



# The Structure of Problem Structuring Conversations: A Boundary Games Approach

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## Abstract

One of the questions associated with facilitated problem structuring is how the micro level of actors' multimodal communications, contributes to the emergence of a macro level, framing the possibilities for action in a workshop. This paper shows a way to study this macro level, building the visualization of the conversations' structure starting from a boundary games theory micro analysis of the interactions. Our empirical evidence comes from following a group of academic consultants working to define a value proposition for their activity. We focus on analyzing two out of nine workshops that were felt diametrically opposite in terms of facilitation and achievements. Moving from the micro towards an upward level, three configurations building the structure are identified—shifting, branching and converging. The work carried out allows us to: (1) visualize the structure of conversations in a problem structuring context, (2) highlight the role of multimodal communications in building the conversations and (3) construct an interpretation bridging the micro and macro readings of a workshop. This knowledge is useful for facilitators guiding the dynamic of a workshop and for researchers looking forward to understanding how micro level interactions build higher levels of the social phenomenon of intervention.

**Keywords** Boundary games theory · Micro level analysis · Workshop structure · Facilitation · Problem structuring · Visualization · Multimodality

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## 1 Introduction

There is a growing interest in examining problem structuring workshops from the perspective of micro-processes (Becker 2016), and this article addresses this issue from the boundary games theory (BGT) perspective (Velez-Castiblanco et al. 2016). This allows us to look at boundaries as the containers of different groups of ideas that change in a language game through multimodal communications such as writing, image, speech, gesture, etc. (Kress 2009). Tracing the evolution of boundaries shows different flows of ideas, which allows the construction of graphs that let us visualize an emerging structure of the problem structuring conversations, framing the possibilities for action in a workshop.

The literature talks about problem structuring methods as ways to intervene in situations in which the problem needs to be constructed. The problem requires to be constructed because its nature “might not even be agreed across the interested parties, never mind any agreement existing on potential solutions” (Shaw et al. 2006: 940). The situations that require these approaches are normally characterized by multiple actors, multiple perspectives, conflicting interests, intangibles and uncertainty (Mingers and Rosenhead 2004: 530). One of the expected benefits is “to help groups arrive at a shared problem definition” (Ackermann 2012: 657).

The work towards structuring the problem involves human interaction, and consequently, constant negotiation (White 2009). It is embedded in a continuous emergent dynamic. From a systems thinking perspective, it is necessary to support the work considering ‘wider boundaries’ (Ackermann 2012), which are, among other possibilities, set, challenged, probe, follow, enhanced and wandered (Velez-Castiblanco 2012).

Two elements support this work: facilitation and model building (Franco 2006). Facilitated interaction is needed because we are dealing with a:

Complex endeavor encompassing not only orientation to time constraints and to generation of idea volume, but also to participant diversity and cooperation. This brings with it a need for interaction formats allowing for distributed cognition, shifting between perspectives, securing collaboration and progression towards a satisfactory outcome. That calls for practical organization of people, phases and artifacts in order to have the interaction perceived (inside and outside the group) as productive, effective and efficient (Nielsen 2013: 89).

On one hand, facilitation is a current focus of research, especially considering the interest of behavioral operational research (Franco and Hämäläinen 2015; Hämäläinen et al. 2013). The idea is that the process cannot be understood if we do not consider the interpretations and biases of the users (Brocklesby 2016). On the other hand, model building has been seen through the lens of material objects supporting cognitive operations of the participants and their value as semiotic resources (Franco 2013; Paroutis et al. 2015). We can paraphrase White et al. (2016), and say that any current effort in understanding problem structuring needs to consider how to approach human agency and artefacts.

Understanding these issues has been called opening the black box of practice (Franco 2013). Franco and Greiffenhagen (2017) classify studies in OR that contribute towards the understanding of practice in three groups. The first group uses theory to

guide the analysis of processes and outcomes, after the actual event (Ormerod 2014; White 2009). The limitation with this group is that the interactions between participants are not available for examination. The second group looks for the actual flow of the interactions. They study those using software that enables tracing participants' contributions (Ackermann et al. 2011; Shaw et al. 2003). However, the actual empirical evidence of how the flow is constructed in the interactions is not present.

The third group looks for patterns in the flow of interactions. However, the distinctive characteristic of the group studies is the use of recordings to substantiate findings with empirical material. The first batch of these studies relied on audio recordings (Tavella and Franco 2015; Velez-Castiblanco et al. 2016). This is limited because the audio is unsuitable for understanding the role of artefacts and different modes of communications. Consequently, current studies are starting to use video (Burger et al. 2018; Franco and Greiffenhagen 2017; Franco and Nielsen 2018; White et al. 2016).

From the methodological perspective, this paper belongs to the third group. It uses recordings (audio and video) for tracking the flow of interactions where language and artefacts intertwine. However, it also incorporates ideas from the second group, specifically Ackermann et al. (2011) work, when they develop a way to portrait a whole meeting under the perspective of the different arguments and ideas produced by the participants. This suggest a method of connecting micro level analysis with a macro view of the process. Notice that although group three represents a methodological advancement, it focuses exclusively on the micro level of the interaction forgetting the need to connect with the macro level as seen in Ackermann and Eden. There are increasing calls from various academic disciplines for finding ways in which the micro level of analysis can be articulated with higher levels of social phenomena. Some demands come from philosophy (Schatzki et al. 2001), strategy as practice (Seidl and Whittington 2014) and operations research (White 2016). Our purpose here is to address the question of how to link the micro level analysis with the macro level of interactions in a workshop.

From the methodological point of view, in contrast to the analysis of computerized logs of the actions of the participants in Ackermann and Eden, we rely on the strategies of the third group (Franco and Greiffenhagen 2017) and focus on actual human to human analysis of interactions. Our paper argues that, for understanding the micro–macro articulation, we can build a structure depicting the different parts and connections of the conversation.

A dictionary definition of structure tells us that it is an arrangement of parts. To take this definition to the realm of our interest, a metaphor comes at hand. Flow structure is a concept used to talk about igneous rocks. It refers to the lines and bands that appear among the rocks when lava flows down and solidifies (Fig. 1). These marks let us understand the different flows with their transformations and movements. For our case, we understand parts not as lava flows, but as conversation flows, as for the arrangement, the way in which these different flows connect to each other. The proposal in this paper is to approach a problem structuring workshop as a space of multiple conversation flows. In this space, a flow represents transformations of information and ideas.



**Fig. 1** Flow structures in igneous rocks. Image from Rygel (2009), and modified by the authors

Following with the rock metaphor, we need a way to represent the marks left by the different conversations to see the “flow structure.” Here we rely on the boundary games theory (henceforth BGT), which understands that an intervention process is:

shaped by communications concerning boundary judgements. These communications involve the OR practitioners in the team (and other participants, when relevant) ‘setting’, ‘following’, ‘enhancing’, ‘wandering outside’, ‘challenging’ and ‘probing’ boundaries concerning the nature of the context and the methods to be used (Velez-Castiblanco et al. 2016, p. 968)

In a nutshell, a conversation from this perspective would be the intertwined multimodal communications that through their effects, change assumptions enclosed by different boundaries. BGT allows depicting and following graphically the sequence of changes to the boundaries. These depictions are the flow’s marks, and with those, we can show a way to explain the transformations and how ideas change during the process of problem construction.

The paper identifies three basic configurations or ways in which the flows of conversations are arranged: (1) *shifting* redirects the flow, changing the direction of the conversation, (2) *branching* opens subordinate flows of conversation, (3) *converging* merges a group of flows. These configurations can be combined to produce a general graph of the structure of the workshop. Understanding how the structure is assembled can help facilitators to produce changes in the emergent dynamics. The findings are illustrated contrasting the dynamics of two, out of a total of nine workshops constructing a value proposition for a group of consultants working at a Colombian university. The research strategy for the data collection was action research inspired.

The paper is organized as follows: first, we explain the theoretical framework of BGT and its pragmatic underpinnings emphasizing the understanding of the events, and the interrelations of the communications based on their effects. Some elements are added to BGT. They clarify key aspects for coding such as the multiple boundaries, effects, modes and how to manage conflicting interpretations. Next, we detail the methodological process, considering the research setting and its pertinence, and the data collection process. The data analysis shows how the structure of the workshops is built on the micro analysis of communications. Some representative fragments are used to illustrate the process. On these bases, the workshops are compared in search of lessons for research and practice. The findings let us appreciate the structure of the structuring conversations, the macro level, and the ways in which actors change and shape the emergent dynamics at a micro level. Finally, we present some conclusions.

## 2 Boundary Games

BGT explains the micro level of intervention focusing on communicative interactions. Communicating the message can be understood, from the perspective of the philosophy of language, as participating in a language game, namely using language and actions in a rule-based activity (Wittgenstein 1958). The notion of language games is a useful philosophical underpinning because every communication, in any communicative mode, can be understood as language and actions. This includes methods or methodology application, regardless their paradigm, the use of theories, stories, or objects. All of them are uses of tools from language games, transforming the language games in place.

Those transformations in the language games that comprise the intervention process can be seen through the changes that arise, in the different boundaries, during the process. Basically, boundaries mark what is inside and what is left outside the situation in focus. Here we look at boundary critique theory for ways to understand the concept (Midgley 1992; Midgley et al. 1998; Ulrich 1983; Yolles 2001). Specifically, Midgley (2000: 35) suggests that boundaries can be understood as “social and personal constructs that define the limits of the knowledge that is taken as pertinent in an analysis.” Boundaries affect how we tackle issues. Where exactly those boundaries “are constructed, and what the values are that guide the construction, will determine how issues are seen and what actions will be taken” (Midgley 2000: 36).

To connect the idea of the transformations in the boundary with language games, BGT uses relevance theory (Sperber and Wilson 1995; Wilson and Sperber 2002). Consequently, it conceptualizes what lies inside the boundary as a set of assumptions that stand for ideas and game’s rules that are used to make inferences about the effects of communications. Those assumptions are affected with every new move within the language game and thereby, the abstract constructed boundary “containing” those assumptions change as well.

The unifying theme behind BGT’s underpinnings is pragmatism. Ulrich (2001), a boundary critique thinker, on the pragmatic approach, cites Peirce: “Consider what effects, which might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our

conception of the object” (Peirce 1969, para 402). The idea of understanding context through pragmatic effects can also be seen behind Wittgenstein idea of meaning as use (Mouffe 2005), and the idea of cognitive effects in relevance theory (Setton 2006).

Velez-Castiblanco et al. (2016) detail six actions or operations on the boundary or ways in which communications (by any means) change the boundary in terms of how they affect the perceived cost–benefit (cognitive effects/processing effort), the relevance of the different assumptions for interpreting a situation. Here is an overview of the operations:



*Setting*: It “draws” a new boundary by establishing new assumptions and rules for the conversation. It can be understood as a change in the topic (sometimes subtle), that creates a space where certain answers fit the implied rules and assumptions. In the icon, the new boundary, the bold circle, brings ideas from past boundaries, represented by the thin circles.



*Following*: It applies the rules and assumptions in place. It can refer to something that has not been expressed, but it is possible to infer from the implied rules and assumptions. The boundary gets stronger because its implications become easier to understand (it reduces the processing effort). The bold line inside the circle represents an operation using the rules and assumptions inside the boundary, to infer something that also lies inside the boundary.



*Enhancing*: It introduces a new assumption, or rule, to the conversation. With this new rule, it is possible to obtain previously unobtainable inferences (more effects). However, it does not change the focus of the conversation, neither the kind of answers that fit the boundary in place. The representation shows how the boundary grows due to the new rules and assumptions and the new possibilities for inferences.



*Wandering outside*: It shows something that is not inside the boundary, but in the process of contrasting both sides, it makes the boundary easier to recognize by recognizing the relevance of the ideas inside, it reduces the effort.



*Probing*: Since ideas are abstract, sometimes being able to visualize if something is inside the rules or assumptions of the conversation, or not is tricky. This game aims to clarify the boundary by prompting an answer. However, the actual answer solving if the issue belongs inside or outside the boundary cannot be predicted.



*Challenging*: It weakens the boundary, making the rules and assumptions less pertinent for the problem at hand. There are two ways in which this is accomplished: one is by pointing out contradictions between elements that are contained within the boundary, while the other is to show that in the light of a different boundary (perspective), the ideas of the boundary in focus are not so appropriate. The represen-



tation shows a line that crosses the boundary and weakens it by the means of reducing the cognitive effects or increasing the cognitive effort.

These six actions or operations on the boundaries can be used to codify the effects of participant's communications during interactions. BGT also adds an element to the codification: the interrelation of the operations performed on the boundary. These interrelations arise due to the need of every communication to find its relevance in relation to previous communications. The interrelations are represented by lines connecting the operations accordingly to the boundaries over which they have effects. BGT requires an iterative process of coding that need to be mindful of the different boundaries, modes, effects and interpretations.

## 2.1 Multiples Boundaries

Although the roots for understanding and considering boundaries in BGT are rooted in boundary critique, there are two important differences in how they are operationalized. One, refers to what elements are contained by the boundary. Boundary critique has conceptualized what is inside the boundary as actors (Ulrich 1983), or values (Midgley 1992). However, BGT follows relevance theory. Consequently, what is bounded is a set of assumptions, a cognitive environment. This produces the second important difference.

Basically, boundary critique literary uses one or two boundaries when approaching to the analysis of the situation. For instance, Ulrich approach, uses the boundary to distinguish between involved and affected. Midgley, uses the boundary to distinguish between the sacred and profane values in a situation to understand conflict. By contrast, BGT requires many boundaries because it focuses on understanding communications. The reason for that is that human beings rely in many different cognitive environments (Sperber and Wilson 1995). Consequently, in coding a conversation, we can have multiple boundaries in play. Those boundaries are introduced into the conversation as shared cognitive environments through the operation of *setting*.

## 2.2 Multiple Modes

Although, the term multimodality is strongly associated with social semiotics, this discipline is not the only one interested in how different modes of communication work together (Kress 2009). Crucially for this paper relevance theory is one of those domains interested in understanding how different modes of communication work (Clark 2013; Forceville 2014).

The argument for the pertinence of relevance to understand multimodality focuses on the effects of communications. Stating the obvious, every communicative mode, communicates. When communicating, actors change material conditions (e.g. making sounds, writing in a whiteboard), and those activate inferential processes in the audience perceiving them. Consequently, these changes ultimately affect the cognitive environment of the audience (Sperber and Wilson 1995). Just like in speech then, we can judge the effects of those other communicative modes through the way in which they change boundaries.

### 2.3 Multiple Effects

One key factor in BGT is that in coding each communication, there is the possibility that several operations on different boundaries can be identified. This derives from the idea that a communication can have multiple cognitive effects (Sperber and Wilson 1995). In other words, a communication can potentially affect multiple assumptions belonging to multiple boundaries.

### 2.4 Multiple Interpretations

The process of coding using BGT produces (and requires) multiple tentative interpretations. The reason is that instead of focusing on propositional content, the coding is based on pragmatic effects. Consequently, we cannot judge the pragmatic effect of a communication based solely on the first impression of its propositional content. The propositional content can enter in conflict with later reactions and inferences of the audience. Therefore, we need to go back and forth developing a coding able to connect the effects in the whole communicative process.

These connections are possible because each interaction is “embedded in broader sequences of interaction” (Potter 2004: 47). These connecting sequences are present in conversations (and problem construction conversations) because we are dealing with processes of meaningful communication in which the audience reacts in recognition of the intention of the speaker (Grice 1991). In terms of relevance theory, every conversation produces “a change in the mutual cognitive environment of two people is a change in their possibilities of interaction (and, in particular, in their possibilities of further communication)” (Sperber and Wilson 1995: 61–62). People are mutually framing their possibilities for action. BGT takes advantage of this intertwinement to clarify and refine our understanding of the conversation.

Typically, the first iteration of an interpretation will start judging the operation on the boundary by the propositional content of the communication. Then we try to connect the reactions to the initial communication. It is important to notice that sometimes people do not react immediately, so it will be necessary to look for the reactions in later communications.

Now, to understand if this first approximation needs to be changed, we look for conflicting views about the boundaries, contrasting the propositional content of the communication in focus and the communications reacting to it. Reactions could imply that the effects of the previous communications were understood differently from the propositional content. Basically, there are two scenarios:

1. Propositional content and reactions conflict in relation to which boundary they are affecting. For example, somebody trying to support a position when, in fact, others understand that a new position is being introduced. In this situation, to solve the conflict, it is required reconsidering what are the communication’s effects and the connections to previous flows.
2. Propositional content and reaction are conflicting in relation to the perceived strengthening or weakening of the boundary. For example, somebody says “yes” in the propositional content, but the nuances in tone say “no.” We can assume



that s/he did not mean “yes,” because later the somebody asks, “why are you not convinced?” In this case, the coding requires to reconsider the effects assigned.

At the start of the codification process, it is possible that solving the conflicts requires reconsidering connections and effects at each new considered communication. This means that the explanation of the events in the interaction is unstable (Garfinkel 1981). The purpose is to go back and forth solving the conflicting issues up to a point in which the coding (explanation) becomes stable. In other words, previous codification does not enter in conflict with new communications.

### 3 Methodology

#### 3.1 Research Setting

Eafit university is a private nonprofit Colombian organization with a strong relationship with the business community. One of its divisions deals with consultancy and it looks to transfer knowledge generated by academia and at the same time, creates opportunities for empirical work for researchers. In their portfolio, the demand for assistance with strategic planning is increasing. In consequence, the consultancy division contacted the subject academic area responsible for strategy's courses.

The strategy area comprises two full time lecturers working at the university (one of them the coordinator of the group, the other, the second author of this paper), and seven lecturers whom work primarily in the business, holding positions in strategic areas or doing independent consulting. The group meets regularly, 2 h/month mainly for preparing courses at undergraduate and postgraduate level. The meetings are held at the end of the working day. When the strategy area was contacted to support consultancy, the coordinator of the group proposed using these meetings to run a series of workshops, looking forward to defining how the demand by the consultancy area could be met.

At this point, the first author was brought in. Two purposes were established for the workshops, first, to define a value proposition for the area of strategy to act as a consulting group. The second, to provide an opportunity for each one of the participants to practice and improve facilitation skills by alternating in the role of facilitating. These two considerations led to the adoption of an action research inspired approach to the research (Dash 1999; Reason and Bradbury 2001). We used an iterative learning cycle in which as a group of practitioners, we were developing our skills (planning the workshop, acting, and reflecting before the next workshop) and at the same time producing valuable empirical data for the micro level analysis and later, for contrasting the workshops' conversation structures.

Nine short workshops (2-h each) spread across a year, were carried out, taking place in the usual study session. Around 15 min at the end of sessions were devoted to reflecting and giving feedback about how to improve the session. The first and second author of this paper participated in the workshops and facilitated some. They also played a leading role in most of workshops' planning processes. The book game storming (Gray et al. 2010) was used as reference for facilitation guidelines and pos-

sible methods and activities. The book suggests the importance of considering issues such as the use of questions, artefacts, improvisation, and reframing among others. The sessions were conducted in a squared classroom. A whiteboard on the front, video beam, screen and computer, were available. Movable tables and chairs were placed in U shaped form.

The first workshop was facilitated by the first author. It was based upon the question: What can this group offer in strategy consulting? A broad map of issues to explore was developed. The topics of legitimacy, reporting, fields of expertise, and coherence and responsibility were identified as important for the kind of consultancy that the group wanted to provide. The group found the workshop useful. However, the opening question used to lead the workshop was felt ambiguous. Participants found different interpretations on what the question was asking for, and this was perceived as problematic. Consequently, in line with an action research learning process, we agree in devoting the second workshop to explore the subject of questions. Additionally, a new facilitator was appointed for the next workshop.

The second workshop aimed to explore the subject of using questions in facilitation. The assigned facilitator selected an exercise for design thinking, specifically the “Wallet Project” (Institute of Design at Stanford 2012) for the exploration of the topic. The guidelines for this exercise emphasize the development of interviewing skills. The object wallet is thought to evoke the “larger context of a person’s life” that increases the possibilities for connection and empathy. So, it was expected to offer possibilities to reflect and learn about questions.

However, the facilitator found it difficult to proceed with the activities. Opposition from the group was building up. This may be explained in part by the group perception. The session was felt as a detour. It did not advance the issues identified in workshop one, nor was it felt that it contributed to an understanding of the issues of facilitation. In fact, the group overtook the facilitator’s leadership of the workshop and started to discuss how to improve the work for the following session. This workshop is analyzed in the next section.

In reaction to workshop 2 problems, the conversations and planning for workshop 3 were carried out through a couple of meetings in the intermediate month. A group was appointed to design the session. It included the facilitator, the coordinator of the area and the first and second author of this paper. We discussed how one of the failings of the meeting could have been the lack of visual support for the activities. Therefore, we addressed this problem with the use of whiteboard, post-its, power point, and collages.

Representative fragments from workshops two and three are the focus of this paper. What makes those interesting is how extreme they are Eisenhardt (1989) and Langley and Abdallah (2011). The second was felt as a non-relevant detour whereas the third workshop focused on returning to the perceived right path. In the second, the use of artefacts was peripheral, while in the third, it was central. In the second, participants overtook the facilitator’s role in the leadership of the workshop. In the third, the facilitator always had a steady hand on the dynamic. The planning for the second was left to the appointed facilitator. The third involved a planning committee. The overall feeling was that the second was inconsequential and the third effective.

The fragment selected from the workshop 2 covered the beginning of the session until participants overtook the facilitator. Workshop 3 covers the first part of the inter-

action, the one in which the facilitator generates the confidence in that the session was in good hands and that this workshop marked the return to the right path. Our approach contrasted these workshop fragments to reveal what they can teach us in terms of the structure and the structuring of a workshop.

### 3.2 Data Collection

We adjusted the instruments to gather the data along the way (Herr and Anderson 2005). When the research process started, we considered that going at once for video recording of the second workshop was too intrusive. We were aware of how recording of any kind is difficult in our context. Additionally, we were conscious that we were dealing with many workshops, working alongside colleagues and co-workers. Consequently, we decided to go slowly, helping the group to get used to the observation. Hence, for workshop 2 we asked permission only for audio recording and note taking. We had problems making sense of a part of the recording due to an activity in which the group was divided into smaller groups and multiples conversations overlapped. Consequently, for future workshops we used several voice recorders.

The third workshop, as mentioned, involved the use of material artefacts such as whiteboard and power point presentations. We used video recording and photos (Paroutis et al. 2015; Franco and Greiffenhagen 2017), for understanding the fine detail of how these elements plus the speech, pictures and gestures were reflected on the micro behaviors. These also lead us later to consider how multimodality reflected on BGT.

### 3.3 Data Analysis

Our analysis was based on boundary games theory (Velez-Castiblanco et al. 2016). This foundation was complemented with new conceptual constructs that were developed during this research, as it will be explained in Sect. 4. The analysis is looking at the micro processes as continuous flows of communications in which several modes like speech, gesture, and pictures are used by actors to create, affect and combine different boundaries. We (the three authors of this paper), carried our analysis by debating to reach agreements among ourselves at every step. For the data analysis, we followed this process:

1. The recordings were transcribed verbatim in their original language, Spanish, indicating the conversational turns. As it has been common in the use of vignettes in soft OR and problem structuring (Franco 2013; Tavella and Papadopoulos 2017), we opted for a clear, easy to read text. This implied that no speech tones were included. The transcription for the second workshop only relied on the audio. The transcription for the third was supported by video and photos to clarify the information on the different communicative modes. One caveat for presenting the results of this paper is that in Spanish, we frequently found that the statements were lacking clarity and coherence. We consider that translating under these conditions, while keeping the original flavor for the purposes of this paper, is still a challenge. For the special case of workshop three, we added a layer to the transcription depicting

**Table 1** Some modal/multimodal conventions used in the transcriptions

Convention	Description	Modes involved
text	The person utters the “text”	Speech
[text]	The person writes “text” on the whiteboard	Writing
[text]	The person erases the “text” from the whiteboard	Writing
<u>text</u>	“Text” is simultaneously spoken and written on the whiteboard	Speech + writing
text.	“Text” is read from the whiteboard	Speech + writing
[*Something/Someone: speech]	Pointing to something or someone while uttering “speech”	Speech + gesture + (extra mode referred by the other two)

some interactions among the participants, supported by material elements such as whiteboard and power point presentations. We created some conventions to represent the multimodal nature of these interactions (see Table 1).

- Before coding we took each participant turn and checked if its intervention could be broken into moves. Making different moves in a turn enable the actor to put several elements in place, adding complexity and detail to the argumentation. Each move typically corresponds to one phrase in speech mode. There is not an unambiguous way to make this division (Van Eemeren and Grootendorst 1984). The move can be described as the minimal part of the communication, out of which we can identify an effect on a boundary. Sometimes, achieving the effect will require a set of phrases; sometimes just a fragment, or even an onomatopoeia or gesture will suffice. Sometimes, just one communication mode does not provide enough information to decide the effect, so multiple modes need to be considered.
- We used two parallel process. On one hand, we coded each move by using one, or more of the six operations on the boundary, proposed by BGT. For that aim, we created a computer font using the icons introduced in Sect. 2 to facilitate the process. On the other hand, during the coding process, we were drawing lines connecting the coded operations with operations from previous moves. In this way, we were tracing the transformations experienced by the different identified boundaries. We call flow the series of those transformations on a boundary. In other words, the flow comprises an initial *setting*, plus all the other operations on that boundary. The coding, plus the connections, constitutes a working hypothesis, an explanation of the events of the segment. Because sometimes an action can be linked to another action far behind in the transcription, we developed the convention of numbering each *setting* (one of the five actions on the boundary) on their order of appearance, assigning a number on the left side of the icon. The numbers on the right side refer to the *setting* to which the action is linked. This can be appreciated in the vignettes in the following section.
- When our initial interpretations were conflicting with later moves, in other words, we had an unstable coding (see Sect. 2.4), we went back to step 3 to examine the coding. Then we came up with a different hypothesis, a different interpretation of

- the operations on the boundary and their connections. We continued this process until finding a coherent, stable explanation, one capable of satisfying later moves.
5. Finally, we cross checked our explanations with those obtained during the reflective segments at the end of the session, and the minutes approved by the participants. These gave us ways to triangulate and sustain our findings.

Following these steps, we produced transcriptions with one added column depicting a diagram that shows the operations on the boundary and their connections (fragments of these are shown in Figs. 4, 5, 6). The complete transcriptions and diagrams were tens of pages long. This is good for micro level detail, but makes it difficult to see the whole picture, namely, the macro level of the workshop. We explain how we proceeded with this level in the next section.

## 4 Findings

### 4.1 Building the Structure

This section follows an unconventional order. Instead of showing first the micro-level analysis of the workshops, it starts focusing on the macro level, the overall structure. Although, technically the structures were obtained after ending the micro-level analysis, it seems useful to have an overall map of the interaction and then be able to locate the segments of interaction (explained from Sects. 4.1.1 up to 4.1.3) in the context of the whole workshop.

Now, with the idea of structure—an arrangement of parts—in mind, we see the micro level of boundary effects analysis as those parts. However, this left the question open to how they were arranged. Working for a while in the codification and linking of the operations on the boundary, we came to recognize that the operation of *setting* was having a fundamental role for visualizing this arrangement.

Why *settings*? Because it creates a boundary, while the other five actions (*following*, *enhancing*, *challenging*, *probing*, *wandering outside*), work on already created boundaries. These five actions or operations are linked in a linear succession of effects to contribute to an already existing flow. Settings create new flows and are also the points in which those flows are redirected, diverged and converged. When settings are taken and linked together (leaving out the other operations), we obtain the skeleton-structure of the workshop. The settings stand for the different flows (the parts), and their links show the arrangements. (See Figs. 2, 3).

The “trees,” or “skeletons,” represent “maps” portraying workshops 2 and 3, respectively. The circles on them stand not only for the *settings*’ operations but more importantly, for the flow originating at that point. The numbers within the circles correspond with the ones used in the vignettes (Sects. 4.1.1, 4.1.2, 4.1.3). This establishes a connection between the micro and macro representations.

Observing the trees, we can notice that *settings* are related to each other in what we can call configurations. Conceptualizing a group of *settings* as different configurations is useful for two reasons. First, it eases the process of identifying *settings*. Coding with BGT is an iterative process in which we go backwards and forward looking for the best

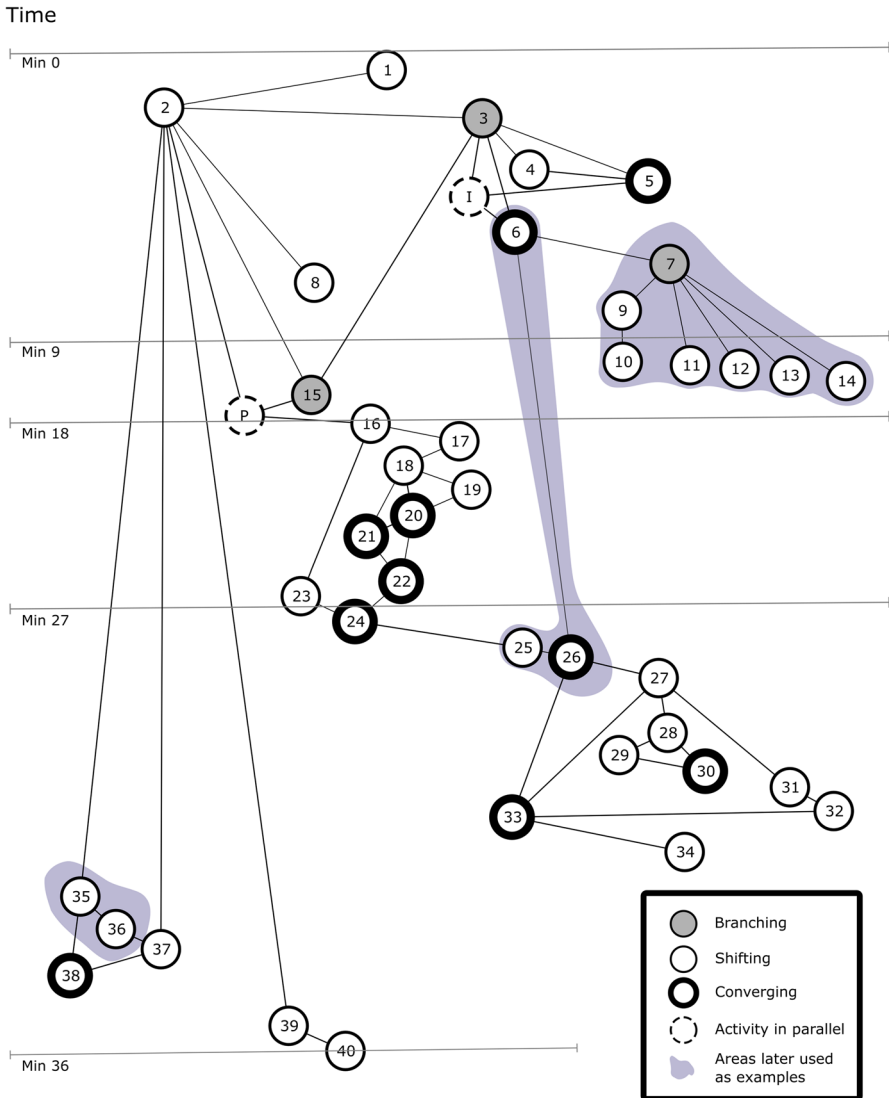


Fig. 2 Structure of workshop 2

explanatory hypotheses of the action. Having a sense of how some operations connect back and forth, gave us additional information to solve conflicts when deciding about the effects.

Second, it helps to identify “building blocks.” The group of *settings*, acts as a pattern of interaction, enabling to understand local purposes of the segment and ways in which the interaction (its structure) is steered. Later, when the blocks of a workshop are assembled, we have a way to represent the flow structure of the workshop encom-



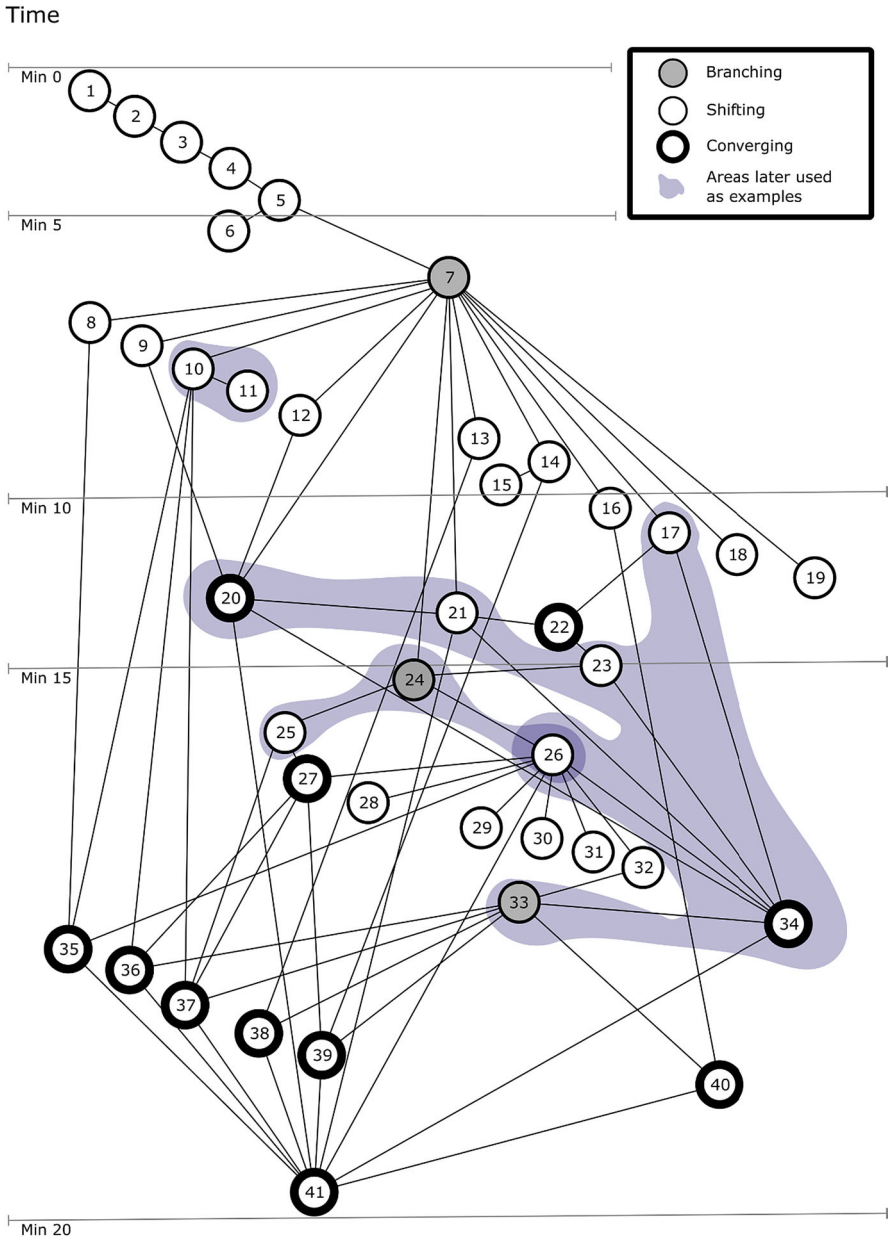


Fig. 3 Structure of workshop 3

passing all the redirections, divergences and convergences of flows. We identified three configurations as shown in Fig. 4.

Next section starts explaining the different configurations (*shifting*, *branching* and *converging*), alternating examples from workshops 2 and 3. Over the base of

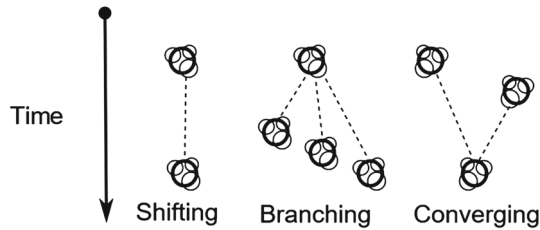


Fig. 4 *Setting's configurations*

understanding them, we can give an overall description of the workshops. Later, the workshops will be compared searching for future lessons for practice and research.

The examples themselves used to illustrate the building blocks will mix two strategies of presentation: the micro-analysis of vignettes and the high-level/structural view. Vignettes are used as illustrations of configurations involving few turns of contiguous interactions. Structural view becomes a must for configurations spanning tens of turns and/or non-continuous interactions. In these cases, we will focus on the *settings* where the flows of conversation originate.

Additionally, we aid the interpretation in multiple ways. We provide a context for each one of the examples by showing the previous events and the ones after. Furthermore, we use several forms of representation: the trees of interaction, and the vignettes of the multimodal conversations. All these strategies invite to a back and forth process of reading while interpreting the passages and enables to connect and see the connections between the micro and the macro levels.

#### 4.1.1 Shifting

In this configuration, two *settings* appear at the extremes of a line (Fig. 4). The *setting* at the top marks the start of the flow of a conversation about a topic. A theme is proposed and there can be a series of operations on the boundary in relation to this theme. The series of actions, the flow of the conversation is then redirected/shifted by the *setting* at the bottom, diverting this flow by creating a different one. The change of course can be considerable, and the new conversation will not resemble the old one. Sometimes, it can be subtle. The new conversation can look very similar to the previous one, however, the kind of expected answers changes. For example, in a conversation somebody can set a boundary when planning for a business travel. Adding elements such as place, date, transport or hotel will count as *enhancings* that add information we did not know in advance, but are expected and required. All these contributions keep the conversation in track piling up more elements regarding the travel. However, if the conversation side tracks to not just add the hotel but to discuss hotel possibilities, a *setting*, not an *enhancing* appears, a new boundary *shifts* the kind of answers that make sense in the defined space. As a consequence, the expectation will be on the line of people providing experiences and useful information about hotels.

**Shifting as Morphing (Workshop 2)** The vignette in Fig. 5, zooms in around minute 32 *settings* #35 and #36 (Fig. 2). It depicts the communication mode of speech, and

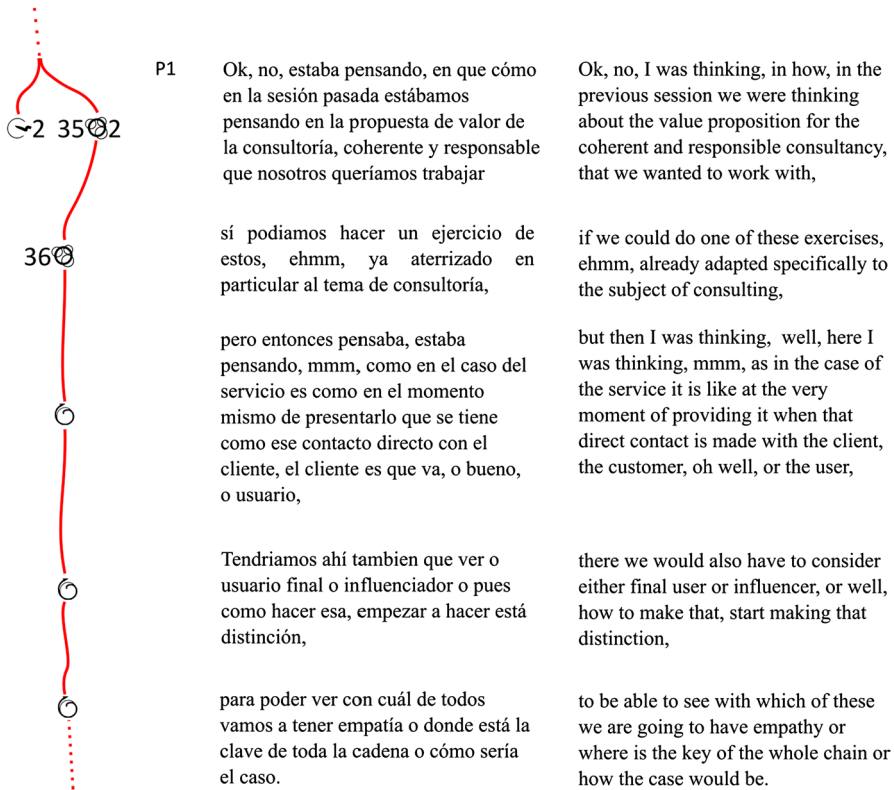


Fig. 5 Shifting as morphing from workshop 2. Dotted lines show that the flow extends outside of the present vignette

it comprises one turn (just one actor involved) with five moves and six operations on the boundary; it comes from a moment in which the facilitator is about to lose the control and direction of the workshop. The conversations placed before this segment, focus around stories depicting successful innovations, a detour from the stated purpose that was not even considering the input from the previous activities. However, in this segment, Participant 1 (P1) changes the topic and links its operations to *setting #2*, a *setting* just at the beginning of the workshop, proposing to carry out some activities and then, link those with workshop 1. What those activities were or why they need to be linked to workshop 1 was not explained. Then, at *setting #35*, P1 starts to express that the workshop promise was not held.

*Setting #35*, brings back an agreement about the kind of consultancy that was decided in Workshop 1 and challenge the work carried out in the session. Characterizing the operation at #35 as a *setting*, involved several discussions among us. An initial interpretation was to say that it was *following* ideas defined in the previous workshop, 1 month before. However, we notice that by now, the idea was forgotten, or it was a very faint memory for most of the participants. Consequently, we had bases to say that a shared cognitive environment was not present.

It is worth noting here the way in which P1 is linking *settings* #2 and #35. S/he is changing the flow and dynamics of the conversation, but P1 needs to show that the idea is relevant to the conversation. The recent interactions (innovation success stories) were not giving space to claim relevance around her/his concern, neither the activities proposed by the facilitator. Our interpretation is that in search of relevance, P1 goes back in search of a connection. *Setting* #2, provides the foundation, since it was the only boundary carrying information in relation to workshop 1. So, *setting* #35 took the base of #2 and shifts/redirects the flow proposed there. If we do not assume this connection, we will not have a way to look and explain how P1 intervention fits and makes sense with the dynamic.

Next, the *setting* #36 shifts the focus again suggesting some group exercises that can be applied to think about consultancy issues. Notice that with these two settings in succession, P1 changes completely the flow of topics of the workshop. They switch from storytelling to put under scrutiny the workshop looking for ways to reframe it, to make it more relevant to the expectations.

The core idea with the *shifting* configuration in Fig. 5, is that an initial idea is morphed progressively by leaving part of the old idea, and then taking some bits of the idea in combination with new ones. The process through several steps, helps to keep the sense of relevance of what is being said and at the same time, it helps to introduce radical departures from the current flow in a smooth way.

**A Misunderstanding from Workshop 3** Figure 6 shows a vignette from Workshop 3 with a different instance of the *shifting* configuration in which the speech, and the writing modes of communication collaborate to achieve the effects. This segment of interaction is part of the *branching* configuration (see Sect. 4.1.2) that starts at *setting* #7, in which people are taking turns to talk about their expectations for the workshop. At one of these turns, at *setting* #10, Participant 1 (P1) expresses an idea that is misunderstood. Consequently, when the Facilitator (F), tries to write down the idea on the whiteboard, s/he produces an alternative version (#11), somewhat based on the one at #10. This has the secondary effect of *challenging*, weakening P1's idea. These two effects are produced only through the writing mode of communication. Notice that the support of the whiteboard helps the facilitator to see that, perhaps, there was no connection between #10 and what is written on the whiteboard (#11). Notice here that the idea is to maintain some synchronization between the writing and the speech modes. This allows keeping everybody on the same page.

Next, the Facilitator *probes* to see if the written version reflects #10. The spoken interchange reinforces *setting* #10 and weakens #11. Finally, the one presented at #11 is erased from the whiteboard, and a fitting version of P1's idea is registered. This *shifting* is different from the one in the previous section. In the previous illustration of *shifting*, the gist was to intentionally morph an idea, here it is about a misunderstanding and the subsequent process of correcting it.

It is important to notice here that the conventions of drawing are different from the ones in Velez-Castiblanco et al. (2016). For instance, look at the *probing*s just after *setting* #11. The previous non-explicit convention implied drawing just one *probing* where the two previous flows met. However, this paper emphasizes that the only operation that can combine boundaries is a *setting*. For that reason, and to make sense

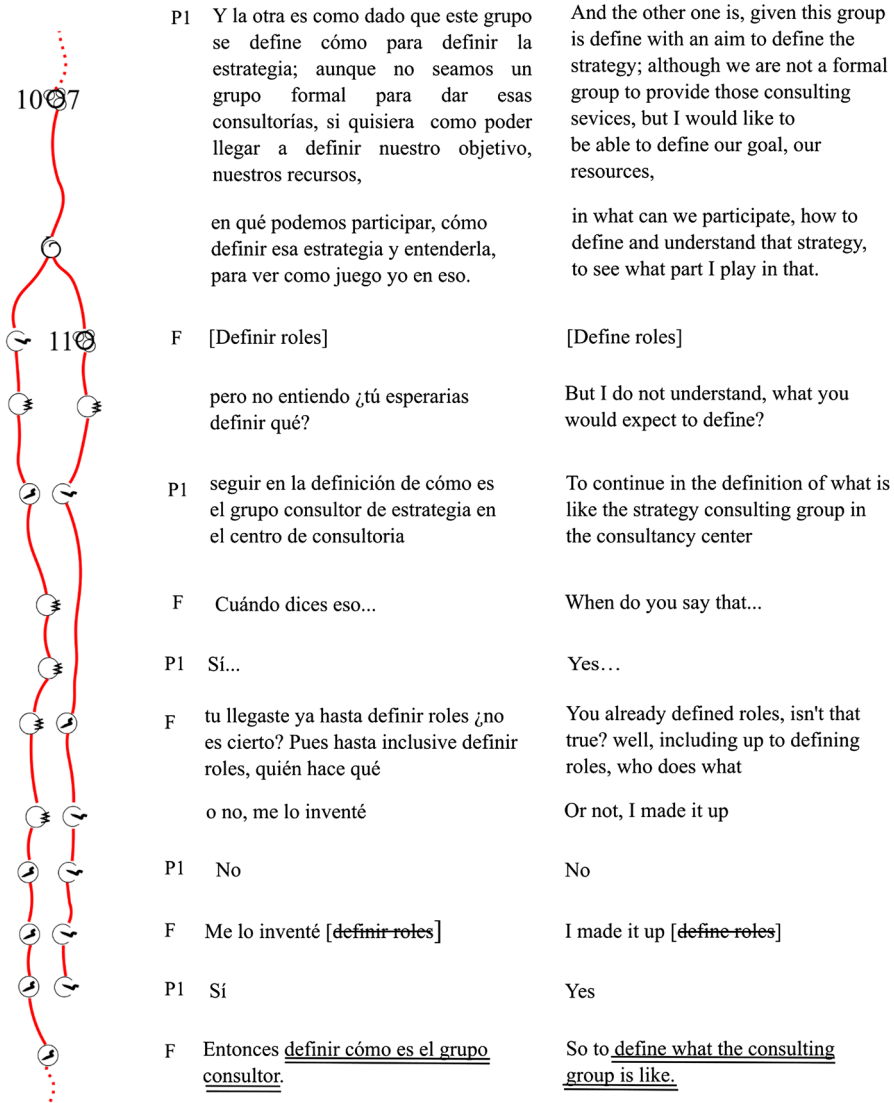


Fig. 6 Shifting in workshop 3

of the idea of different flows, the convention here requires that two *probings* need to be drawn. In this way, we can keep the two flows independent.

This vignette comes at hand for explaining how to handle conflicting interpretations. We will focus on the part when the facilitator writes on the whiteboard [define roles]. A first interpretation is to code it as a *following*. It is expected that the facilitator will take reliable notes, and the propositional content is ambiguous enough to allow us to go with what is expected. However, five moves below we see the same facilitator noticing that [define roles] was not contributing to the same boundary proposed by P1.

The initial propositional content conflicts with later reactions. Consequently, we need to reconsider our hypothesis and decide that the best interpretation for this case was an accidental *setting* by the facilitator, allowing us to see two flows in this segment.

#### 4.1.2 Branching

*Branching* is a configuration in which a *setting* serves as the triggering action leading to several derived conversation flows. In *branching*, an actor is prompting the rise of derived conversation flows, and other actors (or itself) respond to this explicitly connecting their flows to the triggering one. It is important to note that not every *setting* with derived *settings* is a *branching*. It is possible to state an idea and later, in the development of the session, different actors can produce new *settings* based on the original without having a *branching*. We do not have this kind of configuration because at the point of origin, the actor responsible is not looking forward to triggering derived flows, and additionally, the interactions involved are not consecutive in time. In this case, the new settings are also connected to a common point of origin, but they can be better explained as multiple cases of *shifting*.

**Adding Contributions (Workshop 2)** The first example of this configuration is triggered by the *setting* at #7. Here we have difficulties to portray the whole interaction due to the number of elements. As it can be seen in Fig. 2, #7 connects with five other *settings*, numbers 9, 11, 12, 13, and 14, and it can be argued that #10 also belongs to the configuration because it derives from #9. In total, there are 81 speaker turns. Each of these turns, comprises several moves, and those can produce at least one effect on one boundary. The segment of the interaction takes from minute 6:35 up to 13:59.

Before the branch, at *setting* #3, the facilitator offers in his own words “very limited instructions” to carry out individually the design of an ideal wallet. Some people contested the meaning of “ideal” in the instructions. This produced a little discussion in which *setting* #4 presents a different interpretation of the notion of the ideal. Then, at *setting* #5 a *convergence* of #3 and #4 is achieved. However, one of the participants never followed the instructions, and later declared that the meaning of the ideal for the exercise was still elusive.

In *setting* #6, the facilitator ends the individual activity (marked by I on Fig. 2) and gives some additional explanations on the activity just been conducted. Then the *branching* starts at *setting* #7, with the following statement by the facilitator:

What we are going to do next, after listening to you, if you resonate with what I am saying, is a process that they [Stanford University] suggest for building the ideal wallet

Notice that the statement is confusing. First, it is talking about the next activity, the one that is going to be performed after what is really covered at this *branching*. However, what took place afterwards is that the participants explained how they conceived their ideal wallets. So, the best interpretation that we found is that the effect of this statement was establishing the rule for asking the participants to share their designs for the wallet.

The first person to explain the wallet was asked, “you did not do anything, what happened?” The person *challenges* the activity at *setting* #3 and states, “I did not



understand anything.” They again have a small conversational exchange in which the facilitator pushes for answers, and the participant links her/his statements to the raised concerns at #4 to justify the absence of an answer. The discussion was not settled. They kept their positions, and the facilitator starts to question a different participant. Note that this part of the interaction does not appear on Fig. 2. Here the people involved, referred, reinforced and attacked previously defined *settings* #3 and #4.

Then we have four people explaining their idea of such a wallet, each one with their own flow (from #11 until #14). Each of the starting *settings* was preceded by something said by the facilitator to give each one of the participants the turn to explain. He said things such as: “(Participant’s name), tell me, no, I want to listen,” “good...how is your ideal wallet?” “anyone?” Due to that in this workshop, we did not use video, when the name of the person was not explicit, we guess that an additional communicative mode was complementing the speech.

Basically, all the wallet explanations by the participants can be interpreted as *enhancings* and *followings*. There is only one explanation that creates an extra *setting*: #10. This is created because the facilitator did not understand one explanation, so trying to explain participant’s words, he makes a mistake creating another *setting*. This misunderstanding was discussed until it was clear up by the participant.

We can describe what this *branching* does as adding contributions. We identified this particular use several times in both workshops. Generally, the *setting* triggering this use of *branching* is introduced by a facilitator. In Eden’s (1989) terms, this situation is more concerned with providing rules for the interaction process than with the content. It basically promotes and organizes interaction asking for different takes on the subject matter.

Notice that this whole part of the interaction was managed on the speech mode and there was no writing support of the ideas produced.

**Discerning (Workshop 3)** The vignette depicted in Fig. 7 focuses on *settings* #24, #25 and #26 (look also at Fig. 3). It presents a different use of *branching*. In this one, the facilitator describes the logic of the work to follow. The actions here follow the events unfolded at *branching* at #7. This *branching* was adding contributions (just like the one in the previous section), in this case the contributions were the expectations of all the participants in the workshop.

In the Fig. 7, the vignette starts with the *following* connected to *setting* #7 (the number on the left side of the icon refers to that connection). This action serves the purpose of closing the *branching* opened at *setting* #7, and it is a transition to what is to come. The *setting* #24, triggers the branching, by introducing the topic of the workshop. The explanation comprises two flows. The first, introduced at #25 explains that the current workshop 3, builds on what was agreed-on workshop 1. It uses speech and gesture to direct the attention to what is written on the presentation, namely the purposes defined on workshop 1. Again, speech and gesture are used to point out workshop 1’s facilitator (participant 1).

The second flow, introduced at #26, refers to what is going to be the purpose of the current workshop and suggest (by a gesture) that the contents of the whiteboard (produced by the branching started at #7) will be considered in deciding what to do.

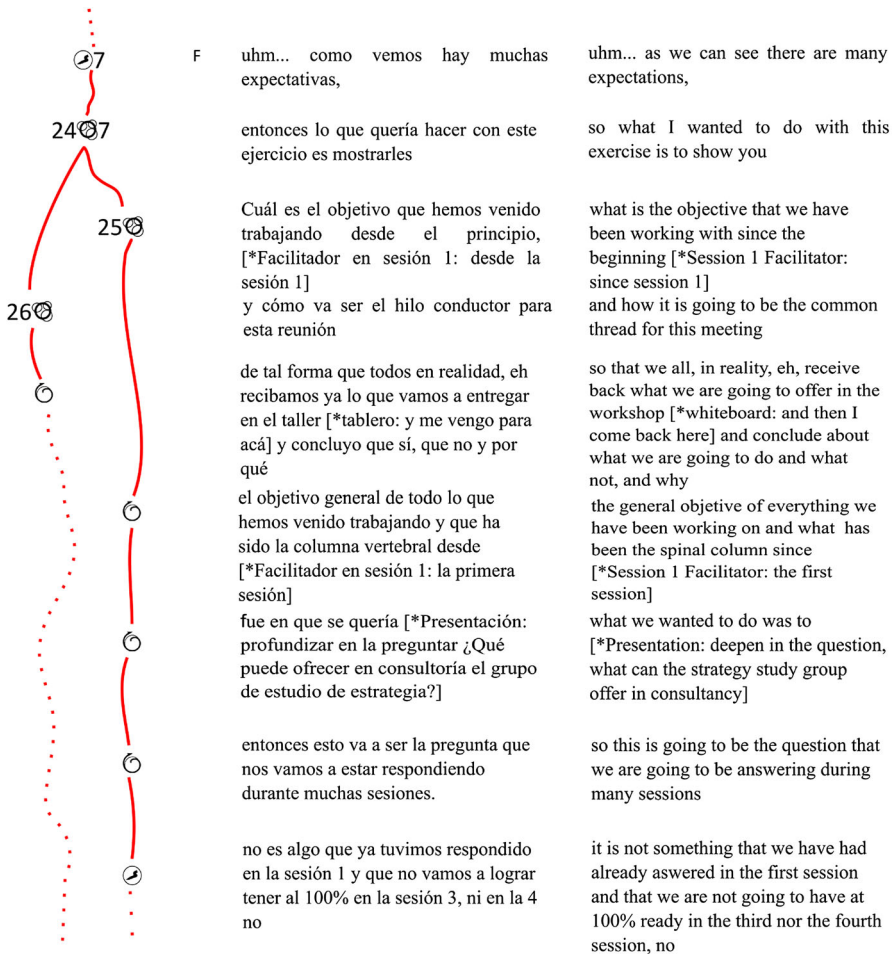


Fig. 7 Branching in workshop 3

The vignette is not showing that afterwards the facilitator makes a *convergence* at #27 showing that the expectations manifested by the participants match the purposes set by the group in workshop 1. This was an intermediate step for later showing that these also matched the purposes for the current workshop 3. Understood in this way, this branching is a pivotal point connecting previous and later stages of the workshop as well as the series of workshops.

We call this *branching* discerning, because it is explaining the different flows (issues) that require to be taken into consideration. The flows differentiate the characteristics of the issues.

There are two reasons that make this vignette interesting. One, because it is showing the process of aligning the present work with what was pursued in Workshop 1. S/he is trying to legitimate the current workshop, linking it to workshop 1 and never mentioning workshop 2.

The second reason is the combination of speech, gestures and artefacts. The speech is complemented with the pointing at different people and artefacts for producing an effect. For instance, pointing to the facilitator at workshop 1, reinforces the link between workshops 1 and 3. The whiteboard stood by for all the ideas produced so far in this workshop. The PowerPoint presentation listed the purposes for the current workshop 3. The pointing helped the facilitator present and reinforces the ideas much faster than speech by itself would allow.

This vignette is also an example of solving conflicts of interpretation. Here, it is difficult in the first instance to know what to do with what is marked as *setting* #24. The first impulse was to take what is coded in #24 and #25 as one move creating one boundary. However, this raises problems with the move at #26. If we go a little further, we notice that there are moves contributing new information to what is said in #25 and #26, reinforcing the idea about the existence of two *settings*. For this reason, we notice that #26 was not derived from #25. Additionally, #24 appears as a separated move, *setting* a new boundary and the other two *settings* branching from this one.

#### 4.1.3 Converging

It refers to a configuration in which several flows merge in a new *setting*. It connects ideas from different parts of the interaction. The *convergence* brings the previous involved boundaries together under a new one. Not all the contents of the involved boundaries are used in the fusion. The new *setting* takes portions of each of the involved boundaries.

**Integrating Boundaries (Workshop 2)** This example deals with the *convergence* at *setting* #26 (Fig. 2). The conversation starting at #25 is about how McDonald's increase sales. The facilitator tells a story explaining how the company arrives at the idea of a dedicated queue for ice creams and milkshakes, thanks to an ethnographic fieldwork talking to customers. The operations on this boundary are performed almost entirely by the facilitator. Those comprise *enhancements*, adding detail and *followings* explaining the implications of the details. Two participants *followed* facilitator's ideas showing understanding.

Then the Facilitator connects the story with some ideas that he previously presented at #6. The ideas refer to a Colombian company and the way in which they were ideating just by throwing difficult questions and challenges to the employees without carrying out a process. Now the *setting* at #26 compares the case from McDonald's with the Colombian company and suggest that it would be better to improve the ideation process in that company with the lessons from the story at #25. All the interaction is carried out using the mode of speech.

We call this use of *converging* integration because there is an argument supporting why the combination makes sense.

**Aggregating Boundaries (Workshop 3)** In this segment (from Fig. 3), the whiteboard enables communicating many ideas thanks to pointing to an object. Additionally, because it maintains the ideas available for visual inspection. The whiteboard facilitates the grouping of ideas produced throughout the workshop.

The previous idea to the node combining the ideas is the #33. Here the facilitator says that what follows is to check if the plan for the workshop fits the expectations. Then at #34, we have the *setting converging* ideas. It is accomplished by pointing at specific phrases in the whiteboard and simultaneously saying: “we see that very probably these last ones are more in line with what we expect from the [today’s] workshop.” The phrases allude to *settings* #17, #20, #21, and #23. They refer to ideas such as keeping the line of work from workshop 1, being responsible and coherent with the consulting process, flesh out the meaning of responsibility and coherence, and coherence-legitimacy. Setting #34 also joins the #26 establishing that the other *settings* follow the purposes established in workshop 1.

We call this use of *converging*, an aggregation because the effect achieved creates a collection of elements joint by their likeness.

## 4.2 Reading the Structure

The three configurations of settings (*shifting*, *branching*, and *converging*) are patterns of interaction that emerge from the micro analysis of the workshops. These configurations seem to fulfil some functions in the overall structure. *Shifting* (Sect. 4.1.1), for instance, tends to be used in cases in which somebody is looking for the right angle of an idea; it progressively changes the idea keeping a link with the precedent one. The two selected vignettes illustrate this point. In the first one, actors misunderstand each other, and they engage in a process of *shifting* to clarify the situation. The second vignette illustrates a thread of conversation where iterative *settings* are making small adjustments to the topic, morphing the initial boundary to one more suitable to the participant concerns.

The second configuration: *branching* (Sect. 4.1.2), opens possibilities to explore different paths derived from the current flow of conversation. Our first case illustrates how it can be used by the facilitator when asking the participants about different views regarding an issue. The second case shows a single actor breaking down the components/paths of the logic of the work to follow.

The last configuration, *convergence* (Sect. 4.1.3), takes several boundaries—sets of ideas—and places all of them under the same umbrella. In a way, it is trying to combine some of the ideas that were presented. Sometimes, it constructs something more complex, by synthesizing different parts. In others, it shows that all the parts respond to a common denominator: a convergence (aggregating boundaries).

Now, these configurations, can be understood as building blocks that can be link together to construct an overall description of a meeting. Let us start with workshop 2 (Fig. 2). Here, the first three steps are the facilitator *shifting* in search for a way to start the activities. Then we have a *branching* starting at #3 with an individual activity (marked, as ‘I’ in the Fig. 2). Based on this, we get another *branching* originating at #7, where people propose their solutions for an ideal wallet, and a new *branching* at #15, where people share their stories in pairs (marked as ‘P’). At the end of this activity, the workshop starts to sidetrack, and no wallets, nor lessons related to the wallet, can be heard again during the workshop.

Starting at #16, what we have is a group of nodes telling different anecdotes about ideation. They talk about the already mentioned case of McDonald's milkshakes and finally up to #34, how the idea of a monkey was transformed into a drone flying over electric cables to shake the troublesome snow. This part of the meeting is characterized by people performing *shiftings*, adjusting the angle of their stories and *converging* with different elements from the stories to enhance the appeal. In the last part, from #35 to #40, the participants manifest that the stories were nice, but that they could not understand the point of the workshop. The participants' strategy at this point was to go back and bring the original declarations of the purpose of the workshop at #2. At the end, *setting* #40, marks the point in which the facilitator's control finally fades in favor of the coordinator of the group and the workshop switch to a new dynamic exploring what to do in the next workshop.

Workshop 3 (Fig. 3), displays more connections. However, its general dynamic can be described in a simpler way. There are some *shiftings* at the beginning while looking for the right way to start. Afterwards, we have three pivotal *branchings*: one at #7, where all the expectations for the workshop are gathered, the second occurs at #26 where the agenda of the workshop is shared, the third *branching*, at #33, explores paths in which elements from the expectations are linked with elements of the agenda. So, the rest of the session from *setting* #34 up to #41 are all *converging*, showing that the proposed agenda for the workshop was coherent with the expectations from the participants, and followed the plan defined on the first workshop. In a way, this was to tell the participants that this would not be like the detour taken on workshop 2, where they lost sight of the purpose.

As it can be seen, moving back and forth from the micro level coding and to the overall diagrams of the workshop helps to see the connections between the different parts. The three configurations and their links provide a context, a frame for the individual moves. The overall structure provides a context for the configurations.

### 4.3 Contrasting Both Workshops

We can now use the visualizations in Figs. 2 and 3 to compare some characteristics of the workshops. Perhaps the most visible difference between both workshops is the use of *convergence*. While workshop 2 looks poor in this operation, workshop 3 centers on a point of almost complete *convergence*. Additionally, the number of elements connected is low in workshop 2 while, comparatively, there are many elements connected in workshop 3. In workshop 3, the connections are made between elements that are relatively distant in time. For instance, it is normal to see *convergences* with elements separated by more than 10 min. On the contrary, in the second workshop, *convergence* is achieved in general, from *settings* that are at a very close range. There is an exception at *setting* #26, but we need to consider that the combination of *settings* here were based in operations also presented by the facilitator (#25 and #6). *Setting* #25 created the precedent flow, the one still fresh within the memory. *Setting* #6's contents were general comments about ideation to explain the activities. Under these conditions, the difficulty to make the connection is lowered. It is interesting to see that, as well as in

workshop 2, the *branchings* open paths that are not afterwards *converged*, a situation that is very different from the one in workshop 3.

We think that one factor that helps to explain the lack of *convergence* in workshop 2, is that artifacts were only used at the individual level for the tasks marked as ‘I’ and ‘P’, but they were not presented to the group; while workshop 3 did use a whiteboard to register participant’s contributions. This helped to keep ideas fresh, reducing the cognitive effort of retaining them in mind (Sperber and Wilson 1995), and make them always available for use and combination. In the case of workshop 2, we can see that only the basic general purposes of the meeting can be combined across long distances. The *convergences* that remain are of short range. It is perhaps for this reason that Workshop 2 relied, at some point, in stories and narratives (Ong 1982). Here the content generated at the *branching* was never *converged*, unlike workshop 3, that was always about joining ideas.

The most common long-range configuration in workshop 2 is *shifting*. The moments in which they are used suggest that the participants were trying to change the dynamic of the workshop. They do not abide to the activities proposed by the facilitator (for example, the instructions were disputed at the beginning twice: in the *shifting* example and at *setting* #3) and the participants bring back the ideas in the initial *settings*, those before the individual activities, looking for ways to make new interpretations capable of establishing a different dynamic, one able to match the exposed purposes.

The use of *shifting* is the other big difference between the workshops, since workshop 2 has a bigger number of occurrences of this configuration. In Workshop 2, the participants were working with fewer ideas, and they played with them by adapting their meanings. This strategy seems appropriate due to the number of stories told. In workshop 3, there are more elements in play and the dynamic was not about adapting them, but about combining them; perhaps this offers an explanation to the comparatively smaller amount of *shiftings*.

When we contrast the perceptions of the participants with the interpretations of the structure, we can explain them in terms of our analytical framework. From this perspective, a weak workshop is characterized by the inability of the facilitator for *converging* flows of ideas with the purpose of the workshop. Additionally, participant’s resistance can be identified by their efforts to connect with boundaries pre-dating the boundaries used by the facilitator to conduct the present activity. In contrast, the perception of a strong dynamic derives from the ability of the facilitator to obtaining ideas from the people and then combining those with the purposes.

However, we must note that in a bigger scheme of interpretation, workshop 2, was in a way important and successful. The perceived problems with it, made it easier for facilitators and participants of future workshops to see the importance of planning and the use of resources and material aids (Ehn 1988; Gray et al. 2010; Hodder 1998; Nielsen 2012; Yanow and Schwarz-Shea 2006).

#### 4.4 About Multimodality in Workshops

In our reflection on the effect of different modes in the workshop, we found it enriching to consider Kress’s (2009) ideas. He recognizes several modes of communication:



image, writing, layout, music, gesture, speech, moving image, soundtrack and 3D objects. All these modes can be mixed to produce effects in the conversational space of the workshop (Forceville 2014). This means there is not a privileged mode fully capable of carrying all meaning for all situations; the different modes collaborate. Exploring how they collaborate in relation to our empirical data is the purpose for this section.

In the data presented, it is easy to recognize the modes of speech, writing, and gesture. We will focus on their affordances, namely what their material characteristics allow for action (Gibson 2010). Accordingly, to Kress:

So while time and the sequence of elements in time supply the underlying ‘(semiotic) logic’ of speech, in image by contrast, space and the relation of the simultaneously present elements in that (usually framed) space supply its underlying ‘(semiotic) logic’... In gesture there is a sequence in time through movement of arms and hands, of the head, of facial expression, as well as their presence against the stable spatial frame (the background) of the upper part of the torso... In alphabetically written languages, writing is somewhat of a of a border category in this respect: it is spatially displayed, yet it ‘leans on’ speech in its logic of sequence in time, which is ‘mimicked’ in writing by (spatial) sequence of elements on the line (in script systems which use the line) on which writing is displayed. This spatial display of writing and of its elements on the line, its ‘linearity’, gives rise to the impression that it works like an image. However, the elements of an image can (usually) be ‘read’ in an order shaped by the interest of the ‘viewer’, while the reading of writing is governed by the ordering of syntax and directionality (Kress 2009: 81).

Our illustrations through the different *setting* configurations consider situations involving writing, gesture, speech. We now proceed with a reflection on these illustrations.

The examples from workshop 2 are our simplest cases: all of them relied only on speech. In the ones for morphing and integrating, the speech makes the whole work of conveying the meaning and the possibilities for the actors. This implies constructing and shaping an argument into a linear succession. In the remaining workshop 2 case—adding contributions—there are multiple lines or flows, each obeying the logic of linear argumentation, while the totality of the lines from the configuration are organized by the sequential turns in time, given by the facilitator.

Workshop 3 presents more complex interactions between modes. The misunderstanding case mixes two modes: speech and writing. Notice that the dominant logic here is speech. In this logic, the ideas about the expectations of the workshop are produced in sequence. The writing follows this logic closely. It mirrors and backs the linearity of the process, but with a difference. On one hand, speech cannot be frozen, as words get lost just after the instant in which they are spoken. Writing enables the persistence of words and makes them amenable for analysis and consistency checking (Ong 1982).

Additionally, from workshop 3, we have the case of discerning. Here, clearly speech is not carrying all the meaning. To work, this communicative mode needs to be complemented by the mode of gesture. Both follow a linear succession in time and support each other. Notice that these two modes direct the attention of the participants towards

what is written on the power point presentation and on the whiteboard. Consequently, a third mode appears on the scene. So, to read the effect of this action on a boundary, the practitioners involved (or the researcher) need to pay attention to all three modes to comprehend the meaning of what is being communicated. The move does not have complete meaning if we do not consider their combined effect.

This workshop also shows another mode use. It refers to using speech plus gesture while pointing at one of the participants (the facilitator of workshop 1). Here we cannot say that the participant acts as a mode. However, pointing to the participant in conjunction with the speech helps to produce effects on the audience.

The final illustration for workshop 3 (aggregating boundaries), also uses speech, gesture and writing. However, this case reveals a different facet about how they can work in a workshop. Here, the facilitator is pointing to specific written ideas on the whiteboard to accomplish the *convergence*. What is interesting about this case is that according to Kress, writing follows the logic of the sequence. In contrast, here the elements/ideas are read in an order shaped by the interest of the facilitator. This is coherent not with the logic of the written word, but with the spatial logic of the image.

This poses an interesting idea. That the writing on a whiteboard does not behave as writing because it is becoming something else. Perhaps is a kind of simplified model. Franco (2013) suggests that models have some affordances such as tangibility, associability, mutability, traceability, and analyzability. A list of ideas in a whiteboard is tangible, enables to make associations among the ideas (*convergence* in workshop 3), at a very simple level allows mutability (correcting errors), trace the developments of ideas (they are organized by their order of arrival), and make them amenable to study (actors read the information in order shaped by their interest).

Based on Franco, we can perhaps think about models as one of the modes participating in the communications in a workshop. Additionally, we can approach to understand how different types of models work to offer possibilities for action on a workshop by studying simple models such as the written list, portrayed here. This research approach is a stepping stone for better understanding the use of more complex modelling tools.

## 5 Conclusions

How to link the micro level analysis with the macro level of interactions in a workshop is the core question of this paper. The lines and marks left by lava flows when cool down—the flow structure—inspired our thinking. This made us ask ourselves, via metaphor, if there was a way to see the marks left by the conversations in facilitated workshops. In the same way that flow structure let geologist to understand the transformations of the rocks, we were looking for a way to trace the transformations of the conversations in a workshop and in this way link the micro level of individual contributions to the macro level of the overall structure of the workshop. In order to construct this link, we used boundary games theory.

BGT is a pragmatic approach that involves understanding the context of interpretation in terms of the effects of the different communications on the boundaries in play. Since, BGT was used only for analyzing short conversations. This paper presents a

more ambitious challenge: develop tools that aim to portray whole workshops. The present work required the development of a series of steps, concepts, and drawing conventions to clarify how to apply this perspective of analysis. The length of the sequences made us aware of many more ways in which communications were used and the need to make sense of more elements playing a role during the process of the workshop. For this reason, we complemented the BGT with multimodality and emphasized upon the effects to connect the different elements of the interpretation.

With this BGT enhanced version, we analyzed from micro and macro perspectives, empirical data from two very different workshops. Their analysis and theoretical discussion allow us to conceptualize problem structuring situations as conversational spaces in which different flows of conversation change the boundaries of issues. These flows are organized in three basic configurations: *shift* (the conversation is redirected and changes its focus), *branch* (several flows depart from a point central topic) and *converge* (flows met at a common point). We identify ways in which these configurations are used, connected and combined. Both, configurations and connections let us reveal and visualize through graphs, an emergent structure of workshops, allowing a more holistic view of the situation.

In the process of interpreting the workshops the micro level readings were contrasted with, the reactions of the participant to the communications and with the emerging configurations and structure. This implies for the researcher an iterative process of interpretation in which the meaning depends not only on the individual operations but as well on the effects and reactions to them. This creates a network of connections, an emerging macro level that acts as the context of interpretation of the micro level.

In the context of workshops, we came to realize the importance of the multimodality, namely, the possibility that actors can combine different modes (e.g. speech, gesture, image) to produce multimodal communications. We found that BGT allows accounting for their effects on the boundary. Based on these effects BGT provides a different interpretation of the relationship between boundaries and model. The typical understanding is that actors in a problem construction setting are divided by boundaries, namely by their different languages, understandings and interest. In order to reach across those boundaries, a boundary object, a model is needed (Franco 2013). From BGT perspective, boundaries are sets of assumptions held by the actors. Those assumptions are then affected by different modes of communications such as speech, gesture, and among all the possible modes in use, models.

It is to note that different approaches to analyze interventions (Franco 2013; Midgley 2000; Midgley and Ochoa Arias 2004; Paroutis et al. 2015; White et al. 2016) tend to treat the use of models and communicative process as dissimilar components to be integrated for understanding the intervention process. For BGT, models are just another mode that are part of a multimodal process. Their role, as it happens also with speech, gesture or writing, can be understood through their effects on the boundaries present during the interaction. Modes can work alone or in conjunction to produce an overall effect.

For practitioners, these theoretical connections imply that planning a workshop requires to consider the possibilities that different modes of communication and their combination offer to the dynamic. The cases studied show that it is possible to be creative in the ways in which meanings are conveyed through the different modes. It is also

important to say that different modes shape the possibilities for participation. Specifically, having shared visual artefacts seem to favor the likelihood for taking advantage of the ideas produce in the workshop. The shared visual aid can help throughout the process of keeping a reliable record of ideas and supporting the *convergences* of those.

The interaction of a micro and a macro level in a workshop calls for developing practitioner's skills to consider both levels when dealing with complex problem-solving settings. Those skills can help the practitioner to understand how flows, configurations and stages of the structuring process connect "in order to have the interaction perceived (inside and outside the group) as productive, effective and efficient (Nielsen 2013: 89).

However, it is also important to recognize that in the conversation flows, participants are also making connections and interpretations. Their communications can support or oppose the proposed dynamic. Those communications can change and derail the current dynamic. Consequently, it pays for the facilitator, to be able to recognize early signs of configurations that will impact the evolving workshop structure.

Finally, we must recognize that every view of reality is only partial. In our case, the big absences are the issues of interest and power. Additionally, our understanding of modes is only scratching the surface. We are not detailing all the nuances and affordances of the modes. For instance, in the mode speech, we only consider the words, not how they are pronounced. Gesture only considers pointing, but no facial expressions, and our models are just basic lists. Our understanding of macro level only covers a workshop. We still need ways to approach what happens outside of this scenery and how they articulate with larger organizational dynamics. Our work is just a stepping stone for understanding the micro and macro level of what it is the complex phenomena of structuring problems.

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