

## How to Notice a Tsunami in a Water Tank: Joint Discoveries in a Science Center

Wolfgang Kesselheim / Christina Brandenberger / Christoph Hottiger

### *English Abstract*

Science centers provide their visitors with hands-on exhibits that allow them to construct knowledge about natural phenomena in a process called *discovery learning*. In this paper, we investigate the multimodal means small groups of visitors use to arrive at joint discoveries. Based on a video corpus of naturally occurring visitor interactions in a science center, we argue that joint discoveries are a specific form of the more general conversational mechanism of *noticing*: They consist of a process which starts with an 'initiation' by one party and is followed by an 'acknowledgement' by another party. In addition, the participants negotiate the discovery-relevance of a *noticeable* by referring to its novelty and its spectacular character, and they actively link their activity to the institution science center by means of *contextualization cues*. Only once all of these aspects are achieved do the participants treat a noticing as a joint discovery. This paper advances our understanding of the mechanism of noticing by investigating the under-researched question of how noticings are tied to a specific joint activity and to their context of use. It also contributes to a better understanding of a central element of discovery learning, namely the interactive accomplishment of a joint discovery.

*Keywords:* discovery – noticing – science center – Ethnomethodology - Conversation Analysis multimodality – video studies – contextualization.

### *German Abstract*

In diesem Artikel untersuchen wir die multimodalen Ressourcen, mit denen Besucher\*innen in einem Science Center gemeinsam Naturphänomene entdecken. Basierend auf einem Videokorpus, das natürliche Besucherinteraktionen dokumentiert, zeigen wir, dass gemeinsame Entdeckungen ein spezifischer Fall des generelleren Mechanismus' des *noticing* sind: *Noticings* bestehen aus einer 'Initiierung' durch eine beteiligte Person, gefolgt von einer 'Ratifizierung' durch eine andere Person. Die Beteiligten handeln die Entdeckungsrelevanz eines *noticeables* aus und betten es durch Kontextualisierungshinweise in den institutionellen Kontext des Science Centers ein. Erst wenn all diese Schritte durchlaufen sind, behandeln die Beteiligten ein *noticing* als 'gemeinsame Entdeckung'. Dieser Artikel erweitert unser Verständnis von *noticings*, indem er der wenig untersuchten Frage nachgeht, wie *noticings* mit einem spezifischen Nutzungskontext verwoben sind. Darüber hinaus trägt er zu einem besseren Verständnis eines zentralen Elements des entdeckenden Lernens bei, indem er den Prozess rekonstruiert, wie gemeinsame Entdeckungen in Interaktion hergestellt werden.

*Keywords:* Entdeckung – noticing – Science Center – Ethnomethodologie – Konversationsanalyse – Multimodalität – Video – Kontextualisierung.

1. Introduction
2. Theoretical Background
3. Materials and Methods
4. Discoveries in the Science Center
  - 4.1. Initiation
  - 4.2. Acknowledgement
  - 4.3. Negotiating Discovery-Relevance
  - 4.4. Contextualization
5. Discussion
6. Conclusion
7. Acknowledgements
9. References

## 1. Introduction

Ever since the conception of the first modern science centers in 1969, this type of museum has seen a rise in popularity in terms of new openings as well as visitor attendance (Lipardi 2013). One of the core characteristics of science centers is their didactic strategy, which is based on the concept of "discovery learning" (Alfieri et al. 2011; Bruner 1961; Eisenberg 2001; Hauan/Kolstø 2014). The idea is that the visitors' "active, prolonged engagement" with the hands-on exhibits provided in the exhibitions (Humphrey/Gutwill 2005) allows for the direct sensory experience of natural phenomena, and that this experience, in turn, leads visitors to construct knowledge about the phenomena. It is obvious that the actors in the field ascribe a high relevance to the idea of discovery when we consider the fact that science centers are sometimes also called "science and discovery centers" or even particularly "discovery centers" (ECSITE-UK 2008; Tlili et al. 2006:204f.) and that there is hardly a promotional text published by a science center that does not promise new discoveries to prospective visitors. However, despite the paramount importance of the idea of discovery to these museums, there is surprisingly little empirical research on the question of *how* visitors to a science center actually discover natural phenomena.

If we look at our corpus of video recordings of authentic visitor interactions in the Swiss Science Center Technorama in Winterthur, Switzerland, we quickly develop a sense as to why this might be the case: More often than not, the hands-on exhibits do not lead visitors to make as grandiose discoveries as one might expect when thinking of the term 'discovery'. Visitors generally do not cry 'heureka!' and formulate an abstract description of a natural law. Instead, one is more likely to find extracts that may, at first glance, appear rather less spectacular, such as the following example (Extract 1), in which a small group of visitors interactively discovers internal waves between two different liquids in a tiltable glass tank (for an in-depth analysis, s. section 4.1 below).

### Extract 1

- 01   **OLE** **guck mal habter grad die:-**  
           *look have you just seen the*
- 02   **OLE** **die wirbel gsehn [hier,]**  
 03       *the whirls here*
- 04   **LIM**                           **[ja ]ja;**  
                                       *yes yes*

As readers with a background in conversation analysis and/or ethnomethodology (in the following: EMCA) will no doubt have perceived, what happens in Extract 1 bears close resemblance to what has been described as *noticing* in previous literature. Perhaps the most well-known definition of *noticing* was formulated by Schegloff (2007:219):

Doing a noticing makes relevant some feature(s) of the setting, including the prior talk, which may not have been previously taken as relevant. It works by mobilizing attention on the features which it formulates or registers, but it treats them as its source, while projecting the relevance of some further action in response to the act of noticing.

We will use this definition as a point of departure for our article and reconstruct the characteristics of joint discoveries in the science center by viewing the cases in our corpus against the general mechanism of noticing as outlined by Schegloff (2007) and the rich EMCA literature on noticings.<sup>1</sup> In particular, we will describe noticings as an indispensable interactional springboard for joint discoveries. As we shall see, participants who have made a noticing then have to negotiate on a case-by-case basis whether they consider this particular noticing to be a joint discovery already or if an additional interactional effort is needed. Thus, in the following,

- we will reconstruct how the participants initiate a noticing and describe what characterizes their partners' reaction to this manifestation by means of fine-grained multimodal analyses. We will call the first step 'initiation' and the second one 'acknowledgement' and show that they are finely attuned towards each other. Importantly, we will argue that we can only speak of a noticing once an initiation has been properly acknowledged. This is to say that we argue for a fundamentally interactive understanding of the concept of noticing;
- we will ask what constitutes the 'discovery-relevance' of a noticing; and,
- we will discuss how the recognizable accomplishment of a discovery is related to the participants' tying a noticing to the context of science and/or science communication.

In doing this, our paper reconstructs one of the defining practices in science centers, namely the work of achieving joint discoveries among visitors. It not only shows how to specify Schegloff's (2007:219) definition of noticing in order to do justice to the processes of joint discovery, but it also addresses the question of how the general conversational mechanism of noticing is adapted to a specific context, from which the noticings 'inherit' a particular, context-specific accountability – something which has not been attempted systematically thus far.

## 2. Theoretical Background

As we mentioned before, we develop our understanding of joint discoveries by viewing the process of discovery against the general conversational mechanism of noticing. Noticings have been studied in a wide range of settings and activities, such

---

<sup>1</sup> Therefore, while our study is also indebted to previous EMCA work on interactions in science centers and museums (e.g., Heath et al. 2012; Heath/vom Lehn 2008; Heath et al. 2005), its main theoretical point of reference is the literature on noticings.

as car driving (Goodwin/Goodwin 2012; Keisanen 2012; Rauniomaa et al. 2018); classroom interaction (Kääntä 2014), shopping activities (De Stefani 2014), toddler interaction (Kidwell 2009), dance classes (Laanesoo/Keevallik 2017), or as a part of settings characterized by multiactivity (Helisten 2019). Despite this diversity, however, one can delineate two major issues concerning noticings which are commonly addressed in the literature.

The first of these issues concerns the role of the embodied components in noticings. While studies provide evidence that noticings can be achieved with embodied means (Kidwell 2009; Goodwin 1981; Kääntä 2014; Schegloff 2007; Helisten 2019), case studies provide different takes on the question whether embodied noticings can already identify the *noticeable*. In some cases, embodied noticings serve as a sort of preamble for a verbally produced "explicit interactional noticing" (Kääntä 2014:88). They "do not have the capacity to identify the noticed feature per se, but they rather serve to render visible that something has been noticed" (Kääntä 2014:103). In other cases, the embodied components of a noticing do not need additional verbal components to identify the noticed feature because the participants have expectations with respect to which entities might be made relevant in a certain setting (Kidwell 2009:155). In our data, the number of potential *noticeables* relevant to the activity is very high. Nonetheless, the participants use multimodal resources to identify and characterize the noticed thing with a high degree of precision, e.g., with the aid of iconic gestures or "vocal depictions" (Brandenberger/Hottiger 2018).

The second major issue about noticings which is frequently discussed in EMCA literature concerns their response relevance. In particular, previous research raised the question whether noticings necessarily impose a response in the strict sense of a second pair part (cf. Schegloff 2007; Schegloff 2010; Couper-Kuhlen 2010). Several studies have pointed out the relation between the expectability of a reaction to a noticing and the type of interaction in which it occurs (focused vs. unfocused interaction: Couper-Kuhlen 2010; Brandt/Ergul 2012) or the "local contextual and interactional configuration" (Keisanen 2012:199). More generally, Stivers and Rossano (2010) have shown that participants actively influence the degree of obligatoriness of a response by means of "response-mobilizing features" in turn design (also s. Goodwin/Goodwin 2012:273). We will see that in the science center, the response relevance of noticings can be understood as the result of both the special relevance of noticings for the observed institutional practice – an aspect that has not systematically been looked at before – and the multimodal means participants use to mobilize response.

The question of the response relevance of noticings is related to an aspect that is still under-researched (but s. Keevallik 2018), namely the question of how noticings are shaped by the different activities they are embedded in. Interestingly, it is Schegloff (2007:87) who points out that noticings are related to the larger "social practices" they are used in; they are always crafted for a specific setting and a specific ongoing activity. This means that even though the sequential format of noticings seems to be essentially the same in a wide range of settings, the assumed motivation for the noticing, its conventional purpose, the relevant next actions that build on the initiation of noticing, the expected attitude of the participants towards the noticed thing, etc., are all contingent on this setting. Thus, when we analyze visitor interactions in science centers, we must reconstruct how the noticings are

embedded *in this specific setting* and what their relevance is for the social practice of engaging with hands-on exhibits in a science center.

In our paper, we will argue that the participants activate the institution 'science center' as the relevant context for understanding their noticing, and that it is precisely this context which reflexively makes us see a noticing as (contributing to) a case of a *joint discovery*. In order to analyze *how* the science center context is activated, we draw on Gumperz' concept of *contextualization cues* (Gumperz 1992). Contextualization cues are concrete linguistic and non-linguistic means participants make use of to 'tie' their actions and utterances to a particular context of understanding. This means that we can draw on the concept of *contextualization cues* to empirically identify the concrete means the participants in our corpus deploy to activate the science center context without having to limit our analysis to a predetermined level of linguistic description (or to *linguistic* units at all). At the same time, Gumperz' concept reminds us that "it is not just the physical environment which constitutes the ground in terms of which figures of speech are understood" (Gumperz 1992:45). For our analysis, this means that we cannot take it for granted that every noticing in our corpus is automatically related to the institutional context of the science center (and thus a case of a joint discovery in the science center). Instead, we must reconstruct the contextualization activities by which the participants indicate to each other that their noticing is related to the science center, and, therefore, qualify as cases of what we call 'joint discoveries'.

Apart from the connection to the conversational mechanism of noticing, our analysis of discovery processes in the science center also draws from EMCA research on scientific discoveries, ranging from the classical analysis of the events that led to the discovery of the Crab pulsar in 1969 (Garfinkel et al. 1981) to more recent work, such as Sormani (2011), Lynch (2011), or Koschmann and Zemel (2009, 2011). These studies analyze the local practices of discovery processes based on audio or video recordings. Their aim is to re-specify discoveries as an "occasioned production" (Koschmann/Zemel 2009:200) of the involved scientists by reconstructing how a discovery is "recognizably obtained and exhibited, in and as part of a distinctive practice and manifest discipline" (Sormani et al. 2011:1), a question that fundamentally relates to our interest in contextualization.

Of these studies, two have been especially inspirational for us. The first one is Koschmann and Zemel (2009). In contrast to the relatively compact processes of discovery we can observe in the science center, the two authors describe a more extended discovery process in the context of professional scientific work. Koschmann and Zemel (2009) subdivide this process into different stages: It starts with a noticing followed by a series of activities to negotiate the discovery-relevance of this noticing, and finally culminates in a "discovery achieved" (2009:213). In spite of the differences in terms of the length of the discovery process and the setting when compared to the subject of our own investigation, this description helps us to deepen our understanding of the more 'compressed' discovery sequences we observe in the science center, which often seem to consist of not much more than the actual noticing. Not least in these cases, the inventory of categories provided by Koschman and Zemel (2009) helped us with our analyses by providing a valuable frame of reference.

The second important study for our purposes is Sormani (2011). This paper reconstructs in detail how a local discovery, namely the appearance of a significant

pattern on a computer display, is actively tied to a series of larger scientific contexts: the "matrix activity" (Levinson 1992:67) of running an experiment, the guiding research question of the experiment series, and finally the context of the experimentalist's doctoral project. In doing so, Sormani (2011) specifies the general concept of *contextualization* for the context of science and emphasizes the importance of the overarching activity for the (negotiation of the) discovery-relevance of a given event. As we will see, this will also play a crucial role in the science center.

### 3. Materials and Methods

Our own understanding of the process of discovery is based on fine-grained multi-modal analyses of our corpus of video recordings, which was collected at the Swiss Science Center Technorama in Winterthur, Switzerland, for a project entitled "Interactive Discoveries". During our data collection, we approached small groups of science center visitors and asked them if we could "accompany them with our camera for a few minutes" in order to "understand what people do in a science center". Willing participants then continued their visit at the exhibit where we met them or else proceeded to the next exhibit. As soon as we reached our agreed-upon time limit, or if we noted a degree of discomfort, we stopped recording and asked the participants to sign the prepared consent forms. In total, we documented more than 100 stretches of visitor interaction of about 20-30 minutes each, over a total of 24 days. We used either two small handheld video cameras and wireless microphones, or the video equipment plus two head-mounted eye-tracking glasses.<sup>2</sup>

Once the data was transcribed, we began our reconstruction of the discovery process by building up a collection of candidate joint discoveries. At first, this process was guided by a broad concept of 'discovery' that was inspired by the etymology of the word: A discovery literally *dis-covers* an object or phenomenon by lifting the cover that was previously over it; that is to say, it makes something perceptible that was already there, but not perceived before (or at least perceived in a different way). Therefore, we searched for cases in which the participants displayed precisely such an understanding of something they came to perceive visually, haptically, etc., and share with their interactive partners. Thus, an emic understanding of discovery was always at the heart of our investigation. Later on, the profile of the discoveries in the science center was sharpened against the background of EMCA work on scientific discoveries on the one hand, and the broad body of work on *noticings* in interaction on the other.

This led us to a final collection of 15 cases of discoveries, which is a surprisingly small number considering that our corpus documents over 35 hours of visitor interaction in an institution which centers its didactic concept around the moment of discovery. In part, this is certainly due to the fact that we were looking for *joint* discoveries, that is to say, moments in which the participants come to such a novel perception or understanding *together*. As we will see later, it is not uncommon that one participant makes a new perception or suddenly comes to understand a phenomenon in a new way but cannot get the other participant(s) on board when it comes to negotiating the discovery-relevance of this perception or understanding,

---

<sup>2</sup> Our data collection procedure is in line with the research ethics guidelines of the University of Zurich.

even if considerable interactional effort is invested in the process. That is to say, we found that the 'success rate' of sequences that start out in a way that suggests that a joint discovery might be under way is relatively low. In other words, many of these sequences are aborted before they reach the status of a joint discovery.

Considering this general picture, we will use the following pages to describe what exactly 'joint discoveries in the science center' mean to the visitors themselves. We do this by profiling the joint discoveries in our corpus against the background of the general conversational mechanism of noticing as well as against deviant cases in which the participants do not reach a joint discovery, despite initiating a sequence closely resembling the ones in which a joint discovery *is* reached.

#### 4. Discoveries in the Science Center

As we outlined in the previous sections, noticings form a good starting point for reconstructing the interactive discovery processes in the science center. Therefore, we will commence our analysis of relevant excerpts from our corpus by re-evaluating Schegloff's (2007) definition of noticings quoted in the introduction and use this to unravel the participants' orientations while they initiate a noticing (4.1) and acknowledge this initiation (4.2). In doing so, we will place special emphasis on reconstructing the multimodal ways in which participants paint a surprisingly complex picture of the phenomenon they are in the process of discovering (e.g., by providing information about its position in space, its shape or extension, its qualities of movement, etc.) in the brief moments that typically make up the noticing. In subsections 4.3 and 4.4, we will sharpen the profile of joint discoveries in the science center. In particular, we will explore what qualities participants appeal to in order to claim or to question the discovery-relevance of their noticings (4.3), and we will show how the discovery-relevance of noticings is jointly produced by activating the institution of the *science center* as the relevant context of understanding (4.4).

##### 4.1. Initiation

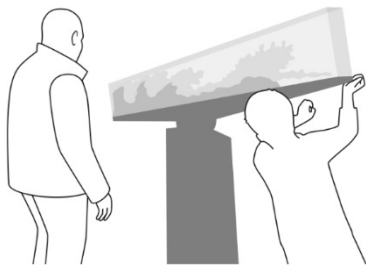
Our understanding of joint discoveries in the science center is closely related to the conversational mechanism of noticing as defined by Schegloff (2007:219, s. the introduction of this paper). In order to better describe the different orientations of the participants in producing a noticing, we reformulated the elements of this definition as 'interactional tasks' which are addressed by the participants when they recognizably produce an initiation of a noticing. We have gathered three such tasks: In initiating a noticing of something, participants can be seen to orient to

- (1) formulating or registering some feature(s) of the setting, including prior talk,
- (2) making it/them relevant, and
- (3) projecting some response by their interaction partner(s), namely a (re)orientation of attention to the noticeable.

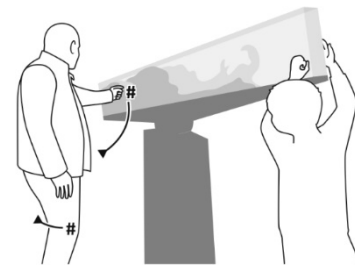
These tasks are in line with Goodwin and Goodwin (2012:272f.) who identify a similar list of tasks that participants address with noticings while driving a car together. With respect to our 'task 3', Szymanski (1999:6f.) emphasizes that other participants may be expected to reorient their (visual) attention to the noticeable once it has been made relevant in an initiation. This means that there is a sound theoretical basis for these interactional tasks.

In the following, we will return to the short extract (Extract 1) we presented in the introduction in order to show how the participants address these interactional tasks. In this extract, Ole (OLE) and his two sons, Liam (LIM) and Jano (JAO), are using a hands-on exhibit consisting of a kind of aquarium that is filled with blue colored water and petroleum. When the water tank is tilted, the two liquids form waves. This is what the father makes relevant here and thereby turns into a noticeable:

**Extract 1, extended<sup>3</sup>**



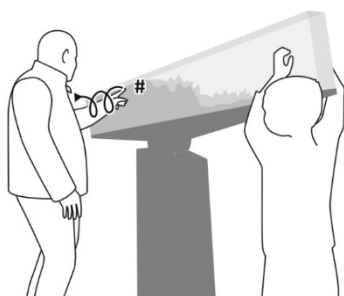
**Fig. #1**



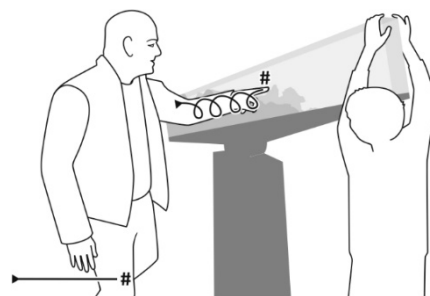
**Fig. #2**

```

01  OLE # (0.3)*+(0.1) >guck mal habter grad+ die:--*#
      look have you just seen the
      ole      *.....points at 'aquarium'.....--*
      ole      +step forward-----+
      #1                                             #2
02  OLE * (.) die      *#+^↑wirbel gsehn [hier,]<+      #
      the whirls here
      ole *2 circular gestures* ^4 circular gestures----->
      ole      +move sideways-----+
03  LIM                                             [ja ]ja; (1.1)#
      yes yes
      #3                                             #4
  
```



**Fig. #3**



**Fig. #4**

<sup>3</sup> Our transcriptions follow Mondada (2016). In the stylized video stills, lines are used to represent movements: A triangle marks the position in which the movement started, and a hash sign marks the end position of the movement.





that the noticeable was perceptible immediately before, but has disappeared by the end of the utterance. Interestingly, this shift in verbal tense is (almost) simultaneous to the aforementioned shift from the pointing to the iconic gesture. This is not by chance. Ole's pointing gesture reaches its apex close to the water tank at a moment when the 'whirls' can hardly be seen any more (s. Fig. 3). However, pointing only helps to identify the noticeable when it is present in the participants' shared space of perception. In contrast, iconic gestures work independently from the temporal presence of the noticeable. Thus, we can read Ole's spiraling gesture (s. Fig. 3 and 4), which follows his deictic gesture after a hesitation (notice the lengthening in *die*: and the micropause that follows, line 1), as a corrective activity which is sensitive to the temporal presence/absence of the noticeable.

### *Task 2: Making the feature(s) relevant*

Ole signals the relevance of the registered features by means of contrast: After observing Jano and Liam's tilting of the water tank from a distance while remaining silent and almost motionless for 3.5 seconds (Fig. 1), Ole draws from different expressive resources at once: speech, body movement, and gesture. He starts to raise his arm to execute the pointing gesture, concurrently moves a step closer to the water tank, and starts speaking 0.1 seconds after this full-body movement has begun (Fig. 2).

The relevance of the formulated features is additionally highlighted in three ways: First, by the fact that Ole begins his utterance with an imperative ('look', *guck mal*, line 1), which explicitly prompts the recipients to direct their attention to the formulated features; second, by the increased speed of speaking; and third, by the way Ole executes his gestures: quickly, expansively, and maximally close to the features he is formulating. Taken together, these aspects add up to the picture that Ole is inviting his sons to join in on the intensive manner of using the exhibit he is displaying.

This becomes even more visible when the utterance and (0.5 seconds later) the apex of the iconic gesture end: Ole takes a big step backwards, which removes him farther away from the exhibit than the detached position of observation he had been occupying previously (Fig. 5). In other words, Ole crafts the relevance of the noticeable by maximizing the contrast between the highly embodied, multimodal formulation of the noticeable and the silent, motionless and distant observation before and after the initiation of the noticing.

### *Task 3: Projecting a (re-)orientation of the interaction partner(s)' attention to the noticeable*

What Ole's initiation projects as the relevant next action is a (re-) orientation of the visual attention of his co-participants towards the noticeable that he multimodally identified and made relevant. He does this by means of the pointing gesture, which renders his own gaze visible to his interaction partners (cf. Hausendorf 2003) and, in doing so, invites them to share his focus of visual attention. Furthermore, by using the imperative 'look' (*guck mal*, line 1), Ole explicitly formulates the (re-)orientation as an action he instructs his co-participants to perform. By means of this "perceptual directive" (Goodwin/Goodwin 2012:268), he increases the expectability of this (re-)orientation and makes the visual experience of the noticeable the topic of a question ('have you just seen... ', line 1) (cf. Stivers/Rossano 2010). Ole

thereby makes a type of answer conditionally relevant that can only be given after the responding party has also made the relevant visual experience. As our data show, this question is answered in a multimodal manner, not only by Liam's partly overlapping confirmation 'yes yes' (*jaja*, line 3), but also by the fact that in the seconds following Extract 1, the two boys begin to produce more waves and to celebrate their amazing character.

It is noteworthy how much information about the noticeable is already contained in this short initiation of a noticing. In the following, we will explore what a typical reaction to such an initiation looks like and how it may respond to the different interactional tasks addressed by an initiation we outlined above.

## 4.2. Acknowledgment

In our data, initiations of noticings, such as the one by Ole in Extract 1, are invariably followed by a reaction by the interaction partner(s), which we have termed 'acknowledgement'. This reaction can be seen as being both the result of insistent attempts to mobilize response (cf. 'task 3' above) and a *general* response relevance due to the central role of sharing new perceptions within the social practice of visiting a science center together. The function of the acknowledgement is to transform something that is only potentially *notice-able* into a publicly and jointly *noticed thing*. Thus, the acknowledgement represents the end point of the noticing sequence: It demonstrates that the person performing the initiation was successful in his or her attempt to interactively share an originally individual act of registering a feature in the surrounding space. The noticing as a whole can therefore be described as a powerful means in communalizing perception within a social group.

The next question we must ask is, therefore, how participants recognizably produce their interactive contribution as an acknowledgement of an initiation and thereby turn the entire sequence into a noticing? We will see that participants do this by observably orienting towards the same three tasks we described for the initiation.

Going back to Extract 1, the acknowledgement is not very conspicuous. It consists only of Liam's 'yes yes' (line 3). However, Liam's utterance is pronounced relatively loudly, thereby displaying a certain degree of enthusiasm. In doing so, Liam affiliates with Ole: He demonstrates that the 'whirls' are noteworthy for him, too. Such a demonstration requires not just a confirmation as an adequate conversational reaction, but a kind of assessment (Pomerantz 1984) regarding the observed phenomenon. One reason why Liam's acknowledgement is nonetheless quite inconspicuous might be that Extract 1 represents already the second time Ole invites his sons to notice movement patterns inside the water tank. In the following we will analyze the first noticing, which happens a few seconds before the start of Extract 1 (represented as Extract 2 below).

**Extract 2**

01 OLE °woa: : . °  
 PART  
 (3.0)  
 03 OLE ein tsunami: oder,  
 a tsunami, isn't it  
 (0.9)  
 05 JAO <<laughing> h\_hoa:> tsu↑nami.  
 PART tsunami

Let us have a brief look at Ole's initiation before turning to Jano's acknowledgement. In Extract 2, Ole concurrently registers a noticeable and displays its relevance: He pronounces the interjection °woa: : . ° (line 1) almost voicelessly, as if silenced by emotion (cf. Goodwin/Goodwin 2012:278 on Goffman's (1978) *response cries*). First, the noticeable is identified only by Ole's bodily orientation towards the exhibit. Then, the fact that Ole remains completely motionless for the following 3 seconds indicates that the noticeable is not a punctual event, but something that goes on for a while. Finally, the noticeable is verbally categorized as 'a tsunami' (line 3). By expanding his initiation through a tag-question (*oder, 'isn't it'*, line 3), Ole actively projects an acknowledgement, which underlines the importance of the acknowledgement for the ongoing activity.

Given these characteristics of Ole's initiation, how does Jano configure his utterance in line 5 in order for it to be seen as the acknowledgment Ole projected? We will see that Jano does this by observably orienting toward tasks that mirror the participants' orientations in the initiation of the noticing, as described in section 4.1 above.

*Task 1: Formulating or registering some feature(s) of the setting*

By using the same wording as Ole (*tsunami*, lines 3 and 5), Jano indicates that he conceives the noticed thing exactly the way his father does, namely as a small-scale model of a huge natural phenomenon. With the repetition of *tsunami*, Jano already contributes to building up a shared understanding of the noticed thing and, thus, configures his utterance as a reaction to the first task of the initiation: the identification of the noticed thing.

*Task 2: Making the feature(s) relevant*

Jano's interjection – which we have approximated as *h\_hoa:* in the transcript (line 5) – celebrates the noticeable (as constructed by his father) as something ranging between amusing and spectacular. By means of this interjection, Jano co-constructs the relevance of the noticed thing and confirms its 'noteworthy' character. In doing so, Jano configures his utterance as a reaction to the second task of the initiation: making the noticeable relevant.

*Task 3: Projecting a (re-)orientation of the interactive partner(s)' attention to the noticeable*

Finally, Jano displays that he is reacting to the third task of the initiation by producing the projected (re-)orientation of attention to the noticed thing. Jano not only

repeats and celebrates his father's characterization of the phenomenon as a *tsunami*, which would have been a sufficient reaction if Jano had seen his father's utterance as an *assessment*. Instead, he additionally directs his visual attention to the water tank and reproduces the tilting movement that had previously led to the appearance of the *tsunami*. In doing so, Jano displays that his continued visual and 'manual' attention to the exhibit is to be seen as a reaction to Ole's initiation.

In light of our analysis so far, we can say that joint discoveries in the science center can be seen as a variety of the general conversational mechanism of noticing, as it has been characterized in the above quote by Schegloff (2007). Therefore, the question we must ask is: What makes discoveries in the science center special; what distinguishes them from noticings in other settings and as part of other social practices?

The answer to this question consists of two components:

- (1) The noticing has to be actively placed in the context of the institution 'science center' (with its constitutive relationship to the world of science and science communication),
- (2) and the discovery-relevance of the noticed thing is claimed or questioned on the basis of two setting-specific qualities: its character as being 'novel' and 'spectacular'.

We will address the second aspect first, since it is closely related to our 'task 2', making a noticed thing relevant (s. 4.3), and will then turn to the question of contextualization (s. 4.4).

### 4.3 Negotiating Discovery-Relevance

In our corpus, we can observe two different outcomes of the visitors' engagement with the hands-on exhibits after a noticing has been achieved through an initiation and a relevant acknowledgement: Either the co-visitors signal to each other that they have found what they were looking for (e.g., by commenting on their experience with assessments, such as 'awesome' or 'cool'), or they display their dissatisfaction (and may then look for an alternative noticeable or abort their engagement with the exhibit). In the following, we want to argue that these contrasting outcomes are related to the participants' negotiation of the discovery-relevance of the noticed thing. We will show that this negotiation is based on two context-specific characteristics of the noticed things, namely their 'spectacular' and 'novel' character.

In order to explore this, we will revisit Extracts 1 and 2. In these extracts, the noticings are embedded in long and intensive sequences of discovering work, and end with a positive comment by Ole (*cool*, not represented in the transcripts). Note that in both cases, the relevance of the respective noticeable is produced by highlighting its spectacular character. In Extract 1, Ole accompanies his initiation with wide, energetic gestures and expansive body movements that demonstrate in an embodied way that he judges what he has just observed to be spectacular. In Extract 2, Ole expresses the importance of his immediate perception by means of the response cry °*woa*:::° (line 1) as well as by 'making a mountain out of a molehill' by calling the rather small waves in the glass container 'a tsunami' (line 3), a description which is confirmed and upgraded by Jano in his acknowledgement (line 5).

The fact that the relevance of the noticing for the discovery process is grounded in the spectacular character of the noticeable becomes more visible if we contrast Extract 1 and 2 with cases in which one of the participants contests the discovery-relevance of the noticeable by questioning its spectacular character.

In the first contrasting case (Extract 3 below), a young couple, Elias (ELS) and Aileen (AIL), explores an exhibit that consists of a flat glass disc filled with a dark blue liquid, which can be turned around a central axis. Elias tilts the disc by a few degrees and observes a milky blotch which slowly wanders upwards. Meanwhile, Aileen is silently reading the exhibit text.

### Extract 3

01 **ELS** **hends +das au wieder mit dene kris↑tall gmacht (.)**  
*have they done this with those crystals once again*  
 els +flips disc----->  
 02 **ELS** **dem+#+fall.**  
*in that case*  
 els -->+ +tilts disc->  
 #6  
 03 **AIL** **(0.6) \* .hhhh ↑yeah# (0.2) (0.9)\* (2.3)**  
*ail \*.points..-----,,,,,\**  
 els ----->  
 #7



Fig. #6



Fig. #7

04 **ELS** **so es paar luftbläsli**  
*just some air bubbles*  
 els ----->  
 05 **(2.7)+ (1.9)**  
 els ---->+  
 06 **AIL** **tidjüm.**  
 07 **(4.3)**  
 08 **AIL** **gömmmer mol wieder döt go witermache [...]**  
*let's go there again to continue*

At the beginning of Extract 3, Elias flips the glass disc by 180 degrees and then starts to cautiously tilt the disc again. The white blotch reappears. This is the moment Aileen initiates the noticing: She produces an abrupt and loud intake of breath, which is followed by the loud exclamation *yeah* (line 3) and accompanied by a

pointing gesture (Fig. 7). By doing this, Aileen demonstrates that she is clearly surprised by what she sees<sup>4</sup> and simultaneously makes her perception interactively relevant. In addition, the relevance of the noticeable within Aileen and Elias' joint activity at the exhibit is also reflected by the sequential position of Aileen's utterance. It appears that notifying her partner of the white blotch is so important that it justifies – observably for both participants – Aileen to ignore Elias' preceding question. In fact, this "interruptive" character of an initiation of a noticing – in the sense that a previously established response relevance is suspended or even ignored – is typical of "'environmental' noticings" according to Sacks (1992 vol. 2:90f.). Nonetheless, not answering the question and producing an initiation of a noticing instead clearly constitutes a dispreferred action in terms of the conversational sequence (Schegloff 2007:58-96) and, hence, contributes further evidence to the overall reading that Aileen is doing a considerable amount of work to underline the spectacular character of the noticeable.

Notice that despite the 'interruptive' quality of Aileen's initiation, Elias produces the acknowledgment that the initiation made relevant. He uses embodied means (his head is bent down towards the disc, holding the disc with both hands) to demonstrate that he is focused exactly on the features registered by Aileen, and he cooperates in the formulation of the noticeable by verbally referring to the physical aspect of the noticeable, categorizing it as 'air bubbles' (line 4). However, it is important to note here that Elias does *not* agree on the spectacular character of the jointly noticed thing. On the contrary: He calls it 'some air bubbles' (*es paar luftbläsli*, line 4). The diminutive ending *-li* of *luftbläsli* along with the flat intonation<sup>5</sup> portrays the noticed thing as small and unexciting. What is more, his characterisation of the phenomenon as 'just some' air bubbles (*so es paar*, line 4) he might even question whether the white blotch is one coherent phenomenon or rather 'just' several bubbles appearing randomly at the same place. Thus, by constructing the noticed thing as not being spectacular and potentially not being an entity at all, Elias contests its relevance for the ongoing discovery process. In doing so, he puts an end to the couple's engagement with the exhibit: After silently observing the fading bubbles for only a few more seconds, Aileen produces a "vocal depiction" in a dying-off tone (Brandenberger/Hottiger 2018, s. also Dingemanse 2014) that can be seen to iconically represent the noticeable vanishing into nothingness, and then the two visitors proceed to the next exhibit without speaking another word about the exhibit they just used.

This development of the engagement sequence after a 'failed discovery' contrasts with what we have seen in Extracts 1 and 2: Aileen and Elias' leaving the exhibit is framed as an abortion, a failure to discover the phenomenon 'inscribed' in the hands-on exhibit, while Ole and his sons frame their engagement with the water tank as a successful completion.

Let us now turn to the second quality that we found to be required for a noticing to become a joint discovery, namely that the noticed thing has to be co-constructed as 'novel' in the sense of 'not having been perceived before' by the participant. Once

<sup>4</sup> On the expression of surprise cf. Heath et al. (2012) and Wilkinson and Kitzinger (2006).

<sup>5</sup> Goodwin (1979:103) describes how participants can make use of sudden changes in intonation to emphasize that they have just made a discovery. These 'discovery intonations' stand in stark contrast to Elias' flat and almost 'bored' intonation in line 4.

again, a contrasting case can show us the importance of this quality for the process of discovery.

In the following piece of data (Extract 4), a group of three uses an exhibit that enables visitors to feel the saccadic movements of their eyes when they touch the edge of their (closed) eyelid. Two members of the group jointly notice the repeated eye movements and try to share their perception with the third member of the group, who affirms that he cannot feel the noticeable.

#### Extract 4

- 01 **ALX** mol (.) du gspühsch jo wenn\_n ufm ↑aug hesch. (0.2)  
*yes you feel it PART when you have it [the finger]  
 on the eye*
- 02 **BEN** dass\_s echli: ↑zitteret, (.)  
*that it's trembling a little*
- 03 **ALX** ja genau.=  
*yes, exactly*
- 04 **BEN** =aber: hhh [...] ((short side sequence omitted from  
 the transcript))  
*but*
- 05 **BEN** ich ha s\_gfühl dass es (das) bi mir immer macht.  
*I have the feeling that it always does (this) in my case*

At the beginning of Extract 4, Alexander (ALX) provides information about the way the noticed thing can be perceived, which might help Ben (BEN) finally to identify the noticeable: 'you feel it [...] when you have it [the finger] on the eye' (line 1). In an *interactive completion* (Oloff 2014), Ben demonstrates that the identification of the noticeable is not his problem here. He proves himself able to describe the feeling triggered by the hands-on experiment: 'that it is trembling a little' (*dass\_s echli zitteret*, line 2), a description that is ratified by Alexander ('yes, exactly', *ja genau*, line 3). Instead, the problematic point for Ben is that the trembling of the eye is something he 'always' (*immer*, line 5) feels. In other words, it seems that for Ben, the fact that the noticed thing is not novel undermines its discovery-relevance. Once more, we can observe that the abortion of the discovery sequence follows immediately after the failed attempt to interactively construct the discovery-relevance of the noticing: The three visitors leave the exhibit with a shrug of the shoulder.

The extracts of this section have shown that the noticed thing must be co-constructed as spectacular and novel in order to be accorded discovery-relevance. Only if this is the case do the participants assign relevance to it in the context of their discovery work and treat it as an element of the joint discovery process or even as its successful outcome, i.e., as 'a joint discovery'. However, if the acknowledgement fails to confirm (or upgrade, cf. Pomerantz 1984) the relevance of the noticed thing by making reference to its spectacular or novel character, we can observe that the participants' engagement with the exhibit is framed as a failure, leading either to renewed attempts to find a suitable candidate for a discovery-relevant noticing or to the abortion of the discovery process.



#### 4.4 Contextualization

In order to complete our reconstruction of joint discoveries in the science center, a decisive aspect is still missing. Even a noticed thing that is judged to be spectacular and novel is not automatically related to the discovery process just because it occurs in the exhibition space of a science center. This relation is interactively accomplished by the visitors by means of their contextualization activities, i.e., by activating the institution of the 'science center' as the relevant context of understanding for a discovery.

It would be wrong to conceive of contextualization as a particular step in or after the noticing sequence. Instead, we can observe in our data that the visitors' contextualization activities can happen at any point during their engagement with the hands-on exhibits: before the noticing is initiated, e.g., when the noticing is the culmination of a process of joint experimenting, concurrently with the initiation and/or the acknowledgement of the noticing, or after the noticing sequence is completed, e.g., if the visitors are working out the underlying regularities of, or reasons for, the noticed phenomenon.

In the rest of the analysis, we want to show how this activation of the science center context is realized by the visitors during their engagement with the hands-on exhibits. Based on our analyses of the visitors' concept of the institution 'science center',<sup>6</sup> we argue that visitors embed their noticings into the science center context by framing the noticed thing

- (1) as an object of a scientific approach to the world, and
- (2) as an object of a special type of science communication which builds on amazement as its basic mechanism of persuasion.

These two frames are not mutually exclusive, but rather two sides of the same coin. Together, they form the ethno-concept of the noticed thing as a *phenomenon* in both senses of the word: 'an object of science' and 'something amazing'.

Let us now return to Extract 2 in order to study how visitors contextualize their activities by actively framing them as part of the context of the institution 'science center'.

#### Extract 2, repeated

```

06  OLE °woa: : . °
      PART
07  (3.0)
08  OLE ein tsunami: oder,
      a tsunami, isn't it
09  (0.9)
10  JAO <<laughing> h_hoa:> tsunami.
      PART tsunami

```

Here, Ole and Jano relate their noticing to the science center context by referring to the noticed thing as a *tsunami* (lines 3 and 5) while they are actually observing the small-scale movements of a few liters of water and petrol. In doing so, they enact a

<sup>6</sup> Due to restrictions of space, we cannot present our reconstruction of the visitors' understanding of the science center as an institution here. This will be the topic of a separate publication.

core element of the semiotic workings of the science center (and of museums more generally), namely the idea that things in the exhibition *stand for* phenomena outside the museum space. Furthermore, in describing the noticed thing as a *tsunami*, Ole and Jano frame it as an *object of nature* and thereby tie their observation to the central topic of the science center: natural forces and laws of nature.

Afterwards, Ole invokes the frame of the scientific experiment by instructing his sons to 'do it more slowly, what happens then' (*machts mal langsamer was passiert dann*, not represented in the transcript). This is the classical strategy of variable control: to repeat the same process ('do it [again]'), changing one condition ('more slowly'), and observing the consequences ('what happens then'). Therefore, tilting the water tank repeatedly is not treated as a ludic activity or as an artistic process that yields aesthetically pleasing experiences here. Rather, it is contextualized as a scientific experiment, which allows the visitors to learn something about phenomena in nature and their laws ('what happens then').<sup>7</sup>

In fact, the repetition of the same process at the exhibit also serves as a means to contextualize the interaction in the context of science. The fact that visitors very often either repeat the processes that led them to make a joint discovery themselves or convince their co-visitor(s) to perform this repetition tells us something about what qualities visitors expect the noticed thing to have in the science center, namely that the noticed thing can be re-produced 'any number of times'. This repeatability again evokes the context of science, because it shows that visitors do not consider what they discover to be a singular and unique event, but something that is seen as the expression of some regularity, of some underlying rules. The 'phenomenon' discovered by Ole and his sons in Extracts 1 and 2 is not the waves they have seen the first time they tilt the water tank, but something like the general rule that if one moves the water tank in a certain way, the result is *always* this *sort of* wave. Such regularities are rarely ever formulated verbally (e.g., in a format like 'every time you do x... y happens' or 'If ... then'). However, we would like to argue that the repeated actions aimed at reproducing the phenomenon that was discovered can be conceived of as *embodied generalizations*: In doing the same actions repeatedly, and in re-noticing the same results, visitors do not claim the existence of a regular pattern by verbal means, but they demonstrate it with their bodily actions.

## 5. Discussion

Our analyses have shown that joint discoveries in the science center can be understood as a specific form of the more general conversational mechanism of noticing. Indeed, we are now in a position to return to Schegloff's (2007:219) definition of what constitutes a noticing quoted at the beginning of our paper and specify it to capture the relevant interactional orientations of the participants when they discover natural phenomena in the science center. We want to provide this specification by re-formulating the interactional 'tasks' that participants have to address in order to

---

<sup>7</sup> Once more, Extract 3 can be used as a contrasting case: The white blotch that Aileen makes relevant in line 3 is treated as not being discovery-relevant. This verdict is reached not only because Elias successfully questions the spectacular character of the noticed thing, but also because by choosing an everyday word ('air bubbles') to refer to the noticed thing, he does not activate science and the science center as the relevant context of understanding.

recognizably produce a noticing and adapting them for joint discoveries. Once again, we will first talk about the tasks for the initiation of the noticing and then about those for the acknowledgement.

The updated three tasks to be addressed in the initiation can be formulated as follows:

- (1) *Multimodally formulate or register some feature(s) that can be perceived in the spatial surroundings.*

Here, it became necessary to remove the reference to "prior talk" from the initial quote by Schegloff (2007:219) and limit noticeables to features in the participants' spatial surroundings. This is due to the fact that only noticeables in the spatial environment lead to a re-orientation of the partners' bodies (e.g., a shift in gaze direction); noticings that refer to features in the previous talk, however, lack this characteristic bodily reorientation (cf. Goodwin/Goodwin 2012:285; Kesselheim/Brandenberger in press).

- (2) *Make these features relevant by referring to the spectacular and novel character of the noticeable.*

In our collection of joint discoveries in the science center, there are only two ways the participants support the discovery-relevance of a noticeable, namely by making reference to its spectacular character and/or by framing it as a novel (vs. an everyday) experience.

By 'novel' we refer to several related qualities: Firstly, *the noticeable is presented as newly perceived*. We have seen that claiming that you have already perceived the proposed noticeable before (or even 'always' as in Extract 4) is an easy way to contest the discovery-relevance of a noticing in the science center. In this sense, Schegloff's characterization of the features made relevant by the noticing as ones that "*may not have been previously taken as relevant*" (Schegloff 2007:219, our italics) is too weak. Secondly, *the noticeable is presented as perceived 'just now'*: We have seen the relevance of this aspect in Ole's transformation of his pointing gesture into an iconic one (Extract 1), which shows how sensitive participants are to the temporal presence of the noticed phenomenon. And finally, *the noticeable is presented as requiring an urgent re-orientation of attention*, an aspect which becomes especially visible when the initiation of a noticing interrupts the ongoing activity. In our data, this aspect became particularly obvious in Extract 3, in which Aileen does not respond to Elias' question and instead initiates a noticing, but it is also a regular feature of initiations of noticings in other contexts, as has been pointed out by Sacks (1992, vol. 2:90f.), Keisanen (2012:208), and Kidwell (2009:153). Thus, the aspect of novelty on its own is by no means exclusive to initiations of noticings in the science center context.

However, things become more specific when it comes to the second core quality of noticeables in joint discoveries in the science center, namely their spectacular character. The co-production of a noticed thing as something spectacular (e.g., by literally making a 'tsunami' out of tiny waves in a small glass container, as in Extract 1), leads to a prolonged engagement with the exhibit that is concluded with a positive evaluation, while downgrading the spectacular character of a noticeable (as,

e.g., in the case of the 'small air bubbles' in Extract 3) may lead to the quick abandonment of the exhibit and the co-produced display of not having found what one was looking for at the exhibit.

- (3) *Project a reaction by the co-visitor(s) as an officially expectable second pair part, namely an immediate attentional orientation towards the noticeable.*

While Schegloff (2007) claims that there is a "diminished 'response-relevance'" in noticings, which makes it questionable whether noticings can really be analyzed as a set consisting of a first and a second pair part (initiation and acknowledgement in our terms), our data suggests otherwise. In the science center, at the very least those noticings which are transformed into joint discoveries by ascribing them discovery-relevance and contextualizing them in the institution of the science center, all consist of these two steps. Our collection of joint discoveries does not contain a single case in which an initiation of a noticing does not lead to some kind of reaction by the co-visitor(s) (but this reaction may not be verbal, often it is purely embodied). What we did observe, however, are lukewarm reactions that question the noteworthy character of the noticeable. This observation is supported by Keisanen (2012:204) who notes that co-participants sometimes challenge the noteworthiness of a noticed event by constructing it as "something that happens on a regular basis". Overall, this seems to indicate that the particular context an activity is realized in can indeed influence the response relevance of noticings. It seems that, to a certain degree, the science center context activated by the participants already "mobilizes response" (Stivers/Rossano 2010): It is difficult *not* to react to a co-visitor who draws attention to a potential discovery when 'discovering something together' is the joint activity one is officially engaged in (also cf. Keevallik 2018 on the interdependence between pursuing a joint activity and the response relevance of initiations of noticings). Despite this general response relevance, we could observe a wide range of multimodal means the initiating partner deploys to influence the *kind* of response that is projected.<sup>8</sup>

We will now address the interactional tasks of the acknowledgement, which mirror the tasks of the initiation (cf. section 4.1). In order to recognizably produce their action as a reaction to the initiation, the participants clearly orient toward tasks mirroring the three tasks of the initiation. Thus, the tasks to be addressed in the acknowledgement can be formulated as follows:

- (1) *Make observable that you have identified the feature(s) formulated and made relevant through the initiation.*
- (2) *Mark that you see the relevance of the noticeable the same way as your partner, namely as warranted by its immediate, urgent presence and its spectacular character. This is to say: Ratify or, better, upgrade the original assessment.*
- (3) *Mark your contribution to the interaction as the projected reaction by immediately and observably (re-)directing your attention to the formulated features.*

---

<sup>8</sup> While the relevance of the response seems to be backed up by the institutional setting and the related shared activity, the relevance of the noticeable, however, has to be established and collaboratively negotiated in the turns that follow a noticing (cf. Keisanen 2012:205).

As we mentioned before, though, there is one more task the participants must address for a noticing to become a joint discovery – and that is: activate science and/or science communication as the relevant context of understanding for the noticed thing by means of *contextualization cues* (Gumperz 1992).

In the following, we would briefly like to share some forms of contextualization we observed in our collection of discovery sequences. The visitors relate their noticing to science

- by explicitly stating a connection to the natural sciences (e.g., by using scientific terminology),
- by making their noticing a part of a process of experimentation (by pursuing a variable control strategy, favoring 'objective' observations, etc.),
- by turning the noticed thing into something that requires an explanation (emphasizing causal relations, formulating hypotheses), or
- by producing *embodied generalizations* (i.e., repeating the process that led to a noticing several times and, in doing so, confirming the regularity of the causal relation). This aspect represents an important difference between noticings that are part of joint discoveries in the science center and noticings in everyday situations.<sup>9</sup>

The visitors relate their noticing to science communication

- by treating the objects in the exhibition as models that represent phenomena outside the current space of perception, e.g., by treating the waves in the water tank as a model of a large-scale natural event (s. Extract 2),
- by linking their noticing to recurrent topics of the exhibition, or
- by celebrating the 'amazing' character of a noticed thing (s. Extracts 1 and 2), which alludes to one of the core ideas of how to communicate science in a science center, namely by confronting visitors with experiences that cause amazement or wonder (cf. the second aspect of the ethno-concept of 'the phenomenon' described above).

Frequently, the way visitors contextualize their discoveries gives the jointly discovered phenomena a particular character, namely that of *simultaneously* being objects of science (making it possible to experience natural forces and get in touch with laws of nature) and objects of a type of science communication designed to cause amazement as a pedagogical technique.

This brings us to the last point we need to address here, which is the difference between joint discoveries in science centers and discoveries in a classic scientific sense. As Koschmann and Zemel (2009:209) highlight, acknowledging an initiation of a noticing is also essential for the process of discovery in a more professional context. However, they observe a stricter division of labor between the speaker who initiates a noticing and his or her partner in their data: While the former is 'only'

---

<sup>9</sup> Take driving a car, for example: A free parking space is only interesting as a singular situation at a particular point in time: the moment the car gets closer. This is when the participants are likely to produce a noticing of a free parking space. It would be very unusual to back up, re-notice the free space and park again, but this is exactly the procedure we find in joint discoveries in the science center.

responsible for registering a feature in the spatial environment, the latter is responsible for assessing its relevance for the discovery process (transforming the noticed feature into a "discovery proposal"; (Koschmann/Zemel 2009:213)). In our data, we could not observe this pattern. In the science center, the participant who initiates the noticing frequently already indicates the discovery-relevance of the noticeable.

Furthermore, the scientific discoveries described by Koschmann and Zemel (2009) (s. section 3 above) extend over a longer period of time so that one can clearly distinguish between a first noticing or "reporting" (2009:208), a phase of assessment and negotiation of discovery-relevance of the noticed thing (including the "proposal for a possible discovery" (2009:200)), and the elaboration of the discovered regularities leading to the "discovery achieved" (2009:213). This is generally not the case in the science center. Although there certainly are cases in our data where the discovery process resembles the extended format described by these authors, the vast majority of the cases we observed showcase a much more compressed discovery format in which the whole discovery process is already contained in the initiation and the acknowledgement of the noticing: The (co)construction of the discovery-relevance of the noticing and the contextualization activities are often *incorporated* in these two steps. This is why, in the case of joint discoveries in the science center, noticings sometimes *are* discoveries, and sometimes they are just *an element* within a larger discovery process. In the latter case, the discovery-relevance of a noticing is negotiated in a stretch of interaction that follows the stepwise realization of the noticing (initiation and acknowledgement) and also contains relevant contextualization activities.

## 6. Conclusion

What do people do when they discover something in a science center? In order to answer this question empirically, we combed through a large video corpus of visitor interactions in the Swiss Science Center Technorama and built a collection of candidate cases of discoveries. Then, we refined our understanding of discoveries, on the one hand by making use of the internal variation in this collection (identifying and describing contrasting and deviant cases), and on the other hand by relating our data to the literature on noticings. This allowed us to develop the specific profile of joint discoveries in the science center.

Our analysis proceeded in three analytical steps: First, we reconstructed the way participants produce an 'initiation of a noticing', registering a noticeable in their spatial surroundings, making it relevant, and projecting a reaction by their partner (4.1). Then, we studied how the 'acknowledgement' is crafted so that it can be seen as an adequate reaction to the initiation, transforming the noticeable into a jointly noticed thing (4.2). Subsection 4.3 was dedicated to the question of what differentiates discoveries in the science center from the general mechanism of noticing. We examined how the participants construct the discovery-relevance of their noticings by agreeing on the spectacular/novel character of the noticed thing, and how they activate the institution of the science center as a relevant context of understanding by way of contextualization (4.4).

In light of our analyses, we are now in a position to describe joint discoveries in the science center as a specific kind of noticing: They are noticings with a specific set of interactional 'tasks' or orientations, and they are noticings that the participants

link to a specific context of understanding, namely the institutional context of the science center with its particular approach to natural phenomena.

Moreover, we can now confidently position our understanding of noticings within the two major strands of EMCA literature on noticings: First, our data provides further insights into the realization of noticings by embodied means. In this respect, the novel contribution of our study consists in showing that the embodied components of the noticings can convey rich information on the characteristics of the noticeable. So far, EMCA literature has described two functions of the embodied components of noticings, namely, to signal that one of the participants has noticed something he or she would like to share (Käntää 2012) and to indicate a participant's stance towards it (Goodwin/Goodwin 2012). Our analysis, however, has shown that during the initiation stage, the participants can convey a considerable amount of detail about the noticeable by embodied rather than verbal means (cf. the detailed information Ole manages to share about a phenomenon that he merely describes as 'whirls' in Extract 1). In doing so, participants can multimodally establish the discovery-relevance of the noticeable. In addition, we have shown that embodied initiations of noticings can even draw attention to phenomena that are no longer visible (cf. the smooth transformation of Ole's pointing gesture into a spiraling movement that 'compensates' for the vanishing whirls in Extract 1). This compensating function of embodied components of noticings, which allows the noticing to work independently from the temporal presence of the noticeable, has not been described in previous literature.

Second, with respect to the debate about the response relevance of noticings, we can note that the answer to this question must consider the activity and context in which the noticing is initiated. Initiations of noticings that occur within the activity of jointly using hands-on exhibits impose a strong response relevance because they are constitutive of one of the main activities the participants pursue in the science center – accomplishing joint discoveries. In this process, (re-)orienting to the features made relevant is indispensable. This is frequently achieved by purely embodied means. Therefore, our study also draws attention to the fact that one would overlook the sequential implications of the initiation if the question of response relevance were discussed on a purely verbal basis.

Finally, our analyses open up a new perspective to further investigations into the general features of noticings: They point to the fact that noticings are always embedded in specific contexts from which they 'inherit' their logic. This contextualization allows the participants to address questions such as: What makes a noticing warranted or justified? What is the reason for the relevance of a noticeable? How is a noticing connected to specific ongoing activities? How is it related to particular roles and the moral order of the context in question? All of these questions can only be answered if we analyze noticings within the larger context of the activity in which they occur. In the case of science center interactions, it is this component that leads the participants to distinguish between a 'simple' noticing and treating something as a joint discovery. Thus, by describing joint discoveries in the science center as a specific kind of noticing, we have empirically described a process that is at the heart of the institution of the science center. Our reconstruction of discoveries can also be seen as a contribution to the so-called "institutional talk programme" (Drew/Heritage 1992) insofar as it shows in detail how an institutional context can

be activated as the relevant context of understanding and how the concept of *contextualization* can be used to describe the multimodal means – on all levels of linguistic or embodied description – involved in this activation.

## 7. Acknowledgements

This research is funded by the Swiss National Funds for Science (2016-2020), project no. 162848. We would like to thank the University Research Priority Program Language and Space at the University of Zurich for its institutional backing and the directors and personnel of the Technorama – especially Armin Duff and Barbara Neff – for their generous support. The graphic representations of the video stills were made by Tara von Grebel and Sarah Steinbacher of the SIVIC at the University of Zurich.

## 8. References

- Alfieri, Louis / Brooks, Patricia J. / Aldrich, Naomi J. / Tenenbaum, Harriet R. (2011): Does Discovery-based Instruction Enhance Learning? In: *Journal of Educational Psychology* 103, 1-18.
- Brandenberger, Christina / Hottiger, Christoph (2018): Sharing Perception when Using Hands-on Exhibits in Science Centres: The Case of Vocal Depiction. In: *Travaux neuchâtelois de linguistique* 68, 59-68.
- Brandt, Adam / Ergul, Hatice (2012): Making Sense of Nonfocused Interactions: Noticings and Assessments among Turkish Women Watching TV. In: Brandt, Adam / Ikeda, Keiko (eds.), *Symposium Proceedings: Challenges and New Directions in the Micro-analysis of Social Interaction*. Kansai: Kansai University, 33-38.
- Bruner, Jerome S. (1961): The Act of Discovery. In: *Harvard Educational Review* 31, 21-32.
- Couper-Kuhlen, Elizabeth (2010): Commentary on Stivers and Rossano: "Mobilizing Response". In: *Research on Language & Social Interaction* 43, 32-37.
- De Stefani, Elwys (2014): Establishing Joint Orientation towards Commercial Objects in a Self-service Store: How Practices of Categorisation Matter. In: Nevile, Maurice / Haddington, Pentti / Heinemann, Trine / Rauniomaa, Mirka (eds.), *Interacting with Objects: Language, Materiality, and Social Activity*. Amsterdam: John Benjamins, 271-293.
- Dingemanse, Mark (2014): Ideophones: Between Grammar and Poetry. In: *Pragmatics and Society* 5, 384-405.
- Drew, Paul / Heritage, John (eds.) (1992): *Talk at Work: Interaction in Institutional Settings*. Cambridge: Cambridge University Press.
- ECSITE-UK (2008): *The Impact of Science and Discovery Centres: A Review of Worldwide Studies*. Retrieved 10 March 2020 from <https://www.ecsite.eu/activities-and-services/resources/impact-science-and-discovery-centres-review-worldwide-studies>.
- Eisenberg, Miachel (2001): Discovery Learning, Cognitive Psychology of. In: Smelser, Neil J. (ed.), *International Encyclopedia of Social & Behavioral Sciences*. Amsterdam: Elsevier, 3736-3739.



- Garfinkel, Harold / Lynch, Michael / Livingston, Eric (1981): The Work of a Discovering Science Construed with Materials from the Optically Discovered Pulsar. In: *Philosophy of the Social Sciences* 11, 131-158.
- Goffman, Erving (1978): Response Cries. In: *Language* 54, 787-815.
- Goodwin, Charles (1979): The Interactive Construction of a Sentence in Natural Conversation. In: Psathas, George (ed.), *Everyday Language: Studies in Ethnomethodology*. New York: Irvington Publishers, 97-121.
- Goodwin, Charles (1981): *Conversational Organization: Interaction Between Speakers and Hearers*. New York: Academic Press.
- Goodwin, Charles (1994): Professional Vision. In: *American Anthropologist* 96, 606-633.
- Goodwin, Marjorie H. / Goodwin, Charles (2012): Car Talk: Integrating Texts, Bodies, and Changing Landscapes. In: *Semiotica* 191, 257-286.
- Gumperz, John J. (1992): Contextualization Revisited. In: Duranti, Alessandro / Goodwin, Charles (eds.), *Rethinking Context: Language as an Interactive Phenomenon*. Cambridge: Cambridge University Press, 39-53.
- Hauan, Nils P. / Kolstø, Stein D. (2014): Exhibitions as Learning Environments: A Review of Empirical Research on Students' Science Learning at Natural History Museums, Science Museums and Science Centres. In: *Nordic Studies in Science Education* 10, 90-104.
- Hausendorf, Heiko (2003): Deixis and Speech Situation Revisited: The Mechanism of Perceived Perception. In: Lenz, Friedrich (ed.), *Deictic Conceptualisation of Space, Time and Person*. Amsterdam: Benjamins, 249-269.
- Heath, Christian / vom Lehn, Dirk (2008): Configuring 'Interactivity': Enhancing Engagement in Science Centres and Museums. In: *Social Studies of Science* 28, 63-91.
- Heath, Christian / vom Lehn, Dirk / Cleverly, Jason / Luff, Paul (2012): Revealing Surprise: The Local Ecology and the Transposition of Action. In: Sorjonen, Marja-Leena / Peräkylä, Anssi (eds.), *Emotion in Interaction*. Oxford: Oxford University Press, 212-234.
- Heath, Christian / vom Lehn, Dirk / Osborne, Jonathan (2005): Interaction and Interactives. In: *Public Understanding of Science* 14, 91-101.
- Helisten, Marika (2019): Disjunctively Positioned Problem-Noticings in Managing Multiactivity. In: *Research on Language & Social Interaction* 52, 318-342.
- Humphrey, Thomas / Gutwill, Joshua P. (2005): *Fostering Active Prolonged Engagement: The Art of Creating APE Exhibits*. San Francisco: Exploratorium.
- Kääntä, Leila (2014): From Noticing to Initiating Correction: Students' Epistemic Displays in Instructional Interaction. In: *Journal of Pragmatics* 66, 86-105.
- Keevallik, Leelo (2018): Sequence Initiation or Self-Talk? Commenting on the Surroundings While Mucking out a Sheep Stable. In: *Research on Language & Social Interaction* 51, 313-328.
- Keisanen, Tiina (2012): "Uh-oh, We Were Going There": Environmentally Occasioned Noticings of Trouble in In-car Interaction. In: *Semiotica* 191, 197-222.
- Kesselheim, Wolfgang / Brandenberger, Christina (in press): The Social Construction of Embodied Experiences: Two Types of Discoveries in the Science Center. In: *Linguistics Vanguard* 7.
- Kidwell, Mardi (2009): Gaze Shift as an Interactional Resource for Very Young Children. In: *Discourse Processes* 46, 145-160.

- Koschmann, Timothy / Zemel, Alan (2009): Optical Pulsars and Black Arrows: Discoveries as Occasioned Productions. In: *Journal of the Learning Sciences* 18, 200-246.
- Koschmann, Timothy / Zemel, Alan (2011): "So that's the Ureter": The Informal Logic of Discovering Work. In: *Ethnographic Studies*, 31-46.
- Laanesoo, Kirsi / Keevallik, Leelo (2017): Noticing Breaches with Nonpolar Interrogatives: Estonian Kes ("Who") Ascribing Responsibility for Problematic Conduct. In: *Research on Language & Social Interaction* 50, 286-306.
- Levinson, Stephen C. (1992): Activity Types and Language. In: Drew, Paul / Heritage, John (eds.), *Talk at Work: Interaction in Institutional Settings* Cambridge: Cambridge University Press, 66-100.
- Lipardi, Vincenzo (2013): The Evolution and Worldwide Expansion of Science Centres. In: Bruyas, Anne-Marie / Riccio, Michaela (eds.), *Science Centres and Science Events: A Science Communication Handbook*. Milan: Springer, 49-61.
- Lynch, Michael (2011): Credibility, Evidence, and Discovery: The Case of the Ivory-billed Woodpecker. In: *Ethnographic Studies* 20, 78-105.
- Mondada, Lorenza (2016): Conventions for Multimodal Transcription. Retrieved 9 November 2019 from [https://franzoestik.philhist.unibas.ch/fileadmin/user\\_upload/franzoestik/mondada\\_multimodal\\_conventions.pdf](https://franzoestik.philhist.unibas.ch/fileadmin/user_upload/franzoestik/mondada_multimodal_conventions.pdf).
- Oloff, Florence (2014): L'évaluation des complétions collaboratives: Analyse séquentielle et multimodale de tours de parole co-construit. In: Durand, Jacques / Habert, Benoit / Laks, Bernard (eds.), *Congrès mondial de linguistique Française*, 2125-2145.
- Pomerantz, Anita (1984): Agreeing and Disagreeing with Assessments: Some Features of Preferred and Dispreferred Turn Shapes. In: Atkinson, Maxwell / Heritage, John (eds.), *Structures of Social Action: Studies in Conversation Analysis*. Cambridge: Cambridge University Press, 57-101.
- Rauniomaa, Mirka / Lehtonen, Esko / Summala, Heikki (2018): Noticings with Instructional Implications in Post-Licence Driver Training. In: *International Journal of Applied Linguistics* 28, 326-346.
- Sacks, Harvey (1992): *Lectures on Conversation*. Oxford: Blackwell.
- Schegloff, Emanuel A. (2007): *Sequence Organization in Interaction: A Primer in Conversation Analysis*. Cambridge: Cambridge University Press.
- Schegloff, Emanuel A. (2010): Commentary on Stivers and Rossano: "Mobilizing Response". In: *Research on Language & Social Interaction* 43, 38-48.
- Sormani, Philippe (2011): The Jubilatory YES! On the Instant Appraisal of an Experimental Finding. In: *Ethnographic Studies* 12, 59-77.
- Sormani, Philippe / González-Martínez, Ester / Bovet, Alain (2011): Discovering Work: A Topical Introduction. In: *Ethnographic Studies* 12, 1-11.
- Stivers, Tanya / Rossano, Federico (2010): Mobilizing Response. In: *Research on Language & Social Interaction* 43, 3-31.
- Streeck, Jürgen (2008): Depicting by Gesture. In: *Gesture* 8, 285-301.
- Stukenbrock, Anja (2015): *Deixis in der face-to-face-Interaktion*. Berlin: DeGruyter.
- Szymanski, Margaret H. (1999): Re-engaging and Dis-engaging Talk in Activity. In: *Language in Society* 28, 1-23.

Tlili, Anwar / Cribb, Alan / Gewirtz, Sharon (2006): What Becomes of Science in a Science Centre? Reconfiguring Science for Public Consumption. In: Review of Education, Pedagogy, and Cultural Studies 28, 203-228.

Wilkinson, Sue / Kitzinger, Celia (2006): Surprise as an Interactional Achievement: Reaction Tokens in Conversation. In: Social Psychology Quarterly 69, 150-182.

PD Dr. Wolfgang Kesselheim  
Christina Brandenberger  
Christoph Hottiger

Universität Zürich  
UFSP Sprache und Raum  
Freiestrasse 16  
8032 Zürich  
Schweiz

wolfgang.kesselheim@ds.uzh.ch  
christina.brandenberger@uzh.ch  
christoph.hottiger@uzh.ch

Veröffentlicht am 14.5.2021

© Copyright by GESPRÄCHSFORSCHUNG. Alle Rechte vorbehalten.