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A guided tour in an Astronomical Observatory: Setting-specific practices in an informal educational environment

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A guided tour in an Astronomical Observatory: Setting-specific practices in an informal educational environment

Guided visits in informal science settings are important educational events that take place every day in many institutions. Even so, research addressing these activities in detail remains scarce. It is assumed that tours are "structured" interactions, having a stable format in which participants follow predetermined actions. Nonetheless, recordings of guided tours show instead that such "structured" formats are flexible, and highly interactive. This paper examines the praxeology of informal educational practices in an astronomical observatory through close analysis of an excerpt of a guided tour. We investigate how educational practices are accomplished by participants (guides and students) with different levels of astronomical expertise, and how interactions in the environment analyzed here happen through participants' natural language practices. The present study aims to contribute to our understanding of guided tours, and in so doing shows the importance of methods for data analysis sensitive to naturally occurring events.

Keywords: informal education; astronomy education; guided tours; ethnomethodology; conversation analysis

Introduction

It is suggested that in informal education[1], "structured interactions"[2] (such as guided tours or telescope observations) have fixed parameters - in duration, content, and, in the relationships between guides and visitors (Cunningham 2004). Nevertheless, such interactions do not necessarily follow prepared scripts, or prescribed actions, as may be thought, but are "highly interactive pursuits" (Best 2012). They are co-produced by

[1] By informal education we refer, in a broad sense, to flexible education, with a degree of organization and planning. It can occur in different settings, like museums, observatories or public spaces. It is collaborative and non-linear, which is dependent on the context where it occurs (Marques and Freitas 2016, 2017).

[2] By structured interactions, we mean interactions conducted by a guide, rather than unstructured ones, where the public visits or conducts activities on their own.

participants (guides and visitors) through specific (and complex) workplace practices as an instructed course of doing. While it is recognized that the role of guides in these interactions is crucial (Pattison et al. 2017), being an important, and many times the only, human contact in the museum-visitor interface (Abu-Shumays and Leinhardt 2002), guides have little support as professionals (Allen and Crowley 2014). Moreover, despite growing attention (Pattison et al. 2018), there is limited research focused on informal education professionals (Small and Plummer 2013), for instance, to study their impact, describe the job, identify best practices (Pattison et al. 2017) or reflect on their training (Barros, Langhi, and Marandino 2018). Consequently, their occupation is not consistently understood (Pattison and Dierking 2013). Best (2012, 35) goes further and states that "the museum guide has not been studied to any significant degree" and "their workaday practices have been overlooked" .

Other studies focus on visitors, sometimes known as "free-choice" learners (Falk and Dierking 2000), whether in family groups, school groups or others. The research on how these different groups learn and make sense of museum tours and other informal activities has been accumulating (e.g. Bell et al. 2016; NRC 2009). However, this corpus of research is far from sufficient to address the ways in which visitors and guides interact and build a visit together.

When we focus on astronomy-related interactions, the research gap is even more apparent. Informal education in astronomy is conducted in different settings and involves diverse stakeholders, but the area is not well organized or integrated (Marques and Freitas 2016); few studies concern guided interactions (Stroud, Groome, Connolly, and Sheppard 2007), for instance in planetaria, observatories, or astronomy-related museums and science centers. In this group we can also include Marques, Carlin and Moutinho (2020) and Carlin, Marques and Moutinho (2021), who investigate the

interaction of an astronomer guide with a child while observing the Sun with a telescope, and Marques, Carlin and Moutinho (2021), who explore the methods and strategies a group of guides use to communicate about astronomical time in planetarium sessions. Apart from those, most studies have their focus elsewhere. Some of these concentrate on the relation between school and museum visits (e.g. Marandino 2001), or on the experience of the visit from the visitor point of view (Lelliott and Pendlebury 2009). Others focus on students' understanding of concepts and knowledge construction influenced by the visits to observatories and museums (Colombo, Aroca, and Silva 2010; Lelliott 2010, 2014) or on the learning of pupils when taught with dome and computer planetaria (Baxter and Preece 2000), rather than focusing on the interaction between visitors and guides.

The knowledge and training of the guides in astronomy related settings has also been addressed (e.g. Barros, Langhi, and Marandino 2018) and there is also some research concerning the role of amateur astronomers as informal science educators (e.g. Gibbs and Berendsen 2007; Yocco, Jones, and Storksdieck 2012). Again, however, these works are focused more on the knowledge and motivations of the amateurs than on the interaction and communication among all the actors involved.

Consequently, research on astronomy education environments fails to account for the social organization of formal and informal education. Whether in planetaria, as suggested by Slater and Tatge (2017), or other informal astronomy settings. This includes, and has implications in the knowledge of, the different activities involved, such as the training of guides, the design and planning of exhibitions and activities, the choice and display of artifacts, among others.

Research instruments that are not sensitive to the interactional characteristics of learning in these settings underplay the communicative requirements of guides and tour-

cohorts. This study addresses this lacuna by discussing how linguistic, tour-specific competencies are achieved on a moment-by-moment basis. In other words, we will be dealing with everyday activities exhibited by participants through their achievements. The question that will orient our study is: how do participants (in an informal learning environment) produce setting-specific practices to make an observatory tour happen? We will present and discuss a piece of video-recorded data concerning the beginning of a guided visit to a telescope used to observe the night sky. This study uses a praxeological approach, grounded in the fields of Ethnomethodology and Conversation Analysis (Garfinkel 1967, 2002; Sacks, 1992).

The EMCA approach to structured visits

Ethnomethodology and Conversation Analysis (EMCA) are cognate fields that investigate how people interactionally and collaboratively produce meaning in social environments. Since the first investigations of Harold Garfinkel and Harvey Sacks, studies in EMCA have focused on the endogenous properties of actions that people perform either in ordinary settings (such as in conversations between friends) or in specialized settings (such as work sites).

This second branch of studies (the "Ethnomethodological Studies of Work" program) is where our research is located. The "Studies of Work" program maintains a close coherence between the phenomena observed within settings, as natural language activities, and with the settings under study; indeed, one of the first of these settings concerned the "discovery" of a research finding by astronomers (Garfinkel, Lynch, and Livingston 1981), which has a discipline-specific coincidence with the settings for our present study. The authors explicated the work of astronomers in identifying an anomaly in the sky. The "local historicity" of the astronomers' observations, as

documented in the record of their methodic practices as their "night's work", shows the realization of the anomaly as an optically discovered pulsar.

We will be looking at people's practices in our data, the ones that are responsible for making an observatory tour happen, such as the instructions provided by the guide and the visitors' recognition of these instructions as competent methodic practices during the *in vivo*, actual course of following these instructions.

The study presented in this article is part of a broader research project that aims to investigate how the social order in informal astronomy guided activities is jointly accomplished by all the members involved. EMCA studies this phenomenon from a praxeological point of view, i.e. an approach that remains tied to members' practical actions rather than *ex cathedra* versions or distortions of cognitivist theorizing. A praxeological EMCA approach focuses on what can be seen and understood by the participants (and so available for inspection of the analyst), through visible accounts, in that interaction. What EMCA addresses in this research is the conjoint production of activities and the making of meaning, as interactionally accomplished by and for the participants. In doing so, the methods used by the participants in that production are revealed. Praxeological analysis is facilitated by video recordings of natural occurring interactions. This allows us to look at and discuss the taken-for-granted, "seen but unnoticed" practical methods used by the participants (Garfinkel 1967). These rationalities or "ethno-methods" – how people display what they are doing as courses of action – are crucial to the production of the uniqueness of any specific activity since it can bring to light its particularities. In researching astronomy-related informal educational activities, we are looking at how participants produce scenes of everyday activities (of their workplace practices), which are in turn treated by members (the participants in the interaction) as "natural facts of life" (Garfinkel 1967, 35). These

facts, according to Garfinkel, are "massive", real-world productions that furnish the "just-this-ness" of people's everyday practices. By "just-this-ness", Garfinkel draws attention to the constitution of activities, what makes a guided tour a guided tour of this particular setting here and now, rather than abstractions or generalizations from "similar' settings and applying them in this context. Analyzing these activities contributes towards a better understanding of how people (guides and visitors) achieve things such as the communication of astronomical facts and practices.

The form of analysis we present here can be applied in the training of guides, or in enhancing visitors' experiences. In this article we also aim to highlight the importance and contribution of the EMCA approach to the study of structured interactions in informal astronomy settings – an area which lacks fine-grained, deeper research. While EMCA is used in formal educational settings (e.g. Carlin 2010; Moutinho 2019; Macbeth 2000; Payne 1976) social organizational research is also starting to be done in informal education settings (Best 2012; Best and Hindmarsh 2018).

Methodology

As social settings are distinct from each other, it is unreasonable to assume that generic methods are suitable for the fine-grained study of specific research sites. Accordingly, methods for data collection and analysis need to be adapted to the phenomena of inquiry (Wieder 1980). For this research we use video recordings of naturally occurring interactions witnessable in a guided tour in an astronomical setting, and its attendant transcriptions. The focus on how guides incorporate the linguistic procedures used in the presentation affords the analysis of naturally occurring actions as "naturally organized activities" (Lynch 2002). Examination of informal education settings requires methods that make visible the "dark matter" of instruction (Lindwall and Lymer 2008),

a physics metaphor used to describe the unanalyzed, taken-for-granted, interactional contexts produced by participants in educational settings that provide for and surround the instructional events that become the focus for analyses in educational research. According to Christidou:

> Trying to capture and interpret a museum visit is not quantum physics, but none the less is not an easy task to do. Museums are complex physical and social environments where different groups of people interact with each other in multiple (and sometimes) surprisingly unexpected ways (2010, 111).

As a socially organized interactional setting, the investigation of tours requires the analysis of the practices that people use to make that event happen. Video-recorded materials constitute "retrievable" data (Mehan 1978), in that these are available for repeated inspection (Burris 2017), whereby we can subject the data to increasingly detailed analysis. Transcription provides a means by which to visualize the productional particulars that are captured by the recordings – both for analysts and for readers of the outcome results and findings.

The granularity of transcripts and the close analysis to which we shall subject these assures the meeting of particular criteria of scientific status, namely generalizability (Sacks 1984; Wowk,1989), reliability (Sacks 1984; Wieder 1980), and validity (Peräkylä 1997). The analytic gain of looking at a guided tour as "a naturally organized activity" is that it ensures that everybody who is party to the setting – all members of the tour-cohort, and guides – is accounted for in the reflexive production of tour contexts, an extra safeguard that the methods are attuned to the reliability criterion of the research. The treatment of people's actions as thoroughly contextual – accounting for the reflexivity of actions as provided for by the context of the setting and producing the context of further actions within the setting – enables the consideration of action

within the informal education environments in and for themselves. This is done without attempting to add layers of conceptualization (*e.g.* critical or comparative evaluations of people's work) that distance us from the phenomena of analysis (Schegloff 1993).

Data and analysis

The data analyzed in this article were recorded[3] in 2018 in the Geophysical and Astronomical Observatory of the University of Coimbra (OGAUC),[4] Portugal. The OGAUC is a research institution specializing in the study of the Sun. It is also an educational institution with a regular agenda of visits and other activities open to school groups and other types of public.

The data are constituted by an extract from a video of a guided tour, recorded during the beginning of a school visit to the telescope dome. The tour group includes school children (around 20) from the same grade (10-11 years old), and their teachers. The guide is a professional astronomer.

[Place Figure 1 here]

The building has a curved ceiling, a dome, featuring a "window" that can be opened. As we can see in Figure 1, the window is slightly open and light can be seen entering the building. The ceiling rotates horizontally to position the opened window. In the center of the dome there is a high circular platform where the telescope is located and from where the guide stands and speaks. The public are positioned around the central platform in a lower position in relation to the guide, as can be seen in the picture.

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3 Written consent for the use of these data for research purposes was given.

4 http://www.astro.mat.uc.pt/novo/observatorio/site/index2.html

The textual presentation of data that we shall be discussing is presented in transcript form, in Table 1. The transcription conventions, based on Jefferson (2004), can be found in the Appendix. Below for each Portuguese utterance we have added a free translation in English.

[Place Table 1 here]

We will conduct the analysis exploring two main features of the activity studied. First, we will focus on the interactive co-formulation of the guided tour; and secondly, on the roles played and displayed by the participants.

The guided tour as an interactive co-formulated event

Katie Best (2012 35) suggested that guided tours are "highly interactive pursuits". The extract in Table 1 is a good example of this. As our data show, the accomplishment of the explanations performed by the guide is dependent on his professional knowledge as an astronomer, his competence as an observatory guide, and also upon the visitors' competencies to orient themselves to the guide's announcements and instructions. The exhibition taking place is not only a task of the guide, but of all the participants who conjointly formulate the context which they are in. The tour is not a symbolic category on a visitor's itinerary, or an abstract responsibility of a guide. It is a result of real worldly interaction in which the participants are talking, manipulating equipment, listening to and looking at each other to find out what that tour is, as "another first time" (Garfinkel 1967, 9)[5], for all practical purposes. In other words, they are making an

[5] Every single event is unique because the participants, the setting, the conditions are never exactly the same. However, this does not mean that we cannot find patterns in these interactions. Although their production is unique, single events exhibit ethno-methods that

organized social event happen, and the video (here the transcribed extract) demonstrates this organization.

While the guide was explaining how the telescope works, he needed to orient the visitors to the whole functioning of the dome. The telescope is fixed on the top of a circular platform, and rotates in two axes to be pointed out in the direction at which the observer wishes to look in the sky. The dome also has a moveable ceiling that is opened when the telescope is ready for use (see Figure 2). Orienting visitors' attention to this fact is done by the guide through talk, gestures, and manipulation of equipment. For example, by saying "the dome opens that" (line 15), the guide makes a non-verbal move pointing at the ceiling to clarify what he meant by the indexical term "that" (see Figure 2). At the same time, the ceiling gains relevance, but the guide announces that the ceiling will not be opened at that moment since "it's useless" (see line 16). This – "it's useless" – is another indexical utterance that can only be interpreted based on the context that the participants are formulating at that very specific moment. As the tour is organized during the day, it is "useless" to open the ceiling since the sunlight will block the view of the other celestial bodies that could be seen through this telescope[6].

[Place Figure 2 here]

However, one thing that the guide can show the visitors is the rotation of the dome ceiling. We can see how this happens from lines 18-38 in the extract in Table 1.

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are massively present in people's daily work. In other words, they exhibit common practices that escape our attention if not observed in detail, in just that specific moment in which it is produced.

[6] Observations of the sun are possible but are contingent upon the use of special filters. However, at the time of filming, the filter was not available. This was explained by the guide some moments earlier, which is unchallenged by visitors. For the practical purposes of the guided tour, this is a professionally acceptable account.

First the guide asks the children to "take a look overhead" (line 18) (Figure 3); to make sure that the children are orienting to his instructions, the guide requests a confirmation in the following line ("is everybody looking above"?). When the guide receives the children's confirmation (lines 20-21), he manipulates the equipment to rotate the ceiling (line 22). When that happens, the children are able to see the rotating movement and jointly produce tokens of surprise ("wow", "look") as shown in lines 23-25.

[Place Figure 3 here]

Here we have an example of a highly interactive pursuit accomplished by diverse, overlapping actions: the verbal instructions provided by the guide (lines 18-19), the equipment manipulation (line 22), and the verbal expressions of confirmation and surprise produced by the children (lines 20-21; 23-25). These actions operate together as a "gestalt" (Gurwitsch 1964) when members are interacting. By "gestalt" we mean that language and other conduct cannot be analyzed separately since this is not how members experience or see the world. They see these resources (language, body movements, equipment manipulation, etc.) not as discrete entities but as a whole.

Guides need to develop site-specific professional competences in order to make the visitors' tour successful. These competences are not just at the level of general astronomical knowledge, both in concepts and instrument functioning and manipulation, but also at the level of local knowledge, that is, the knowledge about that specific observatory and astronomical dome in which they are working.

Furthermore, the guide needs to do more than provide explanations and instructions. He has to orient his attention to the visitors' reactions and how they respond to his talk, at the same time that he chooses the right moment to press the

button to make the dome ceiling rotate. In the co-production of a successful tour, visitors also need to be competent in following guide's instructions by reacting to his talk and moves to formulate a context of an observatory tour in which they do not have much experience to act. The same thing applies to other assistants or teachers who may be involved in that social encounter. However, the level and type of site-specific competence of each participant is different - some give instructions, some follow them; others have questions that can be answered by someone with more knowledge on the matter; some work in that setting, others are there for a short visit, with different knowledge about that space.

For this reason, the guide needs to be aware of this asymmetry of knowledge and try to "compensate" for it, for example, by giving space for the children to report their experience and iterate their assumptions. Following on from Garfinkel and Sacks' (1970) concept of "membership", we can say that the guide needs to be sure that the participants in the guided tour are able to follow the demonstration of the tour as a series of "naturally accountable actions", as any competent member (or "natural language user") would do. The concept of membership refers to the use of natural language; and the guide trades upon visitors' natural language use in order to explain the astronomic profile of this specific setting. For the guide, it is not necessary to assist visitors to achieve anything like his professional site-specific competence, but to assist them to achieve "good enough" familiarity with the setting that is adequate for the practical purposes of a guided tour. The guide accomplishes the comprehensibility of an astronomic, site-specific presentation through "alternating frames of ordinary and science-laden ways of speaking and acting" (Macbeth 2000, 44). From lines 27-40, for example, we can see how skillful the guide is to grant the children the conversational floor for them to do their own observations ("what is going on?" - line 27; "what is

rotating?" - line 33; "is it you or the dome?" - line 34). The interaction here is jointly produced through participants' accountable practices. Each utterance or move is accomplished by the recognition of a previous one, which makes the encounter sequentially structured. The guide, for example, does not provide further instructions to children without their confirmation of understanding of a previous instruction. That is why no prespecified format of guided tours can account for all the necessary methods used by people to produce a specific tour.

Membership organization of guide-visitor interaction

The accomplishment of a guided visit is produced not only through the sequential organization of talk, but also through its categorial organization. As Payne stated,

> (...) members are continuously displaying to one another the relationships they consider relevant at the time, what they see as relevant identities for themselves and for the persons they are interacting with, what they consider the situation to be, and what they consider to be relevant activities etc. (1976, 33)

Guided tour relationships are displayed through members' ethno-methods. In the collaborative production of a guided tour, the local cohort organize themselves using particular ethno-methods that are bound to cultural shared assumptions (Watson 1997), and which are specific to the event being formulated. Among these ethno-methods are membership categorization activities (Moutinho 2019; Sacks 1992; Watson 1997), which are sometimes organized by members themselves into category pairs.

A guide and a group of visitors can be described here as a pair of membership categories, since both categories "guide" and "visitors" are operative. However, the co-presence of those categories is not enough to produce a categorial pair. Even in the same physical space people can be doing something else rather than a guided tour. They can, for instance, be waiting for someone, looking for something they lost, waiting for

the rain to stop so that they can leave the building after the visit, etc. Then, for the categorial pair "guide-visitor" to be realized (so that a guided tour can happen) we need those two categories "guide" and "visitor" to be "interactionally paired". Consequently, talk and other conduct are fundamental for the production of the visit, which, by the same token, are fundamental for the production of a specific categorial pair. The extract presented here demonstrates how the categorial pair "guide-visitor" is interactionally produced, and displayed to all participants in the setting through talk.

Some activities are normally related and connected to particular categories (Payne 1976), and are recognized as such by members. They do this by interacting with each other. According to Payne (1976) this is one of the methods members use to make sense of the conversation – they orient themselves to category-bound activities.

> (...) the speaker can be analysed by his hearers as an appropriate person to make such an utterance; in the making of the utterance, he can be observed to be displaying himself as that appropriate person. He can then be seen to be claiming for himself a particular identity or membership category. At the same time he is providing for a possible membership category for his hearers (Payne 1976, 36).

In our example, the guide produces an array of activities that can be seen by other natural language users (or "members") as category-bound activities. He is in a central position, he talks loudly so that everybody can hear him, he changes his focus to different visitors to "corral" everybody as part of the visitor group. Moreover, as witnessable in other educational settings, the guide makes the visitors behave as a group and "controls" the tour – for instance, being the one who asks the questions, gives instructions, and provides technical explanations on the functioning of the telescope.

On the other hand, the audience acts as an audience. What is generally expected from an audience is to be engaged and focused. The children actively show that by

responding to the guide's questions, by looking at where the guide asks them to look, by not talking too much to each other so that the guide can be heard, etc.

As Payne (1976) suggested, they are not just doing category-bound activities, but also orientating themselves to a specific categorial pair, in this case, the "guide-visitor" pair. This means that categorial pairs are not only produced by members, but also hold relevance for the identification of the member when he or she produces a next action. This is what makes interactions both sequentially-structured and categorially-structured, i.e. sequential and categorial aspects of members' practices are reflexively related. These aspects may be identified in our data.

In the previous section we talked about the asymmetry of knowledge that is characteristic of this kind of interaction. A guide is someone who is affiliated with an institution, knows about the objects, instruments and related information of that space. The guide is also the one who knows the sequential organization of the visit in terms of its historicity and directionality: from where and to where the visit goes. So by giving instructions, such as in line 2 - "*it's a matter of looking here at this window*" or line 18 "*and now I, I'll ask you to take a look overhead*" he displays actions of "being a guide". By looking and responding, the visitors are displaying actions of "being visitors". Giving explanations is another guide-specific activity. Those explanations can be about the characteristics of the observatory and instruments (e.g. lines 6-7, 15-17, 41-42) or about astronomical content (lines 52-54). The guide also shows control of the situation, by operating the dome ceiling – controlling the movement of the window and its rotation, and also by being the one who makes decisions about that movement (lines 17-19) and aperture (line 16). All these actions, produced by that member recognized to be the guide, enjoin engagement activities (looking, nodding, responding to questions, etc.) among members of the group.

The guide clearly controls the interaction, talking almost all the time and guiding the audience through the explanation and demonstration of what the preparation of an observation through the telescope in this dome looks like. Lines 18-40 are particularly interesting to show these skillful guiding activities from another perspective.

By using a series of questions, the guide encourages the visitors to look at the ceiling, and to be surprised by the feeling of its rotating movement. The guide knows that during this kind of movement it is normal that some people feel that they are the ones moving and not the ceiling (in the same way that we, when on a bus parked in a station, sometimes feel that we are the ones moving when the bus next to ours starts moving). We can "see" that the guide knows about this phenomenon through the questions and comments he makes. For example, he asks multiple times who is moving – progressing from the most general open question - "what is going on?" (line 27), to a question with candidate answers – *"and what is rotating? is it the dome or you?"* (lines 33-34). These make evident the relative confusion that visitors may be facing, yet, he requests confirmation of the non-movement of the audience: "*ye::ah (.) you are steady aren't you?*" (line 36), and he ends by stressing again what is moving and what is not (line 40). These questions help the verbalization and consequent explanation of the phenomenon that visitors experience at this moment in the tour. Also, by asking these questions, the guide extends and prolongs the "WOW" experience since the visitors focus on the moving ceiling. On the other hand, if we pay attention to the response, we can see that after line 36, when the guide asks the confirmation question "*you are steady aren't you?*", what follows is a delayed answer (see the silence at line 37). When the group eventually answers (line 38), the elongation of their response suggests that their being steady was obvious. We can then say that the visitors formulate the guide's question as a jocular moment, since it is obvious for them that the ceiling is moving,

even though, for a moment, it seems otherwise. So here we can see "practical" methods of making an experience, prolonging that experience, and emphasizing the salience of that experience.

However, although guide and visitors produce things together, they do not have the same level of experience in that environment. We can see this at moments when the asymmetry of knowledge among them becomes more visible. In line 43, for example, a child (C3) starts to make a comment while the guide is talking, but does not complete it. In line 46, the guide stops and addresses the boy ("*say?*"). The boy then completes his comment in line 47, and the guide replies, not by agreeing or disagreeing, but by complementing the child's statement. Moreover, and very importantly, the guide directs his answer progressively away from the boy, by starting to answer directly to him, but then changing his focus to the whole group, as a single cohort, in line 48.

He does that by shifting his gaze from one boy (C3) to another one next to C3, and then by moving his gaze to the group, in a position that, to some extent, turns his back to the boy (C3) who has made the initial utterance. In Sacks' (1985) terms, in lines 47 and 48 we can see that the guide both "preserves" and "transforms" the contribution from C3. Through preserving and transforming this contribution, the guide confirms and elaborates upon what the boy was trying to say; this move (shifting gaze to the whole group) avoids putting the boy "on the spot" and gives him the opportunity to have his contribution recognized by the categorially ratified participant within this particular tour.

Another feature of this organization is that the guide treats the group of visitors as a group and not as individuals, as a single cohort (Payne 1976). As seen in the previous example, the guide replies to the boy and immediately directs the conversation to the group again. He talks to the visitors as a whole, using "you" in the plural (lines 9,

13, 17, 34, 36) or the infinitive form (lines 40, 41, 47) and constantly changing the person at whom he is gazing. The children align with this characterization, answering all together as a group, in unison.

Another feature of the guide's talk is the use of "we" when referring to the observations and manipulation of instruments (e.g. line 6 – "*look! (.) is this, it is this place that we use*'; line 41 – "*so we rotate the dome and open the window*"; line 51 – "*because during the day we do not see (.) the stars the planets*"). We suggest that this has two consequences. First, it can give the image of the guide as a representative or spokesman of the institution. By saying "this is the place that we use" instead of "I use" he evokes the plural character of the institution and reminds the audience that he is not the only one working with the telescope. Secondly, there are occasions when by using "we" the guide seems to be including the children (in sentences such as *"and so we rotate the dome and open the window"),* and that has the effect of engaging them more. It takes the visitors from a passive position, to one where they are being included in the action of controlling the remote that makes the window open, or the ceiling rotate. So the use of inclusive language can be a technique to engage visitors. It seems effective because the children are displaying complete engagement, answering, showing amazement and responding in unison, for instance in lines 35 and 38.

One utterance that shows this engagement clearly occurs at line 40. It is the final line of the sequence about what is moving and what is steady, when the dome ceiling is set in motion. We remind the reader that this astronomical dome has a curved ceiling that rotates, while all the rest stays still. Being a curved and long ceiling, this part of the dome looks like a continuation of the walls; and sometimes, as at line 40, the guide refers to it as "walls" ("*it is not the walls that are moving, you are*"). The correct statement would be the other way around - it is not you who are moving, the walls are

(actually, the ceiling) moving[7]. But as can be seen in Figure 4, the indexical gesture that accompanies this utterance point in the right directions, and the audience has no problem in understanding what is being communicated following the sequence of previous talk. As mentioned in the previous section, members realize gestural and oral particulars as part of a "gestalt", as indexical accounts which constitute and in turn are constituted by the context of their occurrence.

[Place Figure 4 here]

Discussion and implications

Guided tours may be treated as "structured interactions" but, from an ethnomethodological approach, they are structured by participants themselves through the use of natural language activities, such as formulating context, ordinary displays of engagement adequate to the context that is being formulated, invocation of setting-specific and task-specific contingencies, and orientation to appropriate membership categorization activities; furthermore, as Garfinkel (1967) argued, there is no "time out" from these methods for structuring the tour as a tour, which are occasioned and recognized on a moment-by-moment basis.

As seen from the analysis presented in this paper, what may seem a simple beginning of a tour is full of complex phenomena and, most of all, work to produce the visit and make it an educational event. Some practices used by the participants were pointed out and the interactional nature of this event was highlighted. The competence of the guide in keeping the children connected to what he was explaining - for instance, by constantly asking for attention of the children, shifting gaze from one child to the whole group or using inclusive language - and the competence of the children to follow

[7] see figure 1 for clarification of the spatial configuration.

and engage in the activities, produced a guided visit. This visit was developed through talk, in the sequence of utterances and in the display of membership categories. Studies on guide's work tend to focus on the professional development through self-reflection (e.g. Allen and Crowley 2014) or use non naturally occurring events to understand guides' roles and their relationships with museums (e.g. Abu-Shumays and Leinhardt 2002). Despite the importance of these researches to better understand structured visits and guides' work, they often focus only on the verbal part of the interaction and do not study real visits, with real visitors and guides interacting, consequently missing the opportunity to find the local methods used to produce the visits *in situ* and its linguistic, interactional proprieties.

Knowing about these methods, originated in the real interactions between visitors and guides, has implications in different activities involved in the informal education area, and not just the astronomy related ones. The methods and skills that guides use identified here can be useful in training and evaluation; better understanding of how interaction with the public occurs can inform the planning of activities, design of exhibitions, and management of visitors' expectations.

Another implication of this inquiry is methodological: to realize descriptive adequacy, methods sensitive to the activities that constitute the setting are required. Video-based analysis of these guide-visitors interactions makes visible what cannot be assumed a priori, through fieldwork observations, or reports based on the *post hoc* reflections of participants. Studies using video data of informal education events exist, but are mainly focused on unstructured visits using Point of View (POV) cameras on visitors exploring activities and exhibitions without staff guidance (e.g. Burris 2017; Degotardi et al., 2019; Hauan and DeWitt 2017), or recording unstructured staff facilitation (e.g. Pattison, 2017, 2018). We argue here that video-based analysis of

naturally occurring interactions can also be used fruitfully to study and describe the interactional proprieties of structured activities in informal settings. This is not to say that this study does not have limitations concerning the data recording. As Burris (2017) points out due to camera angle and position, it is not easy to capture all the interactions using video-based methods. However, it is also important to mention that members are not necessarily orienting to all the elements of a setting, at least not as separated entities. Therefore, the idea to 'capture everything' is chimerical. Moreover, there are good examples of studies using video-recordings as data (Goodwin 1994; Mair et al. 2012, 2013), which demonstrate the value and analytic potential of 'working with what we've got'.

Each tour is unique and the practical methods that people use to accomplish a tour *in situ* become visible, i.e. are made available for analysis through this research method. Taking guided tours in astronomic environments as "perspicuous settings" (Garfinkel 2002), as topics of ethnomethodological investigation, enables analytic purchase on the ongoing collaborative production of educational events. This methodological orientation has important consequences for future studies of guided tours, and informal science education, by directing analysis towards the constitutive activities of informal science education rather than using it as a reified category.

Therefore, we suggest that the research techniques adopted in this paper are particularly suited to reflection on guided tours - and to the training of volunteers and experts required for the hosting of guided tours. We also contend that following the methodological protocols outlined in this paper enables a more secure foundation for developing policies and setting-specific practices regarding informal education. By using retrievable data, further research would be able to identify other methods and study real interactions between visitors and guides in astronomical activities, e.g.

telescope observations, planetarium sessions and museum visits, to better understand how these activities are produced and their implications for educational and outreach areas.

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References

Abu-Shumays, M., and G. Leinhardt. 2002. “Two Docents in Three Museums: Central and Peripheral Participation.” In *Learning Conversations in Museums*, edited by G. Leinhardt, K. Crowley, and K. Knutson, 401–423. Mahwah, New Jersey: Lawrence Erlbaum Associates.

Allen, L. B., and K. J. Crowley. 2014. “Challenging Beliefs, Practices, and Content: How Museum Educators Change.” *Science Education* 98 (1): 84-105.

Barros, L. G., R. Langhi, and M. Marandino. 2018. “The practical investigation of instructors in an astronomical observatory: subsidies for qualification.” [A investigação da prática de monitores em um observatório astronômico: subsídios para a formação.] *Revista Brasileira de Ensino de Física* 40 (3): e3405 1–15.

Baxter, J. H, and P. F. W. Preece. 2000. “A Comparison of Dome and Computer Planetaria in the Teaching of Astronomy.” *Research in Science & Technological Education* 18 (1): 63-69.

Bell, J., J. H. Falk, R. Hughes, G. Hunt, J. Parrish, M. Ruffin, et al. 2016. *Informal STEM Education: Resources for Outreach, Engagement and Broader Impacts*. Center for Advancement of Informal Science Education (US). doi: 10.13140/RG.2.1.4736.3446.

Best, K. 2012. “Making museum tours better: Understanding what a guided tour really is and what a tour guide really does.” *Museum Management and Curatorship* 27 (1): 35–52.

Best, K., and J. Hindmarsh. 2018. “Embodied spatial practices and everyday organization: The work of tour guides and their audiences.” *Human Relations* 72 (2): 248–271.

Burris, A. 2017. “A Child's-Eye View: An Examination of Point-of-View Camera Use in Four Informal Education Settings.” *Visitor Studies* 20 (2): 218-237.

Carlin, A. P. 2010. “The corpus status of literature in teaching sociology: Novels as ‘sociological reconstruction’”. *The American Sociologist* 41(3): 211–231.

Carlin, A. P, J. B. V. Marques, and R. Moutinho. 2021. “Seeing by proxy: Specifying “professional vision””. *Learning, Culture and Social Interaction* 30: 100532.

Christidou, D. 2010. “Re-introducing visitors: Thoughts and discussion on John Falk’s notion of visitors’ identity-related visit motivations.” *Papers from the Institute of Archaeology - UCL* 20: 111–122.

Colombo Jr., P. D., S. C. Aroca, and C. C. Silva. 2010. “Daytime School Guided Visits to an Astronomical Observatory in Brazil.” *Astronomy Education Review* 9: 1–7.

Cunningham, M. K. 2004. *The interpreter’s training manual for museums.* Washington, DC: American Association of Museums.

Degotardi, S., K. Johnston, H. Little, Y. Colliver, and F. Hadley. 2019. ““This is a Learning Opportunity”: How Parent–Child Interactions and Exhibit Design Foster the Museum Learning of Prior-to-School Aged Children.” *Visitor Studies* 22 (2): 171-191.

Falk, J. H., and L. D. Dierking. 2000. *Learning from museums: Visitors experiences and the making of meaning*. Lanham, MD: Rowman & Littlefield Publishers.

Garfinkel, H. 1967. *Studies in Ethnomethodology.* Englewood Cliffs, NJ: Prentice Hall.

Garfinkel, H. 2002. *Ethnomethodology’s Program: Working out Durkheim’s Aphorism*. Lanham, MD: Rowman & Littlefield Publishers.

Garfinkel, H., M. Lynch, and E. Livingston. 1981. “The work of a discovering science construed with materials from the optically discovered pulsar.” *Philosophy of the Social Sciences* 11 (2): 131–158.

Garfinkel. H., and H. Sacks. 1970. “On Formal Structures of Practical Action.” In *Theoretical Sociology: Perspectives and Developments*, edited by J. C. McKinney, and E. A. Tiryakian, 338–366. New York: Appleton-Century-Crofts.

Gibbs, M. G., and M. Berendsen. 2007. “Effectiveness of Amateur Astronomers as Informal Science Educators.” *Astronomy Education Review* 5 (2): 114–126.

Goodwin, C. 1994. “Professional vision.” *American Anthropologist* 96 (3): 606–633. doi: 10.1525/aa.1994.96.3.02a00100

Gurwitsch, A. 1964. *The field of consciousness*. Pittsburgh: Duquesne University Press.

Hauan, N. P., and J. DeWitt. 2017. “Comparing Materials for Self-Guided Learning in Interactive Science Exhibitions.” *Visitor Studies* 20 (2): 165-186.

Jefferson, G. 2004. “Glossary of transcript symbols with an introduction.” In *Conversation Analysis: Studies from the First Generation*, edited by G. H. Lerner, 13–31. Amsterdam: John Benjamins.

Lelliott, A. 2010. “The concept of spatial scale in astronomy addressed by an informal learning environment.” *African Journal of Research in Mathematics, Science and Technology Education* (14) 3: 20–33.

Lelliott, A. 2014. “Understanding Gravity: The Role of a School Visit to a Science Centre.” *International Journal of Science Education, Part B: Communication and Public Engagement* (4) 4: 305–322.

Lelliott, A., and S. Pendlebury. 2009. ““A Large Object with a Small Museum”: A Narrative Analysis of Tlotlo’s Experience of an Astronomy Science Center.” *Curator* 52 (3): 241–260.

Liberman, K. L. 2013. *More Studies in Ethnomethodology*. Albany: State University of New York Press.

Lindwall, O., and G. Lymer. 2008. “The dark matter of lab work: Illuminating the negotiation of disciplined perception in mechanics.” *The Journal of the Learning Sciences* 17 (2): 180–224.

Lynch, M. 2002. “Protocols, practices, and the reproduction of technique in molecular biology.” *British Journal of Sociology* 53: 203–220.

Macbeth, D. 2000. “Classrooms as Installations: Direct Instruction in the Early Ages.” In *Local Educational Order*, edited by S. Hester, and D. Francis,21–72. Ams terdam: John Benjamins Publishing Company.

Mair, M., P. G. Watson, C. Elsey, and P. V. Smith. 2012. “War-making and sense-making: Some technical reflections on an instance of ‘friendly fire’.” *British Journal of Sociology* 63 (1): 75-96. doi: 10.1111/j.1468-4446.2011.01394.x

Marandino, M. 2001. “Interfaces in the museum-school relationship.” [Interfaces na relação museu-escola.] *Caderno Catarinense de Ensino de Física* 18 (1): 85–100.

Marques, J. B. V., A. P. Carlin, and R. Moutinho. 2020. “Seeing by proxy: a detailed analysis of an educational interaction at the telescope”. *Revista Brasileira de Ensino de Física* 42: e20190354.

Marques, J. B. V., A. P. Carlin, M. Gomes, and R. Moutinho. 2021. “Periodicity and change: talking about time inside the planetarium dome”. *Science Education* (in print)

Marques, J. B. V., and D. Freitas. 2016. “Mapping the future of non-formal Education and the scientific dissemination of Astronomy in Brazil: A Delphi study”. *Policy Futures in Education* 14: 1153 – 1181.

Marques, J. B. V., and D. Freitas. 2017. “Characterization factors of non-formal education: a literature review” [Fatores de caracterização da educação não formal: uma revisão da literatura]. *Educação e Pesquisa (USP)* 43: 1087 – 1110.

Mehan, H. 1978. “Structuring school structure.” *Harvard Educational Review* 48 (1): 32–64.

Moutinho, R. 2019. “Context formulation and the invocation of membership categories in an L2 classroom”. *Journal of Pragmatics* 140: 100–111.

National Research Council (NRC). (2009). *Learning science in informal environments: Places, people and pursuits.* Washington, DC: National Academies Press.

Pattison, S. A., and L. D. Dierking. 2013. "Staff-Mediated Learning in Museums: A Social Interaction Perspective." *Visitor Studies* 16 (2): 117–143.

Pattison, S. A., S. M. Randol, M. Benne, A. Rubin, I. Gontan, E. Andanen, C. Bromley, et al. 2017. "A Design-Based Research Study of Staff-Facilitated Family Learning at Interactive Math Exhibits." *Visitor Studies* 20 (2): 138–164.

Pattison, S. A., A. Rubin, M. Benne, I. Gontan, E. Andanen, T. Shagott, M. Francisco, et al. 2018. "The Impact of Facilitation by Museum Educators on Family Learning at Interactive Math Exhibits: A Quasi-Experimental Study." *Visitor Studies* 21 (1): 4-30.

Payne, G. 1976. "Making a lesson happen: an ethnomethodological analysis." In *The Process of Schooling: A Sociological Reader*, edited by M. Hammersley, and P. Woods, 33–40. London: Routledge/Kegan Paul Ltd.

Peräkylä, A. 1997. "Reliability and validity in research based on tapes and transcripts." In *Qualitative Research: Theory, Method and Practice*, edited by D. Silverman, 201–220. London: Sage.

Sacks, H. 1984. "Notes on methodology." In *Structures of Social Action: Studies in Conversation Analysis*, edited by J. M. Atkinson, and J. C. Heritage, 21–27. Cambridge: Cambridge University Press.

Sacks, H. 1992. *Lectures on Conversation*. Oxford: Basil Blackwell, vol. 1 & 2.

Schegloff, E. A. 1993. "Reflections on quantification in the study of conversation." *Research on Language and Social Interaction* 26 (1): 99–128.

Slater, T. F. and C. B. Tatge. 2017. *Research on Teaching Astronomy in the Planetarium*. Cham, Switzerland: Springer.

Small, J. D., and K. L. Plummer. 2013. "Survey of the Goals and Beliefs of Planetarium Professionals Regarding Program Design." *Astronomy Education Review* 9: 1–10.

Stroud, N., M. Groome, R. Connolly, and K. Sheppard. 2007. "Toward a Methodology for Informal Astronomy Education Research." *Astronomy Education Research* 5 (2): 136–148.

Watson, R. 1997. "Some General Reflections on 'Categorization' and 'Sequence' in the Analysis of Conversation." In *Culture in action: Studies in Membership Categorization Analysis*, edited by S. Hester and P. Eglin, 49–75. Washington, D.C.: University Press of America.

Wieder, D. L. 1980. "Behavioristic operationalism and the Life-World: Chimpanzees and chimpanzee researchers in face-to-face interaction." *Sociological Inquiry* 50 (3-4): 75–103.

Wowk, M. T. 1989. “Talk in an organization: Organization in talk.” In *Working with Language: A Multidisciplinary Consideration of Language Use in Work Contexts*, edited by H. Coleman, 541–564. Berlin: Mouton de Gruyter.

Yocco, V., E. C. Jones, and M. Storksdieck. 2012. “Factors Contributing to Amateur Astronomers’ Involvement in Education and Public Outreach.” *Astronomy Education Review* 11: 1–11.

Appendix – Transcription Conventions

(.)	No timed pause, usually of 0.4 seconds or less
(2,3)	Timed pause
=	Equal signs, one at the end of a line and one at the beginning, indicate no pause between the two lines
(...)	Unintelligible
?	Rising intonation
.	Falling intonation
,	Continuing intonation
°word°	Soft stress (usually when the speech is lower than the surrounding discourse)
: or ::	Prolonging of the preceding sound or syllable
[	Beginning of an overlapping talk
]	End of an overlapping talk
(word)	Questionable words
((word))	Researcher' comments or aspects of the utterance (such as whispers or coughing)
'word'	Reported speech

Table 1. Transcript of the visit to the telescope dome. Captions: Cs = children (visitors); C#= a single child; G = guide.

(1)	Cs	(…)((crianças e prof.s falam simultanea e imperceptivelmente)) tá a abrir ((barulho da cúpula a abrir)) *(…)((children and teacher speak simultaneous and imperceptibly)) it is opening ((noise of the dome opening))*
(2)	G	é questão de olhar aqui pa esta janela (.) sim *it's a matter of looking here at this window (.) yes*
(3)		tão a ver? *are you seeing?*
(4)		(6.0)
(5)		(…) ((burburinho ligeiro das crianças e professores)) *(…) ((slight buzz of children and teachers))*
(6)		olha! (.) é esta, é este sítio que nós usamos *look! (.) is this, it is this place that we use*
(7)		pra fazer as observações à noite? (.) *to make the observations at night? (.)*
(8)		tá bem? *ok?*
(9)		portanto se vocês quiserem vir fazer observações aqui *so if you want to come and make observations here*
(10)		(depois) vão ter que vir (.) num dia à noite (.) *(after) you will have to come (.) one day at night (.)*
(11)		certo? *right?*
(12)	C1	si[:m *ye[:s*
(13)	G	[mas assim ficam a conhecer os telescópios (.) *[but this way you get to know the telescopes (.)*
(14)		e a cúpula *and the dome*
(15)		e então é assim a cúpula abre aquilo= *so that's how it works the dome opens that=*
(16)		=eu não vou abrir mais porque não vale a pena= *=I am not going to open it because it's useless=*
(17)		=mas para vocês verem ela também ro:da= *=but just for you to see that it also rota:tes=*
(18)		=e agora vou, vou-lhes pedir que olhem para cima (.) *=and now I, I'll ask you to take a look overhead (.)*
(19)		tá tudo a olhar pra cima? *is everyone looking above?=*
(20)	Cs	=si[::m =ye[::s
(21)	Cs	[si::m [ye::s=
(22)		((the guide presses a button to rotate the dome))
(23)	Cs	=uau!= *=wow!=*
(24)	Cs	=[uau= =[*wow=*
(25)	Cs	[olha [*look*
(26)		(.)
(27)	G	o que é que tá a acontecer? *what is going on?*
(28)		(.)
(29)	Cs	tá rodar

it's rotating=

(30) Cs =[a rodar

=[rotating

(31) Cs [tá roda::r

[it's rotating

(32) (.)

(33) G tão e o que é que está a rodar=

so and what is rotating=

(34) =é a cúpula ou são vocês?

=is it the dome or you?

(35) Cs =a cú::pla:=

=the do::me:=

(36) G =po::is (.) vocês tão parados não tão?

=ye::ah (.) you are steady aren't you?

(37) (.)

(38) Cs si::m

ye::s

(39) G [po:is

[ye:ah

(40) não são as paredes que estão a rodar, são vocês

it is not the walls that are moving, you are

(41) então nós rodamos a cúpula e abrimos a janela

so we rotate the dome and open the window

(42) para observar na direção que quisermos (1.0)

to observe in the direction we want to (1.0)

(43) C3 pá apanhar a [lu

to catch the [mo

(44) G [tá bém?

[ok?

(45) é assim que funciona

that's how it works

(46) diz? ((olhando para C3))

say? ((looking down at C3))

(47) C3 pá panhar a lua e o sol quando::

to catch the moon and the sun when::

(48) G ((volta o olhar para o grupo))pá panhar o que for necessário (.)

((shifts gaze to the whole group))to catch what is necessary (.)

(49) normalmente é à noite que fazemos as observações

it is usually at night that we make the observations

(50) e assim (.) observamos é:: as estrelas? e os planetas

and so (.) we observe eh:: the stars? and the planets

(51) tá bem?

Ok?

(52) porque durante o dia nós não vemos (.) as estrelas os planetas

because during the day we do not see (.) the stars the planets

(53) por causa da luz do sol

because of the sunshine

(54) que é muito forte (.)

which is very strong (.)

(55) tá bem?

Ok?

Figure 1

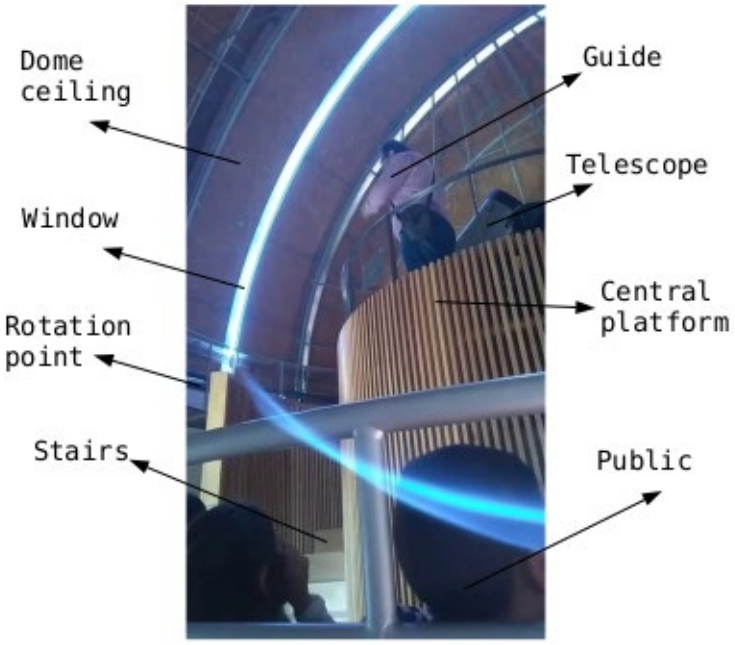

Figure 2

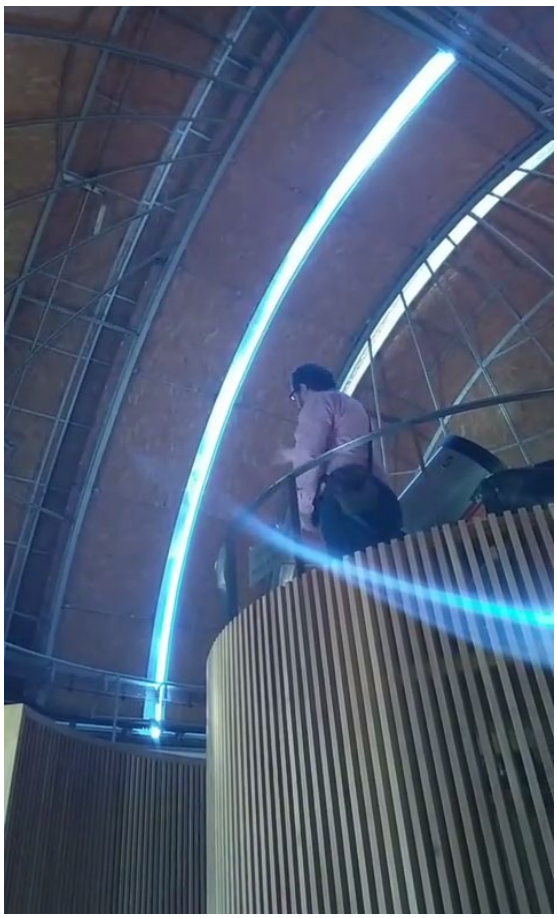

Figure 3

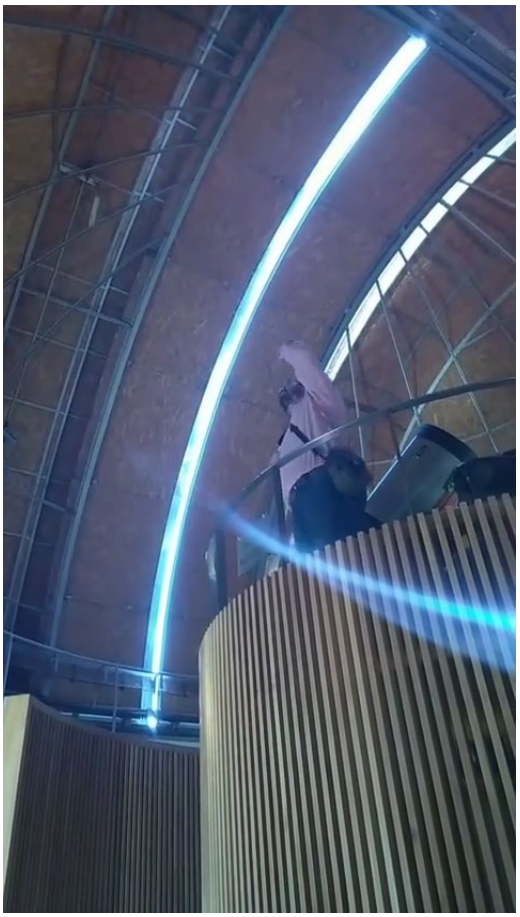

Figure 4

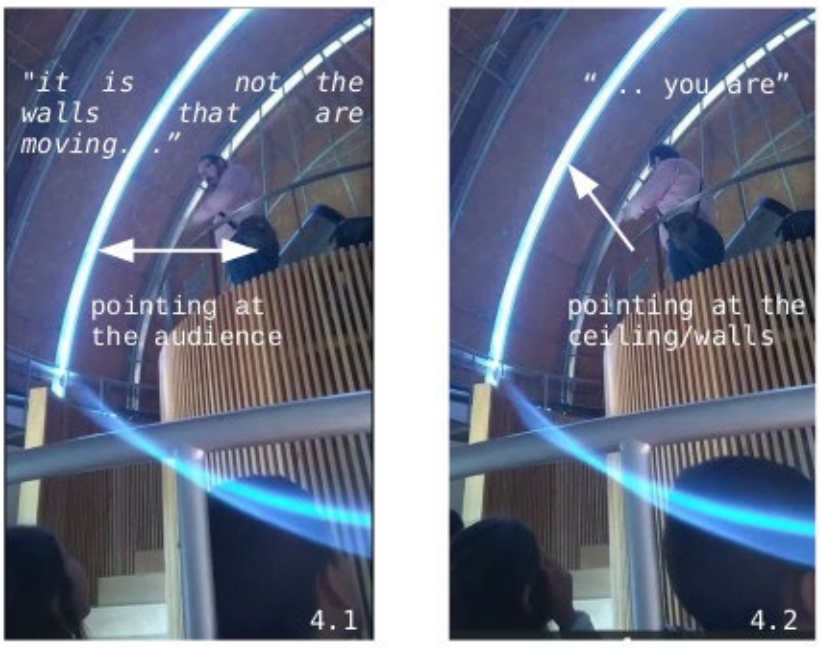

Figure Captions

Figure 1. Snapshot of the visit.

Figure 2. Pointing at the window.

Figure 3. Directing attention to the ceiling.

Figure 4. Pointing out what is steady and what is moving.