it is often resistant to precise description. Nonetheless, in the activities we observe previously, the participants accomplish this through the ways they collaboratively scrutinize the co-present object, reformulating aspects of it through successive and iterative turns-at-talk. As a result, we see the participants build an articulated perception of the objects that becomes more stable through the course of the interaction. This was possible even when there existed large gaps in the interactants' expertise. Little knowledge about geology could be presumed

to be shared outside of what the geologists could collaboratively establish in their ongoing interactions. Nevertheless, in each instance, we see participants construct an in situ inventory of knowledge that they then draw upon in collaboratively experiencing the co-present world.

Much of this work falls under what Mogk and Goodwin (2012) describe as pre-inscriptional practices – that is, the interactive, manual, and embodied work that practitioners deploy in locating, extracting, and depicting natural, unaltered features and materials in the co-present landscape. In this regard, we see tactile practices provide one of many means participants have for making these liminal, working objects amenable to scrutiny through some tactile manipulation, (e.g., picking at, scraping, chipping, or pounding on it with one’s hand or hammer). The geologists literally break apart the world for the express purpose of making that accessible for what Latour and Woolgar (1979) described as inscriptions – that is, the discursive artifacts that animate discourse in a given discipline such as geosciences as both a community of practice and body of knowledge.

In working with features and materials taken from the landscape, we see practitioners in these settings not engaging with objects that are isolated and self-contained (at least in their first appearance). Rather, we see the objects emerge from the dense materiality that the practitioner operates within. As a result, we see geological objects, from their initial noticing to their description and extraction, continuously being revealed by the geologists for one another as “progressively witnessable and discourseable” (Garfinkel et al. 1981, 138). This progressive process is produced via the set of professional practices that include the technical and analytical procedures that geologists use for searching for, locating, extracting, and describing geological phenomena. This work, however, necessarily depends on the interactional work of noticing, scrutinizing, and handling meaningful objects. Through such actions, they mobilize their co-participants’ attention toward various aspects of co-present objects, making that phenomena discursively co-present and actionable. It is with these practices that the material phenomena are revealed incrementally in their “unity” as analytical objects in time and through interaction (McCumber 2011, 148) and through which the natural world here enters discourse and is then (re)constituted as socially meaningful and consequential.

Conventions

Transcripts use Mondada’s conventions for transcribing multimodality (2018a).

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