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# Revealing Objects and Aspects in Scientific Practice

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*Abstract*
In this paper, we investigate how objects emerge as a focus for participants in interaction in their situated work (here, being geo-scientists working in either a laboratory or wilderness setting). We investigate the practices that participants use for directing others' attention towards the multi-sensorial qualities of co-present features, in order to discursively reveal those features as categorical and work-relevant objects. These practices are systematic and take aspects that are otherwise ineffable and transform those into public resources in order to build both current and subsequent action. Conversely, the practices that participants have for disclosing the experience of an object are part of the same means through which the object itself emerges via interaction.

*Keywords*: Objects in Interaction – Conversation Analysis – Ethnomethodology – Scientific Practice – Aspectual-seeing – Multimodality – Multisensoriality.

*German Abstract*
In diesem Artikel untersuchen wir, wie im Kontext der situierten Arbeit Objekte als Gegenstand geteilter Aufmerksamkeit in der Interaktion entstehen. In unserem Fall geht es um Geowissenschaftler, die im Labor oder in der Wildnis arbeiten. Wir untersuchen Praktiken, die Teilnehmer anwenden, um die Aufmerksamkeit auf multi-sensorische Eigenschaften der Merkmale der Objekte zu lenken, damit diese Merkmale als kategorisch und arbeitsrelevant präsentiert werden. Diese Praktiken sind systematisch und verwandeln ansonsten unsichtbare Aspekte eines Phänomens zu öffentlichen Ressourcen, damit Gesprächspartner laufende und nachfolgende Handlungen ausführen können. Als Fazit ergibt sich, dass Praktiken, die Teilnehmer zur Offenlegung ihrer Erfahrung eines Objekts benutzen, Teil derselben Mittel sind, durch die das Objekt selbst in der Interaktion entsteht.

*Keywords*: Objekte in der Interaktion – Konversationsanalyse – Ethnomethodologie – Wissenschaftliche Praxis – Sehen eines Aspekts – Multimodalität – Multisensorialität.

## 1. Introduction

In mundane day-to-day life, we tend to think of objects in relatively simple terms, in how they appear to us, how we physically interact with them, their relation to other objects, within categories, etc. We perceive them as intact, whole, and separate from their material surroundings: a coffee cup, for example, is separate from the table it sits on. The wall, while a part of the room, is nevertheless treated as conceptually distinct from the floor below or ceiling above. Objects are, moreover, routinely recognized, tacitly and publicly, as self-evident instances of a categories – and as instances of those categories, they are operated on as being comprised of features, attributes, or properties. These in turn can be seen as either incidental or necessary for the object's membership to a category: A soccer ball, for example, may be white, but its color is not a necessary property for using the ball. "Round" on the other hand is a necessary property. It is relatively uncommon outside of manufacturing or arts & crafts for persons to find themselves deliberating on the properties of a given object and whether they align with or deviate from what is otherwise anticipated given its categorical description or practical use – rather, the object is used as prescribed or rejected as defective. In most mundane contexts then, the category is first and foremost *the perceived thing* that shapes how a given instance is analyzed and operated on in any circumstance.

### 1.1. Objects in Scientific Practice

In many settings, especially like the laboratory and field settings investigated here, objects rarely manifest themselves simply. Instead, they emerge as products of collaborative work, where practitioners co-operate on objects and/or materials for their emergent potential as members of a given category, and do so by identifying and assessing various features, attributes, properties made available to them via different sensory modalities. The objects handled by the practitioners investigated here, particularly in field geology, are, moreover, embedded in a physical landscape and not so easily distinguishable from their material surroundings – at least not without the perceptual, discursive, or embodied work needed in extracting them. As a result, how the object emerges in these settings, how it is apprehended by participants, can often be distributed across a number of modalities. What appears to be oriented to in perceiving an object is rather a constellation of different features, including location, object(s), properties, and perceptible qualities – all of which are mutually elaborated through the interaction.

A growing body of work in interactional research has turned its attention towards investigating how participants use objects to facilitate their courses of action, and how co-present objects in turn are recruited by and transformed via those interactional processes. Nevile/Haddington/Heinemann/Rauniomaa (2014) distinguish two trajectories for how objects are used in interaction: We either see participants interacting with objects or in turn using objects in mediating interactions with others. Here, objects act as "situated resources" and are recruited by persons in facilitating whatever course of action they are pursuing. Conversely, we see objects being shaped and operated on by participants as emerging in and through social interaction. Here, objects emerge as "practical accomplishments" as the outcome of the

interaction or participants' situated work (Nevile/Haddington/Heinemann/ Rauniomaa 2014; Neville 2018). Work on such object-centered interactions demonstrate the range of interactive work accomplished through the handling, manipulation, and/or orientation toward co-present objects, whether that be in a) transforming the organization of social interaction through activity shifts (Brassac/Fixmer/Mondada/ Vinck 2008; Fasulo/Monzoni 2009), b) facilitating participants' situated work (Fox/ Heinemann 2015; Gåfvels 2016a, 2016b; Goodwin 2010; Lindström/Norrby/ Wide/Nilsson 2017; Mikkola/Lehtinen 2014; Jakonen 2015), to the construction of basic action (Mondada in press), and the management of social relationships in video-mediated interaction (Licoppe et al. 2017).

The objects analyzed in this paper are, moreover, continuously revealed via the practices that practitioners have for experiencing objects, specifically, as multi-sensorial phenomena and reformulating that experience for one another in interaction. In the context of geological field- and laboratory-work, the objects are operated on as multi-sensorial objects, leading participants to use touch, sound, and smell in revealing and recognizing the object as well as transform it in collaboration with others. Recent work has demonstrated the numerous ways in which interactants operate on objects primarily for how they are experienced sensorially, whether that be tactility in object-mediated interactions with blind participants (Kreplak/Mondémé 2014) or touch, taste, and smell (Keisanen/Rauniomaa this issue*;* Mondada 2018a, 2019, this issue). Here, we see the sensorial (re)constitution of objects come to the forefront of the interaction and the participants' mutual orientation, as they attempt to articulate for one another the sensory experience of what smelling, tasing, or touching a particular object is like. Such is central to the data analyzed here where the interactants use numerous senses in deliberating on the classification of the objects they are scrutinizing in their collaborative work Accordingly, we do not analyze a particular type of practice (e.g., assessments, directives, etc.) accomplished via the handling of a given object, so much as we are analyzing the emergence and fluidity of objects and the multiplicity of multi-sensorial forms they take as interactants operate on them in the course of their situated work.

## 1.2. Transforming Objects via Aspectual Change

Participants accomplish this work through what Wittgenstein referred to as "aspectual seeing," or how a person notices an aspect of something they see, hear, feel, etc. Malcolm Budd clarifies this in the open of his essay on Wittgenstein's aspect-seeing (1987:1):

> When we are looking at an object we sometimes see that it has not changed while we have been looking at it and yet the way in which we see it has changed: we see it differently, although we see that it is no different from how it was.

Wittgenstein was primarily interested how aspects change for an observer and the consequences this had for how an object was perceived: In noticing an aspect of something already seen, heard, felt, etc., the observer changes from seeing something as an instance of one kind of thing to seeing it as an instance of another. This can be occasioned by changes in figure and ground in the composition of the thing being perceived, or it could be occasioned by the sudden shift in seeing something via its likeness to something else. Though these shifts may focus on different facets

of the object(s) being considered, all aspectual seeing is at its core an issue of "...what, if anything, ceases and what, if anything, takes its place" in noticing something that one had not before (ibid:2). For the analysis presented here, however, various aspects are operated on as meaningful primarily for their relation vis-a-vis one another, and more importantly, the aspectual changes we observe throughout the data are occasioned by the participants' embodied and discursive actions.

In the analysis below, we examine five excerpts where participants attend to a co-present object for the purpose of guiding their recipient's attention toward some perceptible quality given off by the object (Excerpts 1 and 2) or manipulate the object in some physical manner (e.g., hammering the outcrop in Excerpt 3 or prodding at the rock in Excerpts 4 and 5) so as to occasion an aspect for their recipients to experience and recognize as salient for their ongoing work. Both means disclose aspects of the object that in turn inform co-participants about its relevant properties of the object: e.g., how coherent it is, whether its "coarse" enough to be described as such, how far along its reaction is, or one should experience a given category of rock.

## 2. Data & Methods

This corpus is drawn from four separate video-documented, multi-day, ethnographic trips to field-based projects with field geologists. The study participants involved included late- to early-career geologists, graduate students, advanced undergraduate researchers, and undergraduate students in a geology capstone field-course. In the latter two field studies, the participants also included computer, information, and social scientists in addition to geoscientists as part of a multi-disciplinary collaboration. Each of these visits were video-recorded while the researcher(s) accompany the participants in the field documenting how they move through the landscape, find locales of interest, locate and investigate geological objects, make drawings, measurements, or collect samples of geologically relevant phenomena. After the data were collected and brought back from the field, the videos were transcribed and analyzed with a focus on the participants' use of talk and embodied practices. This relies on the careful transcription of recordings, developed for talk (Jefferson 2004) and for multimodality (Goodwin 2007, 2010; Mondada 2016, 2018b).

## 3. Analysis

Professional communities, such as with geo-scientists, scrutinize phenomena in the environment according to the categories and courses of action that facilitate their collaborative projects. Practitioners use a range of sensory experiences, including sight, hearing, smell, and touch, and embodied practice, to locate, extract, and/or construct the distinctive artifacts that animate their work. Moreover, they must be able trust other members of their respective community to also be able to experience relevant structure in the complex visual field provided by the emerging structures in the co-present landscape in roughly analogous ways. Indeed a crucial component of what it means to validly assume the identity of a geologist is mastery in such professional vision and a bulk of the work that takes place in professional settings

is the socialization of novice members into this mastery (Goodwin 1997; Mogk/ Goodwin 2012).

In Excerpt 1a below, a student working with others on a geology field project in the Yellowstone wilderness closely scrutinizes the rock fragment she holds with a loupe.

**Ex. 1a - Muscovite**

```
01      Nina:  and plag::
02   Darrell:  yeah
03      Nina:  nn:::::: and a little bit of °biotite
04             Is there muscovite in this too.
05               (0.3)#
          fig:          #fig-1.1
```

Figure 1.1

```
06     Sarah:  Yea:h. I don't know what #that-,
          fig:                          #fig-1.2
```

Figure 1.2

```
07               (0.2)
08      Nina:  I think there i:s.
09   Darrell:  Yea^:h.
10              (1.2)
11   Darrell:  °now
```

```
12   Darrell:  Remember muscovite was one of those things
13             we're lookin for.
14      Nina:  [Yuh.
15     Sarah:  [Yuh.
16      Kate:  [Yeah.
17      Nina:  So we should take a station here?
               ((continued…))
```

As Nina inspects the rock, she lists the features that she sees (e.g., *biotite*, a mineral) before asking about there being *muscovite* present. This differs from her unproblematic (and uncontested) recognition of biotite just a moment earlier.

Nina's openly inquiring about the presence of muscovite (line 4) provides space for input from others. Sarah, standing next to Nina, leans and points towards the rock suggesting that she also sees muscovite. Darrell, the senior geologist, confirms Nina's suspicion with *Yea:h,* muscovite is indeed visibly present, and then reminds the group that *Muscovite was one of those things we're looking for*. Nina follows Darrell's utterance with a question/proposal, *So we should take a station here* showing her recognition of muscovite as not only being a valid classification, but something that organizes the group's subsequent work.

The participants handle and manipulate the rock fragment according to the projects they are pursuing. One is in determining whether the outcrop from which the sample is taken is appropriate for taking a station. The other is alternatively, the enskillment of novices, specifically in the sensory competencies necessary for their work. We see the latter in the continuation of the sequence below, where the rock fragment progressively emerges as an instructionally relevant object, which in this instance is about being competent in identifying and recognizing muscovite, in the "wild".

**Ex. 1a - Muscovite**

```
17      Nina:  So we should ∆take a station here?
          s:                ∆
18               (1.0)
19   Darrell:  n' then,
20     Sarah:  #Is it that.#
         fig:  #fig-1.3    #fig-1.4
```

Figure 1.3

Figure 1.4

```
21               (0.6)
```

```
22   Darrell:  Yeah. Stuff's really silvery th[ere.
24     Sarah:                                  [that's m(i)-
25     Sarah:  >that's, muscovite
27   Darrell:  #Yeah. That's muscovite.
        fig:  #fig-1.5
```

Figure 1.5

```
28     Sarah:  [Okay
29   Darrell:  [Stuff that looks rea:lly silvery
30               (0.6)
31     Sarah:  Oka[y.
32   Darrell:     [Flashes at you kinda of a silvery color
```

From line 17 to 20, Sarah takes the fragment from Nina, inspects it, points to a place on its surface, before moving it toward Darrell and asking him, *is it tha:t?* In line 21, Darrell leans in to inspect the fragment in the subsequent 0.6 gap, before confirming Sarah's question in line 22, also pointing to the fragment: *Yeah. Stuff's really si:lvery there?*. Sarah subsequently seeks re-confirmation, which Darrell provides, again describing it as *(th')stuff that looks rea::lly sil:very::*, while both participants continue to gaze at and point at the place on the rock

Rather than just operating on the muscovite as a taken-for-granted classification for a mineral seen in the rock, both participants persevere through multiple sequences in checking its description alongside the criteria for determining its presence, that is, its perceived "silvery" luster (something Darrell reiterates at numerous points in the talk: lines 22, 29, and 32) to be the relevant criteria. The manner in which both participants operate on the fragment is guided by the instructional demands of the situation. Having already determined the presence of muscovite, Sarah uses this occasion to check her perception of the mineral using Darrell's expertise as a resource. The group expends "... extra time and effort to consolidate their embodied experience of what actually constitutes an exemplar of the category muscovite in the dense, complex rocks actually encountered in the field" (Goodwin 2018:353). In doing so, we see the participants carefully inspect what has now been identified as muscovite, learning how to align a given appearance, the "really silvery flecks" with the classification which in turns gives substance to that classification.

In this relatively brief sequence, while the participants are handling a distinct object, i.e, the rock fragment they are inspecting, they operate on it more so for its internal composition and relation to the exposed outcrop from which it was extracted. The discursive significance given to the fragment is derived from its aspectual consideration. In coordinating their collaborative work towards the "muscovite," they do so, moreover, via its experiential underpinning: e.g., *really silvery stuff* or *flecks* as Darrell and Jim put it, respectively. Altogether, we see that the participants' ability to collaboratively identify this fragment as having a distinct make-up and character and in turn use that to coordinate action demands a fluidity through which they move between referring to a given type, its substantive criteria, and their manual handling of the fragment itself.

In order to be usable, the features and/or materials relevant to participants' work require differentiation, extraction, and/or their manufacture by the participants – either from other prior materials or from the co-present surround itself. As a result, the objects being investigated by our participants rarely exist in their final form; rather, they emerge through time and through practice in the co-present setting in the participants' perception. We suggest in our analysis that where practitioners manipulate objects, they do so to make relevant experiences accessible. Even where no object is being actively manipulated by the participants (such as our case below where the co-participants are monitoring a chemical reaction), practitioners nonetheless direct one another's attention toward the developing chemical reaction.

In this excerpt, from a geo-chemistry laboratory, the lead investigator, Bill, is stirring a chemical reaction in a vat, while a student researcher, Robin, sorts fibers on the floor. Of interest here are the discursive and embodied practices the participants use for direction attention towards the smell emanating from the vat and the significance attributed to that sensory experience.

**Ex. 2 - Ammonia**

```
01    Bill:  So are'ya getting some of that(.) (0.4)
02           kind of ammonia smell: from it?
03              (1.8)
04    Bill:  #Smell a little bit of ammonia?
       fig:  #fig-2.1
```

Figure 2.1

```
05              (.)
06   Robin:  From what. that?=
```

07 Bill: #From thi:s?
***fig: #fig-2.2***

Figure 2.2

08 (1.6)
09 Bill: See if you can recognize tha:t.
10 (4.2)#(1.8)
***fig: #fig-2.3***

Figure 2.3

11 Robin: KKhhuh #KKhhuh KKhh [h
***fig: #fig-2.4***

Figure 2.4

12 Bill: ([heh)
13 Robin: There's somethin. I c'd- I'd [(yih know)
14 Bill: [°yeah
15 Robin: I wouldn' know what [it was
16 Bill: [That's the C:: :H [:N:
17 Robin: [khhh
18 (1.2)
19 Bill: So in the oxidation:,

```
20          some of the thuh- (0.4) nitrogen, (0.5)
21          goes to ammonia.=apparently
22   Robin: (it's something)
23             (0.8)
24   Robin: .nhhhh It's awfully stro::ng.
25    Bill: Mm hm
26   Robin: Distinctive.
27          If I ever sm(h)elled th(h)at again
28          I'd know what it i(h) [s:
29    Bill:                       [°Yea(h)h
```

The talk opens with Bill making multiple inquiries in lines 1-4 as to whether Robin recognizes a smell coming from the vat. Both of his inquiries presuppose the presence of the smell and its accessibility for Robin to recognize and assess, even offering a candidate identification for the smell as 'ammonia like.'

While Bill invokes this smell as a being relevant here in this moment, Robin shows little to no immediate uptake. Her first opportunity to do so passes after a rather lengthy 1.8 second gap in line 2, and after a slight delay, she responds in line 3 with a repair initiator, *from what?*, and a candidate *that?* gesturing towards the vat, which Bill confirms. Bill then directs Robin to the vat with *see if you can recognize tha:t.* She walks to the vat, leans in to smell before standing up and coughing in line 9, providing a visceral reaction to the fumes (appropriate if one is breathing in ammonia). She nevertheless resists equating that smell with ammonia, instead, only acknowledging that *°yeah, there's somethin. I c'd- I'd- (yih know). I wouldn' know what it was.* After Bill gives some explanation as to what causes the smell, Robin continues describing the smell as *awfully strong* and *distinctive* before finally stating that *if i ever smelled that again, I'd know what it is.*

Throughout this sequence, we see an emerging smell is brought to Robin's attention by the instructor, and she in turn shows her recognizing its presence – even if she does not align with its description as *ammonia-like.* In confirming there being a distinctive smell in that moment she aligns with its significance for the progress of the reaction, an experience she can recall and use at later points in their collaborative work. Accordingly, Robin displays a greater competency in handling the materials necessary for their work in the laboratory and as a result expands her competency as a member of both the lab and larger community of practice. The percept invoked in this excerpt further contributes to the objectivisation of the reaction as something that can be recognized and mutually monitored by the participants.

While in the prior excerpt the smell emerges independently of the participants' immediate actions, in other instances, revealing aspects of objects often requires the participants to actively manipulate the object. This can be seen in the next excerpt. Here, geologists are breaking apart an exposed outcrop to take samples. The interaction begins when Darrell asks for a hammer to tap against the exposed rock in order to determine where the rock is weakest (that is, ‘looser' or ‘less coherent') and thus easiest to break apart. As he taps against the rock with the hammer at different points, he and the students comment on the changes in sound, specifically in how those reveal the rock's structure.

## Ex. 3 - Hammer[1]

```
01  Darrell:    ^TO::M:;
02               Why don't you take your hammer over here.
03               I'm just curious how loose this is,
04  Darrell:    I just want to tap it a few times to see
05                  (.)
06  Darrell:    how coherent it is (so::)
07               (1.0)*#(.)*(.)*(.)*(0.5)*
          d:          *    *   *   *     *
        fig:           #fig-3.1
```

Figure 3.1

```
08                  (.)@
          d:           @
09  Darrell:    oo:@:h::@#: °this thing@ mi:ght go°
          d:          @    @             @
        fig:             #fig-3.2
```

Figure 3.2

```
10               @(0.3)@(0.3)@(0.3)@(0.3)@(0.4)
          d:     @     @     @     @     @
```

[1] The symbols used in the transcript (e.g., *, @, Δ, +) mark hammer strikes separated by intervals of time. Changes from symbol to symbol mark changes in the sound made by the hammer as Darrell taps against the rock.

```
11      Tom:    sounds pr∆#etty hol∆low
          d:              ∆         ∆
        fig:               #fig-3.3
```

Figure 3.3

```
12                 (0.2)
13  Darrell:    r+ight +#there::
          d:     +     +
        fig:              #fig-3.4
```

Figure 3.4

```
14                 (0.1)+(0.5)+(0.5)+
          d:            +     +     +
15  Darrell:    hear that?=
16      Tom:    =:yea+h::
          d:            +
17     Matt:    :uh-uh
18                 +(0.3)+(0.2)
          d:       +     +
19  Darrell:    that +might break off
          d:            +
20                 (0.3)+(0.3)
          d:            +
21  Darrell:    let's *see if: dave is
          d:             *
22                 =a[ble to get a good sample=
23     Matt:         [what *abou:::t,
          d:                *
```

```
24  Darrell:    =<that's h*#ard::,
                          *
        fig:                #fig-3.5
```

Figure 3.5

```
25                (0.1)*(0.1)
          d:           *
26  Darrell:    that's* not going anywhere,
          d:            *
27                   (.)
28  Darrell:    but +right here+
          d:        +          +
29                 (0.3)+#(.)
          d:           +
        fig:            #fig-3.6
```

Figure 3.6

```
30  Darrell:    yeah:; that whole thing's shaking
31                   (0.2)
32     Matt:    :yeah:
```

Darrell probes the outcrop across several points on the rock commenting on the changes in sound his hammer makes. His initial taps against the rock occur in line 7. In that same gap, he moves to an adjacent location. Just as he begins tapping there, the sound changes to a more hollow sound. Darrell's response cry marks the significance of this change, while his subsequent °*this thing might go*° frames the change in sound at this point in terms of how it reveals an unfolding, locally-relevant and contingent future coordinated on breaking apart the rock. Tom goes even further in describing the sound in line 11 as sounding *pretty hollow.*

As Tom provides his comment in line 11, however, Darrell is already moving across the rock before remarking in line 13, *right there::*, while tapping against the rock, marking another change in the sound as particularly salient at this point on

the rock. The significance of this point on the rock is further emphasized in Darrell's subsequent question, *hear that?*, inquiring whether Tom and Matt also recognize the difference in sound at this point, and his final, *that might break off* in line 19. Darrell's utterances are deictically tied to the place on the rock where they are produced, the time in which they are produced, and finally the distinct quality of the sounds as they change through the sequence.

Just as Darrell proposes in line 21 to wait and see whether Dave is able to get a good sample, he begins tapping over the same locations on the rock again. In doing so, he frames both the tapping and talk as reconfirming the points on the rock that were least likely to break (i.e., lines 24 and 26: *that's hard* and *that's not going anywhere*) in juxtaposition to the point that was most likely to break (line 28: *but right here*).

Synthesizing the last two examples, we can see that in both, participants collaboratively provide for and engage in "aspect-seeing," where various aspects of an object are made accessible via sight, smell, or sound, and thus made actionable for others and finally reveal that object as something slightly different than it was before. Additionally, we see the objects both provide a medium through which practitioners conduct their collaborative work, while also being revealed via that work: A smell emerges from the ongoing chemical reaction which reveals its progress, and different sounds made by Darrell's hammer are due to the differences of the hidden composition of the rock which in turn informs the geologists of where they may subsequently break the rock. Directing attention to the perceptibility of these aspects provide for opportunities for mentors and novices to calibrate their shared experience of the objects and phenomena they are investigating, it also provides opportunities for novices to develop their own competence as members of their respective communities of practice. Aspects of objects in the previous examples were further revealed as actionable particularly in their temporal organization and informed the practitioners what was currently happening, what might happen, and what range of possibilities were open or closed to the practitioner next. Objects become knowable and actionable through the temporal horizons that co-participants project through their use.

In the excerpt below, we see an array of actions deployed through different modalities toward revealing a co-present structure, transforming it into a categorically relevant object. Just prior to the excerpt, a group of senior and novice geologists stop by the side of the road to examine the exposed rock at a road-cut off the side of a highway. The talk opens as the lead geologist, Dave, approaches Matt and Austin and asks in line 01 *so what are you guys seeing?* initiating what turns out to be an IRE (initiation, response, evaluation) sequence which gets extended several times by Dave throughout the excerpt (Zemel/Koschmann 2011). The focal talk belongs to Austin who reports that he and Matt *found one of the those boudinage structures*.

**Excerpt 4a - "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- found one of those boud@inage structures
         a:                                  @.............>
```

```
06                  @#right here
          a:        @traces--->
        fig:         #fig-4.1
07                   (1.0)#@ (0.4) @ (0.2) @
          a:        -------@,,,,,,,@.......>
        fig:              #fig-4.2
```

Figure 4.1

Figure 4.2

```
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
```

While Austin displays little doubt about his classification (referring to it as "one of those"), we see through the excerpt that its presence of the object is in fact not self-evident to Dave, and instead depends on the ways in which Austin describes and depicts it in his talk and embodied action, with each formulated aspect requiring its demonstration in the rock.

We see this first in Austin's use of gesture: As Austin reports on the structure in line 5, he reaches up to the rock face (just prior to his deictic, *right there*) and using a pincer-like gesture, traces the outline the structure (lines 6-7, figs. 4.1-2). It is only here (after the approximately 1.6 gap in talk in line 7) that Dave confirms his also seeing the boudinage in line 8: *there you go.* Austin continues elaborating on the structure in line 10 in incremental fashion, *pinched- pinched off at the top,* while pointing towards the rock, which Dave again confirms in line 11. This response-evaluation occurs in lines 18-19 again, where Austin points toward and animates the structure pinching off in the other direction. Throughout the sequence we see an alternation between categorizing and describing the structure and demonstrating that description through its visible depiction in the rock via gesture (similar to how

in Ex. 1, the participants alternated between labeling the muscovite and grounding that labeling in its sensorial experience: "really silvery stuff."). The depiction of the boudinage structure continues in the rest of the excerpt after a follow-up question from Dave: *so what's the rock type.*

**Excerpt 4b - "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-------------->
       fig:                  #fig-4.3
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-4.4
39                 (0.2)
41    Dave:      @#yeah.
         a:      @gaze->
```

Figure 4.3

Figure 4.4

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

Austin responds to Dave's question using tactility. Just prior to line 34, he reaches up to the rock he describes *a lot more felsic stuff,* and with the flat of his hand, begins pressing on the rock (fig. 4.3). Over the subsequent 3.1 second gap in line 35, he reaches down toward the rock that he had earlier described as "pinching off" (line 18) and starts picking at the rock describing it as *it's ve::ry course* in line 36 (fig. 4.4). Just as he finishes his utterance, he starts breaking off pieces of rock and continues doing so through the subsequent 0.8 second gap in line 37. Dave's evaluation, *that one i:s. yeah.*, in line 38 confirms the just prior description. It does so conditionally, however, only confirming the 'coarseness' of the rock that Austin just probed.

Whereas in the earlier excerpt, where Austin's description is demonstrated via his tracing out the layout of the structure, the question being answered here is about formulating the composition of the rock. In picking at the rock and breaking off pieces, Austin provides an ostensive demonstration of 'coarse' as an aspect of the rock crucial to its description. Altogether, we see that the embodied and tactile actions that Austin uses in formulating various aspects of the the object in turn comprise a meaningful and thereby constitutive component of how it is perceived and emerges in this setting.

The way in which Austin depicts the structure in his talk and embodied action throughout the excerpt is well fitted not only for how it is perceived in the rock, but for how boudinage is defined as a geological object: Boudinage, adapted from the French "boudin" (a type of linked sausage), denotes a segmented or "pinched" layer or vein of rock enveloped within a different type of rock (Voight 1987). Visually it appears as having thicker sections periodically segmented by thinner sections, with each typically denoting more and less competent material, respectively. Accordingly, Austin's pincer-like gesture in lines 6 to 7 traces the thicker portion, while his point in lines 9 to 10 locates where the layer thins or "pinches off" as he put it (thereby marking the less competent material). Through his talk and embodied action, Austin projects a reasoning for what type of object this is – one that is more or less affirmed by Dave, the more senior member, especially in Excerpt 4a. Austin's subsequent tactile work in Excerpt 4b in dislodging debris from the rock is not incidental to this project; indeed, it is quite essential, as where the rock thins, it is presumed to be a less competent, and thus coarser (i.e., made up of less consolidated grains of rock) and easier to break apart with one's fingers. Ultimately, the meanings conveyed via Austin's tactile action are treated as essential for his attempt at describing the rock as coarse, and consequentially, Dave coordinates his later agreement on what Austin does with the rock in his hands.

In the next excerpt, Jack, a geologist, and Adam, a computer scientist, are inspecting a large fault-line in a road-cut. Just prior to the excerpt, Jack refers to "fault-gouge", a loose aggregate rock often found in fault-lines. As we join the talk, Jack points out an example of fault-gouge on the rock-face for Adam. As is the case with the previous excerpt, Jack formulates the co-present object, gouge, through a number of different modalities, including the way he physically manipulates the gouge with his hands. In picking, scratching, and prodding at the rock, repeatedly knocking away and breaking pieces of unconsolidated rock ostensively depicting aspects of how gouge is defined. These depictions in turn provide for the object's emergence as a perceivable and knowable thing in the interaction.

**Excerpt 5a - Fault-gouge**

```
01     Jack:  *so this is*where the ^gou::ge is coming down.
          j:  *.........*traces--------------------------->
02            >so:,* *^th:i:s:.
          j:  ---->* *press--->
03              (1.0)
05     Jack:  #s:tu::ff:?
       fig:   #fig-5.1
06              (0.8)
07     Jack:  .hh is the* *^fault gou::ge:
          j:  --------->* *picks---------->
```

```
08                (0.8)
09      Adam:   #yeah*::,
10              @ (0.6) @
           j:   ---->*
           a:   @.......@
         fig:   #fig-5.2
```

Figure 5.1

Figure 5.2

Jack explains what *fault-gouge* is for Adam by pointing to an instance of it. He begins by locating it on the rock-face, tracing along the fault in a downward sloping motion, until arriving at the gouge just prior to his *this* in line 2, where he start prodding at the gouge with his hand. He manipulates the gouge in two ways: He first presses against it with the tips of his fingers budging finer grained debris from the rock (lines 2-8, fig. 5.1), before switching in the same turn-at-talk to picking and scratching at the gouge dislodging larger pieces of intact rock. He continues to do so throughout line 7 and into line 10 (fig. 5.2). His manipulations of the rock provide not only a demonstration of "gouge," but the multiple components of its description: gouge is defined as loose, unconsolidated, and brittle material made up of aggregate rock and consists of both fine particulate and larger pieces of intact rock. The composite nature of the object's definition comes up again in the continuation of the talk.

**Excerpt 5b - Fault-gouge**

```
09      Adam:   #yeah*::,
10              @ (0.6) @
           j:   ---->*
           a:   @.......@
11      Adam:   it's just clay
12              @ #(1.4) @
           a:   @press---@
         fig:     #fig-5.3
13      Adam:   at this point.
14                 (.)
15      Jack:   *>yup< with::
           j:   *.............
16              *^ch#:unks* o:f::
           j:   *pulls----*picks-->
         fig:       #fig-5.4
```

Figure 5.3

Figure 5.4

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

In lines 9-14, Adam confirms Jack's description with *yeah::, (.6) it's just clay (1.4) at this point*. He concurrently reaches up and presses against the gouge in a manner similar to how Jack first manipulated the rock (line 5, fig. 5.1). Adam's manipulation complements his utterance as it provides ostensively a demonstration of how one might experience clay: While the picking made with a thumb and forefinger differentiates 'chunks' from their surrounding matrix, the pressing that Adam does here (and Jack did earlier) makes no such differentiation; it treats the material it presses against as largely undifferentiated in texture as one might except "clay" to be or other fine, particulate material. Each component – the talk, manipulation, and the gouge itself – mutually inform one another, and thus incrementally reveal the object through the interaction.

While Adam's manipulation mirrors Jack's earlier, it only depicts one part of how gouge is defined, something that Jack's subsequent talk and embodied action seemingly orient to in lines 15-18. Jack's talk here enacts two relevancies for Adam's prior. It begins with an agreement token while elaborating on it. In doing so, it both adds to and re-completes Adam's prior description, displaying that gouge is not only made up of finer, clay-like material but also larger intact chunks. Jack manipulates the gouge animates this aspect of the rock: Whereas earlier in the transcript, Jack both 'pressed' and 'picked' at the gouge, depicting both aspects of its definition, in lines 15-18, he only picks at the gouge breaking off piece of intact rock. The cumulative effect of his embodied and discursive conduct simultaneously recognizes the prior description of gouge as "clay", while also manual explicating part of the gouge made up of smaller embedded 'chunks of intact rock.'

As with Excerpt 4 the interactants demonstrably operate on aspects of the object that are revealed not just through the talk or sight, but through the speaker's engagement with the materiality of the object. This in turn provides the means by which that object emerges to the participants as a categorically meaningful object. Altogether, the fault-gouge emerges from the successive coordination of talk, manipulations, and the structure of the gouge itself, with each co-operating on and mutually elaborating one another. Moreover, these co-operations do not privilege the talk; rather, Jack's picking, scratching, and pinching at the gouge makes visible its physical structure and thus takes up brunt of the categorical work in revealing how gouge is defined. Lastly, the visible differences in how Jack manipulates the rock are not incidental to how they alternatively formulate the gouge. As such, pinching larger chunks of intact rock remediates Adam's prior incomplete formulation, because it provides a greater specificity for the object being considered.

## 4. Discussion

A generic property of the interactions we observe is that the descriptions we see participants apply to co-present objects, materials, and their aspects, are oriented to as meaningful vis-a-vis their relation to one another as they are successively revealed through sequences of action. Consequently, objects in these settings most generally emerge in a complex, non-linear fashion, in a complex interplay between objects, co-present phenomena, and the discursive and/or embodied practices co-participants use for revealing them as publicly-attested to instances of a given analytical category. Moreover, given the tentative relation we tend to observe in how participants formulate object versus how they formulate its categorically-relevant properties, participants repeatedly check their proposed categories and properties against their perception of the co-present feature, materials, and its expected versus perceptible properties. In doing so, we see the participants closely scrutinize the properties they consider criterial for the object according to how those properties should be experienced.

The objects are revealed through the practices participants use for making those sensorially accessible to one another. While we cannot analyze how participants experience different qualities, we can, however, analyze the practices participants use, particularly within a given community of practice, for publicly revealing the experience of that to others. Through the excerpts we see this accomplished in one of two ways. In both Muscovite (Ex. 1) and Ammonia (Ex. 2) participants accomplish this by repositioning themselves vis-a-vis the object for the purpose of perceiving a particular aspect of it, either bringing the object closer under their and others' field of vision or by bringing themselves closer to the object. In each instance, the (re)positioning we observe is performed with regard to making it accessible – precisely within a given modality of sensory experience – so the interactants can either see muscovite or its silvery luster or smell an 'ammonia-like' smell emerging from the vat containing a chemical reaction. In "Hammer" (Ex. 3), "Coarse" (Ex. 4), and "Fault-gouge" (Ex. 5), the interactants instead act on the object physically manipulating it so as to occasion others' recognition of various aspects and doing so allow for its transformation. In Ex. 3, Darrell uses the hammer to produce the sounds that make its composition accessible to the participants, and in Ex. 4 and 5, the speaker physically manipulates with the co-present material making accessible those aspects of the object that reveal as it as coarse or as fault-gouge. The excerpts examined in the study show objects in these settings to emerge through time and through the interaction. The manner in which participants operate on the objects aspectually. The attention and action directed towards these multi-sensorial aspects in turn allows for the transformation of the objects in the participants' perception of them.

## 5. Conclusion

How are the objects and phenomena jointly recognized and agreed upon by members of a given community of practice actually constituted within their respective work? This is both a question of the actual practices used to (re)constitute the objects in the first instance and a question of how actors themselves become compe-

tent practitioners within those communities. In the settings investigated in this paper, the intelligibility of objects emerge via their placement within a range of material, sensory, and linguistic signs, specifically those used within the work of a given community. This emergence is made meaningful through a layering of spatial, temporal, and social spaces, in routinely operable ways, wherein the object is revealed temporally through the endogenous practices that organize the work and activity. Phenomenally, what the practitioners inspect is not just the object (or aspects thereof), but the relevant properties that participants consider criterial for the object's inclusion within a member-relevant category. Such action relevant perception of the object is lodged, not within the individual but within the historically shaped practices of his or her predecessors. An interactional account of a temporarily unfolding perception of objects thus necessitates an analysis situated within both activities and historically-sedimented structures that define the community. The totality of the material and sensorial objects that become meaningful do so in their position within different material assemblages and projected courses of activity. This is particularly a challenge when this question is applied to context where the practitioners encounter, not "objects" per se in the first instance, but rather a dense material world from which those objects are fashioned and/or extracted, according to the categories and types that animate discourse within the geo-sciences both as a community of practice and scientific discipline.

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