Interdisciplinary Analysis for Human Group Dynamics

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ABSTRACT

There are still considerable breaches between purely qualitative and quantitative approaches in many working models for group dynamics in psychology and social sciences. We argue that an interdisciplinary approach may help bridge these gaps towards more integrative models. We ran a discussion group based on the Operative Group Model (OGM), using a complex systems approach to reinterpret its dynamics, and applied network theory as well as thematic discourse analysis (DA). Finally, we consider the potential advantages of performing an acoustic analysis on the audio recordings from the group sessions. To our knowledge, this integrative approach has never been applied in the context of an OGM.

In this study we provide two main levels of analysis: the participant's personal and group experience, and the experimentation and analysis methods' aspect. For the former, we gather data from group theory in psychology, psychoanalysis, the OGM, and the participants' feedback. We then use DA and a bipartite graph identifying weighted "thematic nodes" as a research framework. Finally we explore possible ways to incorporate an acoustic analysis, notably implementing a Hidden Markov Model (HMM). The goal is to identify appropriate interdisciplinary models to analyze human group dynamics with both quantitative and qualitative methods. We present some preliminary results from overlapping data that might pinpoint movements towards group cohesion. We then discuss further considerations on the analysis framework and future applications. Finally we consider the advantages of implementing the OGM to foster meaningful interdisciplinary dialogue in research groups, notably to overcome communication difficulties between researchers and enhance collaboration.

Keywords

Human Group Dynamics, Interdisciplinarity, Discourse Analysis, Thematic Analysis, Acoustics, Operative Group, Psychoanalysis, Empirical Research.

Section breakdown:

Introduction

Research Questions

What traces of identifiable phenomena in human group dynamics (HGD) could we gather at different levels of analysis? Can transdiciplinary markers point to "something that is going on" at the same point in a time series? What would that be and how could we identify it? Qualitative analysis of group conversations have suggested periods of transition, focusing on different themes and different dynamics, for example from individual agents to group functioning. What trace could those qualitatively identifiable phenomena leave on an audio record? Does quantitative analysis of the audio record confirm, enrich or contradict the qualitative analysis? Can we identify markers of distinct shifts in group dynamics coupling networks and DA? Moreover, what kind of shifts should we look for? In addition, regarding the participants' personal experience, can an interdisciplinary OGM help bridge communication gaps between professionals of different fields, strengthen bonds between researchers and catalyze further collaborations, in a contemporary scientific ambiance of ultra-specialization?

Approaches in psychology that have traditionally relied on observation, clinical facts or case studies, and methods stressing quantitative data, seldom seem to interact with each other. It is only rather recently that approaches like grounded theory, discourse analysis[1], evidence-based practice, and subjective factors in psychotherapy[2] and supplementary quantitative methods have begun to mingle. Thus, there is still a need to expand on the use of interdisciplinary models that could provide further integration on HGD.

Group theory of humans and analysis of conversations suggest that group cohesion (GC) is strongly related to task performance. GC is a dynamical process that has been studied by diverse schools of thought and at various levels, and it can change in time, intensity, and form, to name a few elements. Related group phenomena have also been studied, like interpersonal synchrony of conversational dynamics as well as nonverbal communication and body movement synchronization[3].

Furthermore, we find that a complex systems approach can give us immense metaphorical insight on the analysis of HGD. Network theory and agent based modelling provides us with the tools to further ground these notions. We also wonder what links we could discover by incorporating an acoustic analysis. The main goal of this pilot study is to identify viable ways to integrate such models, and hopefully discover overlapping data to gain further knowledge about HGD.

Background

We ran a discussion group on interdisciplinary dialogue, where participants could freely interact to discuss interests, difficulties and diverse experiences stemming from their diverging disciplines. The organization of the group was based on the Operative Group Model (OGM). This model comes from the social bond theory of

Pichon-Riviere[4], having its roots in cybernetics, behaviorism and psychoanalysis. It is centered on a shared task, and thus is not a therapy-oriented group. It views the group as a complex structure of interaction and feedback that can operate to facilitate a group task.

As Pichon-Riviere puts it[5], the task is defined as the movement towards a manifest or explicit object of knowledge. Learning implies change, as it entails transforming or even abandoning old ideas and worldviews to integrate new ones. This is not always automatic, even if consciously desired, and it has some inherent difficulties that need to be surpassed. Indeed, there are certain gaps and cuts in the communication web that emerge as signs of epistemological obstacles, or that which hinders the attainment of certain knowledge. The OGP operates in reducing the inherent difficulties in order to foster these changes.

This technique not only takes into account manifest phenomena, but also implicit underpinnings, integrating unconscious and conscious dimensions. It works with notions such as the emergent of the group (a person that in a certain moment "springs forth" a theme or subject that resonates within the rest of the group), and takes into account *massenspsychologie*[6] to identify group dynamics and latent themes, anxieties and desires. It pinpoints movements towards group cohesion, rupture, and differential aspects between the agents and their relation to the group. It analyzes emergent material with the dialectics of interplay, contradictions, and feedback synthesis to take into account different aspects of reality.

With today's scientific trend of overspecialization, even the most open-minded researchers run into difficulties when attempting to overcome communication barriers between different fields and approaches. It is for these reasons that we chose the OGM as a fruitful model for participants to engage in interdisciplinary dialogue and facilitate the integration of new models. Moreover, a potential byproduct of this method is the increase in group cohesion between participants, with the productivity gains that it entails.

Complex Systems Integration

In addition to the traditional OGM analysis, we integrate a complex systems perspective to reinterpret its dynamics. This "complexity update" would seem to be a logical step, as the OGM is based on cybernetics, which is the precursor to complex systems. Nonetheless, to our knowledge, there have not been any widespread efforts in this direction. For references on the effective applications of non-linear dynamical systems and complexity in psychology and social sciences, one only needs to take a look at the studies originating from the *Santa Fe Institute*, the *Society for Chaos Theory in Psychology and Life Sciences*, or the Institute for *Contemporary Psychoanalysis*, to name just a few.

Group interactions can be viewed as complex systems, sharing some properties that are natural to other systems, such as having the ability to self-organize, and adapting to how information is acquired, encoding, regulating, processing, and propagating it in time. In the context of dialogue, interaction, and groups, valuable research has also been carried out integrating complex systems. We point the reader to *Dale et al.*[7], who argue that the dynamical systems framework may help to integrate existing theories, introducing "basic concepts like self-organization and synergy, reviewing empirical work that shows how human interaction is flexible and adaptive and structures itself incrementally during unfolding interactive tasks, such as conversation, or more focused goal-based context". Another important example is the extensive work of Stephen Guastello on group dynamics and organizational behavior[8].

Nonetheless, there is still much to be done in the integration of group models that take into account multiple qualitative aspects of human existence, especially in the integration of unconscious processes, implicit difficulties in change, learning, and integration. It would be an error to consider these dimensions of human existence as nonexistent just because of the inherent difficulty to quantify them, as Simon DeDeo points out, "Humans are not Bayesian Angels."[9] Undoubtedly, human reality is not only constituted of what is directly quantifiable, but also of the oftentimes seemingly contradictory subjective reality, in which fears, desires, and other phenomena escape the "normal logic" of what should happen. This is what we could playfully call the "Human Glitch," or as David Krakauer might say, stupidity is "the greatest problem facing the world today."[10]

Possibilities for a complexity OGM

For our part, we can conceptually reinterpret the dynamics of the OGM as a complex adaptive system with feedback relations between its components. This is not to be taken literally, or as a direct transposition of different epistemological models, but rather as an interdisciplinary metaphor for understanding phenomena that may exhibit similarities, which may advance our scientific understandings toward greater explanatory comprehensions[11]. In this panorama, while taking into account thermodynamics, we view a cluster of agents interacting, with different transitions in their equilibrium behavior or states. We shall make group cohesion one of the main phenomena that we wish to identify. Group cohesion is a dynamic process, constantly evolving and fluctuating in time, possibly having no real static equilibrium.

We could consider that, as entropy increases, as seen in the interactions of the group, it goes through distinct shifts, from individual to group functioning of the agents, and a potential phase transition into chaos. Therefore, a certain increase in entropy would be a necessary but not sufficient condition for group cohesion. Concurrently, the role of the coordinator would be to foster optimum variability in the system, as a flow of ideas and dialogue, which is also linked to group cohesion. If the energy is too low (akin to a freezing point), group cohesion could be promoted by increasing the throughput, and regulating the energy just before it pushes the system towards a bifurcation or phase change into chaos (like a boiling point.

Hence, we could see the group oscillating between at least three states:

- Ungrouped Agents : Functioning mainly as individuals, with little group interaction: (Stagnation/rigidity/freezing state)
- Grouped Agents: Towards group cohesion (dialogue, interaction, synchronization, circulation of ideas)
- Chaos: Extreme entropy pushing the system into a phase change, from language and verbal dialogue, into enactments (the non-reflecting playing-out of a mental scenario), that could for example take the form of shouting, fighting, crying, etc.

Hereafter, the OGM entropy could be linked to language interaction and flow between the agents. Energy fluctuations could, for example, increase agent interactions, speeding up and intensifying exchanges, group dynamics taking hold in an otherwise non-mixed cluster of individuals, thus fostering group cohesion. A drop in temperature would lead an agent towards encapsulation, entailing less interaction with other agents, with a decrease in language flow and ideas. An increase in a specific thematic propagation could be related with an increase in entropy, and if it resonates beyond a certain threshold (more agents reacting to it), it can be branded as an emergent in the group dynamics. Finally, another feasible action might be to introduce a measure of overall entropy. For example, this might be visible in a session with very low energy and less interaction between thematic nodes and agents, vs. one that is more dynamic, mixed, and fluid.

Questions and Possibilities in Integrating Networks, Thematic Discourse Analysis, and Acoustics

Some important questions arise concerning the possibilities of integrating the aforementioned interdisciplinary models in the analysis of HGD. For example, how could we find indicators of transitions like group cohesion in the audio recordings? Can we find a continuous range of coordination or critical points, and how could we identify possible links to them? Furthermore, how could network theory and DA help us in the integration of the data?

Our general approach to the integration of networks and DA will be centered on finding the thematic nodes in discourse and the edges they have with the agents. Interesting possibilities arise in recognizing indicators of interpersonal synchronization (IS) between agents through its relation with language patterns, voice frequency, intonation, and turn taking, among other variables. How could we then investigate IS and speech rate convergence, not only in dyads, but in groups? Could some of the denser thematic nodes be related to voice frequency synchronization between agents?

Networks, Agents and Themes - For the DA we need to curate a data set on the themes. We identify the themes as recurring patterns that can be clustered around a central organizing concept that captures its essence. We then build a network with a spreadsheet for the participants as agents, with weighted edges to the themes as nodes, carrying out a correlation matrix for each session.

With regards to acoustics, what indicators should we look for? Some of our initial ideas on the analysis of audio pointed to identifying markers of synchronization between individuals, in regards to rhythm, tempo, pitch and envelope. In the first stage, we could scan the audio for patterns and transitions, regardless of the actual discourse content. We could make a time series analysis detailing some recurring patterns, information peaks and drops, and apply a HMM. Subsequently, we can compare the time series with the DA and group dynamics analysis to check for overlapping data.

For instance, for each session we could make an envelope exploration in the audio, marking the thematic node and their weighted edges with the agents, with an analysis of the discourse (such as different stances on the topic). Additionally, patterns coming from the waveform could point to some overlooked data in the qualitative analysis, for example thematic similarity or a change in themes. We could also perform a time series analysis on silence and turn-taking, giving us a sense of the distribution pauses and their connection to discourse and group IS between individual agents, pointing towards group cohesion (does a theme spike global or recurrent individual agent interaction, does it decrease the turn taking time, is the silence reflective or uninterested? DA analysis and group dynamics might give a hint to that). We will cover this in more detail and propose further possibilities on the ensuing sections.

Method

We carried out 4 recorded sessions of group discussion based on the OGM. We analyze group dynamics with this qualitative model, integrating complexity notions. A network and a bipartite graph were made, consisting of the thematic nodes in the discourse with weighted edges to the agents (participants). Next, we study the quantitative aspects from the acoustic analysis, using several approaches for fluctuations found in the waveform, and test a HMM.

Participants

The group consisted of 7 participants and one coordinator trained in the OGM ($n = 8$). The sessions were centered around the task of engaging in interdisciplinary dialogue. The participants were recruited amongst the attendees of the Santa FE CSSS. All participants volunteered either spontaneously or by receiving an invitation to the project. None of the members were personally acquainted before arriving at the CSSS, although some had recently began collaborating together in other projects in the program. All participants communicated in English, although half of the group were non-native English-speakers. All of the participants came from different research fields, thus constituting an entirely interdisciplinary group, with a global shared interest in complexity science.

Procedure

With a general structure based on an OGM[13], 4 one hour sessions where scheduled over the course of three weeks. Participants were seated around a table, facing each other, and an audio recording device captured the sound in the middle of the table. The agents' anonymity and confidentiality was ensured, and consent to participate and be recorded was obtained from all participants. To avoid possible interruptions, usage of cellphones and computers was strictly forbidden, as well as entrance of external persons to the group during the sessions.

The group task was to interact freely around the subject of interdisciplinary dialogue. The coordinator's main role was to provide the necessary structure for the group, to sustain its material organization, and to foster the flow of communication, intervening at key points with the goal of decreasing or increasing the throughput for optimum variability of dialogue, as was formerly described. In other words, this can be understood as trying to sustain group dynamics of optimal flow between extreme upper and lower boundaries of phase transitions.

In the first session, the participants were asked to introduce their research areas and interests before engaging in the task. For the subsequent sessions, in this introductory period the coordinator would go over a brief synthesis of the subjects discussed in the preceding session, after which they were free to interact.

Data collection and implementation

In the sessions' time series, we searched for patterns and significant data overlap found in the different methods implemented. For the preliminary analysis shown in this paper, we present only the most significant data.

With the gathered material, our actual resources, time, and facilities, we opted to analyze the group dynamics with the complex systems-enriched OGM, and integrate the overall impressions of the participants' experience from their comments. For the DA, we transcribed the sessions and curated the thematic data set detecting the central organizers. We then integrated the thematic nodes and the agents from the group in a correlation matrix, and made a bipartite graph in a weighted network.

Regarding acoustic data, we took the time series of the waveform and observed patterns and fluctuations in the envelope, peaks/lows, and silence gaps. Additionally, we checked for general entropy for sessions as well as outlier sections. Further work is needed for the implementation of the HMM, as the first approaches yielded imprecise results, and the possible ways of carrying out a fruitful analysis on an OGM remain ambiguous. Particularly because the audio signal we had at our disposal is the main group recording, which on analysis turns out messy. Individual signals for each agent would greatly facilitate the task and give out more accurate results. A detailed discussion on the difficulties encountered and further possibilities for analysis and implementation are discussed in a dedicated section.

Results

Here we present the most significant data found in the preliminary analysis of our pilot study.

We identified the two main thematic nodes as "T" and "D". Although more nodes and subgroups were present, we will focus on these two as they will recurrently appear throughout all the sessions, with the highest density being in the first session, from which we present the data below:

Agents	T-Node	D-Node
A	3	0
B	0	2
C	2	1
D	2	2
E	1	0
F	1	0
G	1	3
H	4	2
N-Density	14	10

Figure 1. Table for the First Session

T-node: The T-node strength correlation is the highest of our thematic nodes, with 14 edges and connections to all agents except one (data from 1st session). The central organizing concept that captures the essence of this node is sociopolitical discourse. In the beginning this was tied to perceived power (construction and destruction), aspects of ridicule, the incomprehension of politics towards science, and the difficulty of passing a message to public policy or "making them understand," and hope for possible changes. In the group discussion, T correlated with a significant raise in entropy, appearing before outbursts of laughter, letting off steam, but also fostering vivid group discussion with complementary and contradictory views. The discussion was emotionally charged, but from an ego-distonic perspective, that is, as things perceived as exterior to the self. The exchange on the T-node would evolve into more integrative views, as we will see in detail in the group dynamics integration.

D-node: D comes in at second place, having 10 edges, but also 3 agents that are not connected to it (data from 1st session). The central organizing concept of the D-node is interdisciplinary experience, and their implications on a personal and professional level. This encompasses differences and similarities between research models, including technical language, and explanations of reality through models. In the group discussion, D correlates with more self-experiences, difficulties, and contrary to the T-node, the spikes in entropy were less pronounced but more sustained, exploding less drastically, but promoting dialogue in a more sustained interaction.

A closer analysis reveals that both of these nodes are correlated with a change in silence patterns, increased turn taking and voice rhythm. We put forward the hypothesis that their emergence, resonance, recurrence and higher entropy precedes a phase transition, from individual or dyadic functioning to actual group dynamics, thus fostering possible group cohesion.

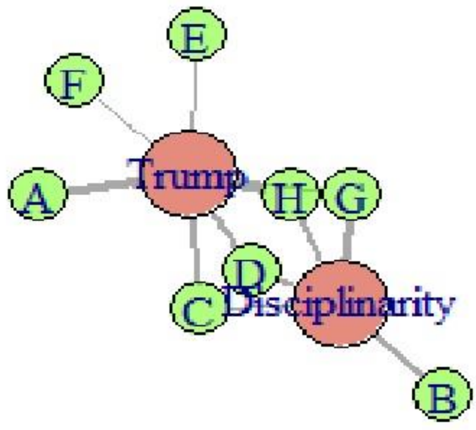

Figure 2. Weighted bipartite graph for session 1 (Agents are green, thematic nodes are red)

Thanks to the acoustic analysis we can appreciate a global similarity of transitions in the acoustic envelope in three out of four sessions. If we divide the time series into four equal segments, we can identify a first phase corresponding to the throughput of the introduction, immediately followed by another section with lower entropy, the deceleration of conversation rhythm, and turn taking. In the ensuing third phase, there are peaks in the envelope, with an increase in entropy and dialogue interaction, less time between turn taking, and acceleration, which then dies down towards the end of this time section. The envelope of the final section grows slowly and always ends with a considerable increase in entropy.

Although this is a small sample to be statistically validated on a quantitative level, integrating the qualitative analysis could suggest an initial period of "warming up" of the group dynamics after the introduction, agents interacting slowly until an emergent pops up, increasing entropy and interaction as it resonates with the group. Then after this outburst, there could be an integration phase, a winding down of the interaction before the pattern repeats itself just before the end of the session. The sequence would go as follows:

Initial throughput> free interaction of agents slowly warming up> critical mass and emergent node> stronger group dynamics, leading to possible group cohesion> entropy receding, period of integration> second wave of emergence> end of the session.

The remaining session does not follow this global pattern. It shows more stability in the envelope and smoother fluctuations. A more precise analysis of interpersonal synchrony would need to be performed to find out if this is akin to a synergic structural organization[3], and if the smoother fluctuations could indicate a sustained optimal flow of dialogue, with the ensuing possibility of group cohesion. Moreover, this could be conceivable, considering that this was the third session, it has concomitant habituating of the agents to the model and the group, which has already experienced previous glimpses of GC. Thus, group dynamics could settle in more readily, bringing a more effective coordination with less discontinuity. However, we find from the qualitatively notes that this particular evening session also had a more "monotone" quality, and the overall group had less "energy." Consequently, more throughput was periodically added into the system in comparison to the rest of the sessions. For a more accurate analysis, individual audio signals are needed, so as to be able to process all the agents' interactions more precisely in a computational model and time series, possibly implementing topic modeling and machine learning. A study on asynchronous interaction could also bring more light to this.

Group dynamics integration

At the starting point, the group begins as a cluster of differentiated individuals interacting in a defined frame of space and time. Group dynamics have not yet been installed, and movements towards group cohesion have yet to appear. In the acoustic time series, we can see more gaps and more silence time in between the interactions, as compared to other segments where qualitative data indicates more group cohesion.

The T-node correlates importantly with the classical group psychology phenomenon of "scapegoating." In a nutshell, it can be viewed as a group defense mechanism that involves pointing to an external target to displace aggression and vent frustrations. As such, the target of their displacement or projection may serve as a scapegoat[13]. This object typically does not internally belong to the defending group, and can be either a vulnerable target or can be rooted in stereotypes that exaggerate the power of successful minority groups. This particularity of human mass functioning has the effect of increasing group cohesion, uniting people against an object that is perceived as external and potentially threatening to the group interests. The canonical example is of course the rise of Nazism, but it still permeates history up to modern day politics.

In the group, the T-node initially thus incarnated such a scapegoat, identified as political power. We have already seen how initial emergence of the node brought on more entropy and group interactions. Qualitative analysis suggests the use of a group defense mechanism that has the byproduct of bringing the group together, GC against a shared "evil". But in a second phase, after anxieties were expressed and frustration was vented in cathartic dialogue and outbursts of laughter, instead of pointing the blame and assuming positions of self-righteousness, the need for the defense gave way to further integration. The group elaborated upon the T-node not only as an ego-distonic and external agent, but tried to integrate it in a more encompassing approach, as part of a social dynamical system in which the subjects are also embedded . Through this integration, not only were the difficulties discussed, but also possibilities of action, thus demonstrating the transition to a more active stance.

Further possibilities

With this introductory study we worked on ideas that could be used for future research, and that for diverse reasons could not be immediately implemented. Notably, for the acoustics analysis, due to material resource limitations, we had to work with one main audio signal, whereas individual signals for all agents are preferable. Due to the particularities of the group setting, with various agents interacting at once at bottleneck points, the signal can get messy. Although high entropy moments might provide us with a general quantitative indicator of a spike in group interaction, for example agents coming together on a theme and speaking at the same time, or in outbursts of laughter, it becomes difficult to flawlessly identify each of the agents at these points. Hence for more precise data on discretizing the agent interactions by time, topic, and distribution of pauses, individual signals are needed. This also facilitates further approaches, including an HMM, which, in part for the above reasons, could not be fruitfully implemented in our trials. This could easily be rectified by having the additional required materials, notably individual microphones for each agent.

Another possibility is further work on the audio transcription to integrate data mining and machine learning. For instance, performing topic modeling to analyze sets of words that tend to appear together, and noting the patterns of speech with more linguistic detail than we have with the DA. Applying other computer models to analyze accent diversity and harmonic synchronization in humans might prove another worthwhile option.This has been done in animal models, for example to analyze bird singing.

"**From individuals to coupled oscillators."** An interesting direction for future studies concerns a conceptual exploration of physical oscillators for viewing communication and interpersonal synchronization between agents. This might yield some insight into group phenomena which would correlate with group cohesion and dynamics in an OGM, like voice frequency harmonization, competition, subgrouping, etc. For instance, we could consider communication between agents like physical systems in resonance, with chaotic system dynamics that may be complimentary. The question arises, how could we see this other than conceptually? In integrating the above models, we could further advance our research with this hypothesis. We could find some indications of this in the audio, and applying Fusaroli et Tylén's approach to the synergy model could prove useful; they used a quantitative method to assess lexical, prosodic, and speech/pause patterns related to interpersonal synergy, which points to structural organization at the interaction level , finding that synergetic aspects of dialog provide the best statistical predictors of collective performance.[3]

This might also prove advantageous to identifying further indicators of group cohesion through the study of agents and their relation to topic cycling, turn taking, or interruption. Agents in a group can show, like coupled oscillators, complementarity, harmonizing, and discordance. Animal studies have been carried out to measure the natural statistics of marmoset vocal exchanges, showing that they take turns in extended sequences. This vocal turn taking has foundations in dynamics characteristic of coupled oscillators, which is similar to the dynamics proposed for human conversational turn taking[14]. Even though marmoset monkeys originate from a different branch of the evolutionary tree from humans, it is has been suggested that some data demonstrate convergent evolution of vocal cooperation[15]; thus it is worth considering on the interdisciplinary exploration of human group dynamics..

Conclusion

In this pilot study we focused on possible interdisciplinary models to analyze Human Group Dynamics in an OGM. A considerable effort was put into researching appropriate models and proposing new ideas that might help further advancements in this area. We found that work focusing on dyads is far more readily available than suitable models to analyze groups. We infer that this is because group analysis is inherently more complicated, with more degrees of freedom, noise, and fluctuations. Thus, this is still fresh territory with much ground to explore, and we hope this work can further enhance new research directions.

Our preliminary analysis found some interesting overlaps concerning the movement towards group cohesion. In addition, we can highlight that one of the most robust hypotheses in this study states that the emergents of the OGM can be more readily identifiable with the interdisciplinary integration of networks coupled with DA and acoustics. Furthermore, the denser thematic nodes might help pinpoint events of group cohesion in the time series. This is because a particularly dense node, by having resonance within the group as demonstrated by its weighted edges, fosters group interaction, which may have an effect on interpersonal synchrony between agents in the group. A deeper acoustic and linguistic analysis might help ground this hypothesis on further observable data.

In this experiment, the qualitative observation in the OGM identifies an emergent and its resonance in the group correlated with nodes T and D. In integrating complex systems, we could think of this as a phase transition from individual to group functioning, and we can trace an increase in entropy that is quantitatively inferred from the appearance of this particularly dense node in the time series, which overlaps with peak patterns on the waveform, as well as different speech/pause patterns that might point to a change in structural organization at the level of the interaction. These patterns play a crucial role in task-oriented conversations, as Fusaroli and Tylén have suggested in the synergy approach[3]. For a more accurate analysis, individual audio signals are needed, so as to be able to process all the agents' interactions using computational models. Topic modeling, machine learning, and a HMM seem adequate candidates. A study on asynchronous interaction could also shed more light on this, as well as working on the hypothesis of coupled oscillators.

Concerning the experience of the participants, the OGM's approach proves to be a viable method to facilitate overcoming interdisciplinary gaps, as well as increasing group cohesion between researchers that might lead to scientific collaborations. Even though we had a quantitative small sample, preliminary qualitative results suggest that some individuals discover valuable insight and lasting impressions from collaborating on interdisciplinary discussion in an OGM, even in short trials. Possibly due to more integrated emotional experiences reaching beyond the level of intellect, as well as the OGM's inherent focus on facilitating the change implicated in learning by surpassing epistemological obstacles. This is not without emotional investment though, and the personal experience may vary from general catharsis and a feeling of group bonding to moments of hesitation and difficulty.

The group discussions raised important points on interdisciplinarity. Content-wise, these are some of the topics that were discussed: epistemological frameworks; the difficulty of implementing knowledge into the real world and social policy; the dangers of filtering every part of reality through one model, reductionist views and binary thinking (eg. black or white, right or wrong, rich or poor), sometimes even identified in oneself; the "trap" of thinking that one science or system of thought "might save as all," like a religion of economic growth at the cost of the destruction of ecological systems; and the search for a different view from closed loop perceptions.

Finally, a unifying point on the desire to make a change in a system, be it in beliefs, in oneself, in a city, or in the economy or social politics, with a latent conclusion that alone, no one model can "save us," but that hopefully interdisciplinary approaches might breach gaps and blind spots otherwise overlooked.

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