

# Metaphorical Reasoning Together: Embodied Conceptualization in a Community of Philosophical Inquiry

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**Abstract:** In this paper, we show that taking an embodied stance at cognitive moves as not limited to speech acts but including concrete sensori-motor actions, either isolated or coverbal gestures, enriches our understanding of collaborative reasoning. More specifically, we follow the bimodal co-construction and circulation of metaphors in a Community of Philosophical Inquiry (Lipman, 2003). We show how the participants used many source concepts in the exploration of the abstract concept of ‘thinking’, and were able to build a *conceptual synthesizing metaphor*. Our results support a bimodal metaphors salience hypothesis: metaphorical gestures play a great role in making reasoning visible to others and therefore fostering collaborative learning.

## Introduction

According to Lipman, the founder of Philosophy for Children, a Community of Philosophical Inquiry (CPI), as a pedagogical practice, is supposed to favor deep collective reasoning and better cognitive understanding of a complex issue addressed through critical, creative, and caring thinking (Lipman, 2003). Its aims at teaching students how to build on opinion and to reason collectively about a philosophical question. In a CPI, students are encouraged to listen to each other with respect, to elaborate on each others’ ideas, to assist each other in justifying opinions and drawing conclusions. In Lipman’s words, it consists in “attempt[ing] to follow the inquiry where it leads rather than be[ing] penned in by the boundary lines of existing disciplines” (2003, p. 20).

But, even if the face-to-face interactions in a CPI involve multimodal communication, studies have so far mostly focused on students’ individual speech developed in such setting or on the role of the moderator described through series of verbal actions, as if learning would only take place in the brain (e. g. Simon & Tozzi, 2017). Clearly stepping away from traditional individualistic cognitivism (Menary, 2010a), adopting an embodied view on cognition offers avenues for renewing research on collective reasoning and collaborative learning. Such theoretical approach has methodological implications that guided our empirical work on a videotaped CPI among eleven 12-to-14-year-old students who are discussing about “thinking”. This study shows that taking cognitive moves as not limited to speech acts but including concrete sensori-motor actions enriches our understanding of conceptualization. More specifically, we follow the bimodal co-construction and circulation of metaphors in the CPI as activating concrete sensori-motor experience to apprehend abstract concepts collaboratively.

## Theoretical background

Our approach to metaphor is based on a strong embodied view on cognition. As it occurs in a CPI, metaphor also takes part to a more global cognitive dynamic of collective reasoning instantiating how learning is socially grounded.

### 4E cognition and the embodied approach to metaphor

Following the cognitive approach to metaphor, we consider the metaphorical process as the fundamental embodied basis of the conceptual system that makes it possible to think-and-act in our environment (Lakoff & Johnson, 1980). In this perspective, metaphor consists in building and apprehending complex abstract concepts (here after named ‘target concepts’) by comparison with familiar concrete concepts bodily experienced and transmitted (here after named ‘source concepts’). Metaphor expression exploits several modes of communication, including gesture (McNeill, 1992). In particular, Müller considers that the bimodal combination of speech and gesture is one of the key contextual resources available to catch attention and focus it on the dynamic process of metaphor activation (Müller, 2008).

More precisely, metaphorical gestures belong to the category of representational gestures, which can be defined as gestures playing a referential function by directly “*exploit[ing] imagery*” (Goldin-Meadow, 2004, p.314). A metaphorical gesture bodily refers to a concrete source concept either by drawing its shape and dimension, or by locating parts of it or tracing its trajectory or miming its actions (Colletta et al., 2010, McNeill, 1992). Such gestures are representational: they help express ideas by providing concrete images to refer to abstract concepts (e.g. the gripping and trenching gestures to express respectively founding and dividing) (Müller, 2008, McNeill, 1992).

## 4E learning and reasoning together in a CPI

### Collaborative learning as part of the social dimension of cognition

The very idea of following how metaphor are co-constructed in a CPI through a combination of speech and gesture supposes the students to deal with typical issues related to the Semin and Cacioppo's grounding Social Cognition model (2008), such as monitoring and goal-mediated synchronization. According to this model, monitoring synchronization is based on neurophysiological processes by which a perceiver mirrors actions produced by another. When subjects are engaged in a collective task, goal-mediated synchronization plays a complementary role by helping not only to mirror actions but to select adaptative and complementary responses.

Considering metaphor as an instance of collective reasoning is also consistent with studies on group cognition, which showed that taking the group as a cognitive agent helps make sense of learning processes that overcome the sum of students' individual progress (Stahl, 2006). Following an extended cognition perspective, we do not address metaphorical reasoning together as a cognitive process taking place 'in' a specific group agent, separated from its environment. We rather try to figure out how collective thinking occurs through interactions among individuals who are themselves interacting with their environment, exploiting the contextual resources available to apprehend the concepts at stake. If the group as a whole might build ownership of (part of) the metaphorical process, it is always through the environment shared among the participants. For instance, everybody might align in gesturally conferring the same specific metaphorical meaning to the same place in the room.

### Reasoning in a CPI

CPI is based on a pragmatic approach to philosophy: reasoning about abstract concepts is made possible through a confrontation of concrete individual experiences within a community. In that sense, we claim that it can be linked to embedded cognition since actions with environment are viewed as a basis for conceptualization. According to Tozzi (2009), reasoning in Philosophy for Children can be specified into three distinct reflective tasks: *problematization*, *conceptualization* and *argumentation*. *Problematization* consists in questioning our own points of view and those of others, as well as the assumptions they imply, their origin and consequences. *Conceptualization* aims at defining concepts, developing conceptual networks and distinctions. *Argumentation*, here used in a very restrictive way, consists in basing statements on rational arguments.

The more extensive view on argumentation supported by the research community on argumentation studies also offers fruitful insights about how metaphors generally contribute to reasoning. Metaphorical process is actually at the crossroads of two fundamental practices of reasoning: arguing by categorization and arguing by analogy (Plantin, 2018). In Grize's natural logic, reasoning is based essentially on the argumentative exploitation of images working as cognitive models:

Natural logic can be defined as the study of logico-discursive operations used to construct and reconstruct a schematization. The double adjective is here to highlight the fact that they are thinking operations, but only as long as they are expressed in discourse. (Grize, 1997, p. 65).

### 'Visibility' as a condition for reasoning together

Research on collaborative learning showed that just having the students work in groups is not necessarily enough to foster true sociocognitive conflict (Roschelle & Teasley, 1995) and even less unlikely to automatically results in a cognitive resolution of such conflict (e. g. Polo et al., 2016). A usual way to analyze how fruitful student-student or teacher-student interactions are in terms of learning outcomes is to specify the type of talk that they should develop (Dyke et al., 2012, Mercer, 1996). Even if most of these approaches only focus in speech, one of them draw interesting perspectives for addressing collective reasoning more globally: *exploratory talk*. *Exploratory talk* is considered as the most cognitively productive form of talk in small groups:

First it is talk in which partners present ideas as clearly and as explicitly as necessary for them to become shared and jointly evaluated. Second, it is talk in which partners reason together – problems are jointly analyzed, possible explanations are compared, joint decisions are reached. From an observer's point of view, their reasoning is visible in the talk. (Mercer, op. cit., p. 363)

Interestingly, a key property of *exploratory talk* is to make ideas and arguments *visible* to others. It seems that real-time 'visibility' of thinking-in-action is an essential condition for student-student interactions to actually foster collective reasoning. We assume that such 'visibility' can be reached and studied with a multimodal approach, notably through metaphorical gesture.

## Methodological approach to an empirical study of CPI

Our approach is deeply empirical. We provide a qualitative multi-level case study describing how bimodal metaphorical reasoning takes part to collaborative learning in a session of CPI. After specifying the pedagogical situation studied and the data collection, we present our research questions and working hypotheses. This methodological section ends with an explanation of each of our analytical steps.

### Pedagogical situation and data collection

The analyzed situation occurred in the particular context of a CPI demonstration. The session was moderated by M. Sasseville, one of the leading expert in the field, and observed by teachers, researchers, CPI practitioners and parents. It took place in November 2015, in an urban lower-class French secondary school, and involved a group of eleven students familiar with Philosophy for Children, aged 12 to 14 years, who volunteered to come on a Wednesday afternoon, a time when the school is usually closed. Participants sat in an arc facing observers who were placed on bleachers. The philosophical issue discussed was the definition of thinking. M. Sasseville started the CPI with the prompting question: "Where do thoughts come from?". The whole CPI was videotaped using a 360° camera situated in the center of the participants' arc. Speech was fully transcribed using Elan® software. Gestures were only annotated in selected episodes especially relevant for analysis.

### Research questions and working hypotheses

We explored the role of bimodal metaphors in collective reasoning in the context of this CPI. This global purpose consisted of four research questions:

1. How do the final analogies used by the students apprehend the *target concept* of thinking?
2. Does the metaphorical process trajectory evidence collective elaboration of metaphors?
3. Is metaphorical thinking together associated with advancement in reasoning?
4. More specifically, how do metaphorical gestures take part to conceptual complexification?

We based our work on the two following fundamental hypotheses:

1. Metaphors emerge and evolve through social interaction and interaction with the environment, during a CPI, describing conceptual trajectories that we can retrace *a posteriori*.
2. The salience of co-verbal metaphorical gesture make the associated cognitive process more visible and therefore foster the collective appropriation of the metaphor.

### Analytical steps: Following conceptual co-construction through bimodal metaphors

Our analytical strategy was to follow how conceptual co-construction occurred through metaphors using both verbal and gestural thinking and communicative resources. We proceeded in two main analytical steps. First, we coded the whole CPI discussion using Elan software, in two different ways, in order to identify episodes of special interest. We then undertook a multi-level qualitative case study based on some of these episodes.

#### Systematic coding with Elan® software: coupling two complementary approaches

Two complementary coding schemes were held separately to identify episodes of special interest in Elan®, the first focusing on *source concepts* and the second on *cognitive models*.

The *source concept* coding scheme, applied to all the discussion preceding the closing sequence, consisted in 5 main annotating lines. The first line was used to identify and chronologically number episodes in which *source concepts* were used. Lines 2 and 3 were used to systematically annotate respectively verbal and gestural *source concepts*. For each of these lines, two dependent lines were added to relate each expressed *source concept* to a *target concept* and to a speaker. This systematic coding allowed us to highlight *source concepts* flowing and to calculate the frequency of each *source concept*.

The *cognitive model* grid was based on an exploratory coding of the closing sequence, which was later on applied to the rest of the discussion. The analysis of the final round table empirically *grounded* the construction of this second coding scheme (Charmaz, 2006). The analytical grain used was larger, corresponding to the level of the analogies made by the students to describe the main target concept: each code related to a metaphorical *cognitive model* helping them define 'thinking'. Such comparisons are explicit analogies in the closing sequence, but they may be referred to in ways that are more implicit at different stages of the metaphorical trajectory retraced during the preceding discussion. Actually, our aim was to go back in time in order to figure out how the *cognitive model* underlying each final explicit analogy was gradually constructed through the CPI. In the second coding step, we applied the code of a *cognitive model* whenever at least one key defining feature of the *model* was referred to, either gesturally or verbally, during the discussion. Obviously, such previous occurrences of the *models* were

generally less complex than the final analogies, which is consistent with our hypothesis 1 stating that the metaphor gradually shapes through a specific cognitive trajectory.

#### From the whole discussion to the conceptualization phases: multi-level deep qualitative case study

Crossing the results from the two independent coding of *source concepts* and *cognitive models*, we were able to identify that one particular *cognitive model*, ‘using a file’, was emblematic of the process of metaphorical collective thinking that we were interested in. We decided to focus on this case to conduct a multi-level deep qualitative study instantiating bimodal metaphorical reasoning together. We first specified how it helped the students apprehend the *target concept* of thinking in comparison with the other *cognitive models* that they used. Such analysis, coupled with a visualization of the chronological occurrences of the different *cognitive models* along the discussion, then allowed us to characterize how it related to the other models. After addressing the macroscopic level of reasoning progress through alternation and co-enrichment of multiple metaphors, and the mesoscopic level of the cognitive features composing this specific *cognitive model*, we zoom in to the micro-analysis of the bimodal complexification of such model through three conceptualization phases.

### **Results: bimodal construction of metaphor as a ground for reasoning together**

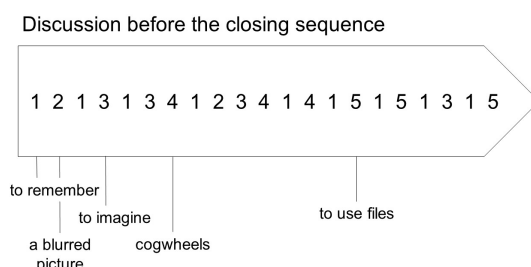
In this section, we present the results of this deep qualitative case study. First, the macro-level and meso-level analyses show how a specific *cognitive model* plays the role of a *conceptual synthesizing metaphor* (CSM). We then specify the micro-level bimodal collective complexification of such CSM.

#### Metaphorical thinking together: macroscopic and mesoscopic analyses

##### Final analogies as *cognitive models* of ‘thinking’

During the closing sequence, when the students are asked by the moderator to conclude by making an analogy for ‘thinking’, they explicitly mention 9 cognitive models of this target concept, which were identified through an exploratory coding (here after mentioned in the chronological order of emergence in the conversation, in students’ own words): *to dream, a milky way, to use files, cogwheels, to reflect, to remember, a cloud, a blurred picture, to imagine*. We used all the verbal and gestural information provided by the participants to characterize these analogies as cognitive models, in order to address our first research question about how they allowed the students to apprehend the abstract concept of ‘thinking’. At most, this bimodal semantic analysis allowed for characterizing the 5 following aspects: nature of the fundamental units composing the system; whether it corresponds to a dynamic process or a static state; internal structure; localization; size (Polo, in press). In this closing sequence, some *cognitive models* are only mentioned without being described along these 5 characteristics, for other *models*, only 2 or 3 of these aspects are specified. Sometimes, the information is only conveyed in gesture, as, for instance, the localization of dreaming “in the head”, or the dynamic processual dimension of cogwheels.

Such characterization of the 9 *cognitive models* reveals that all the students, at the end of the CPI, share a few common features in their apprehension of what ‘thinking’ is. First, it is a system consisting of fundamental units, the thoughts, which can be compared to pictures. Second, it involves chronological or causal relations that allow switching from one thought to another. Third, thinking is presented as an internal process localized within the cognizer. It is nothing but surprising that the students share some conceptual features about thinking at this moment of the CPI, since they have been discussing about this concept for more than 40 minutes.



**Figure 1.** Emergence and reuse of 5 *cognitive models* of thinking along the CPI.

Nevertheless, coding of the *cognitive models* along the preceding discussion revealed that only 5 of them were used in the CPI before the closing sequence: *to remember, a blurred picture, to imagine, cogwheels* and *to*

*use files*. Still, none of them was used neither only once nor by only one person. Such result both confirms our first hypothesis and evidence collective elaboration of metaphors (research question 2). As figure 1 shows, during the whole discussion preceding the closing sequence, the students experienced 21 episodes of focus on one single *model* (9 on *to remember*, 2 on *a blurred picture*, 3 on *to imagine*, 3 on *cogwheels*, and 3 on *to use files*). The co-construction of metaphors supporting these *cognitive models* was not linear: the students did not fully elaborate one *model* before considering another one, but rather tended to switch from one *model* to another in a heuristic way. Contrasting different metaphorical views and their ability to apprehend the target concept, such alternation may be a pattern necessary to foster the deepening of each *cognitive model*.

#### Metaphorical dialectical opposition between two models: *to remember* versus *to imagine*

Such heuristic process is made visible through a bimodal analysis of each of these episodes. We created 5 collections of episodes focusing on the same *cognitive model* and paid a special attention to the corresponding metaphorical gestures. Such analysis revealed strong specificities associated to each *model*:

1. *To remember*: pictures from the outside are coming up to the head (44 s collection)
2. *A blurred picture*: thinking is a flow of blurred pictures (10 s collection)
3. *To imagine*: pictures from the inside are coming out of the head (15 s collection)
4. *Cogwheels*: each thought is a cogwheel which move causes another cogwheel's move (17 s collection)
5. *To use files*: we can create files, open them, modify them, delete them, retrieve them (53 s collection).

This gestural description of the models reveals that a strong binary opposition was co-constructed along the discussion between to think as *to remember* or as *to imagine*. The expert moderator himself makes this opposition explicit and gesturally expresses it three times during the discussion, by the 15<sup>th</sup>, 18<sup>th</sup> and 28<sup>th</sup> minute. Our interpretation is that confronting these to metaphors worked as a dialectical tool to gradually sophisticate students' understanding of the *target concept*. Such advancement in reasoning also proceeded through metaphorical thinking, by elaborating what we called a 'conceptual synthetizing metaphor' (CSM) that overcame such opposition and conciliated the strength of several *cognitive models* to better apprehend the *target concept*.

#### *To use files* emerging as a conceptual synthetizing metaphor (CSM)

The cognitive model *to use files* is the latest to emerge (from episode 15<sup>th</sup> onwards), and is co-elaborated by Nourra and Jean-Luc. Finally, Jean-Luc reuses it as a full complex analogy during the closing sequence. For its late emergence in the discussion and its ability to conciliate several key features previously introduced in other metaphors, this *cognitive model* plays the role of a *conceptual synthetizing metaphor* (CSM). With respects to our third research question, a CSM is defined as a metaphor associated to advancement in reasoning by encompassing several aspects of the *target concept* that could so far only be apprehended by multiple metaphors. In this case, *to use files* is clearly a CSM allowing the participants to overcome the opposition *to remember* vs *to imagine*.

Table 1: Features of the three *cognitive models* 'to remember', 'to imagine', and 'to use files' (final round table)

	Fundamental unit	Dynamic process ?	Internal structure	Location	Size
<b>To remember</b>	Evan <i>sometimes at thinking one is uh: like remembering</i> Nourra <i>take an object, a place and.: recording uh: this place this object in our head and: remembering it but uh: [...] not as clear as in the real world</i>				
	Pictures - of objects - of places	Registering Reminding	Blurred aspect	Head	
<b>To imagine</b>	Sofia <i>thinking is like [...] imagining something</i>				
	Pictures	Active cognizer creating pictures			
<b>To use files</b>	Jean-Luc <i>[...] it's a movement in a huge archive where some files are created sometimes by chance mixing some up [...] thinking is [...] moving uh: // using the files that we have in our head</i>				
	Files created - randomly - from previous ones	Creation Displacing Intentional use	Chronology	Head	Big

Table 1 summarizes key characteristics of the latter three *cognitive models* that appeared during the closing sequence. Both *to remember* and *to imagine* are described verbally and gesturally as dynamic processes based on pictures. *Remembering* is depicted as a double process taking place in the head, consisting in a first step in registration of pictures from the outside, and in a second step in reminding them, which is to say accessing these pictures within brain memory. *Imagining*, in contrast, depict a more active subject, constructing and sharing mental pictures created in his head. The CSM *to use files* is the only final analogy fully described into all the 5 parameters of size, localization, structure, degree of dynamism, nature of fundamental units. In this model, the fundamental units of thoughts are depicted as files, which can either be created ‘by chance’ or from a ‘preexisting file’. As a whole, the archive room located in our head is big and well chronologically structured. It hosts either intentional or random processes of file creation, displacing and deletion. We understand the idea of random processes encompassed by this CSM as an integration of the idea that thoughts can come from pictures from the outside randomly registered and reminded – a key aspect of the cognitive model *to remember*. Nevertheless, such CSM also includes the idea of intentionality that was brought from the model *to imagine*. The image that one file might be created from a previous one is a way to conciliate the idea of subject agency with the consideration that a thought is not created from scratch; such causal link can also be understood as integrating the *cogwheels* model.

### Conceptualization: bimodal collective complexification of the CSM at the micro level

Applying a micro-analysis based on the source concept coding scheme presented above, we then show that the CSM *to use files* first emerged through an extended bimodal metaphor about forgetting and remembering. This metaphor was collectively built through three main phases of complexification: “metaphor introduction”, “metaphor specification” and “metaphor exploitation”, corresponding to three distinct stages of conceptualization.

#### Metaphor introduction: *forgetting* is like a file that “we don’t open”

Figure 2 below corresponds to the verbal transcript and the key gesture of the metaphor introduction phase.

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367 : Nourra : (...) about forgetting it’s quite like a file that (...) we keep except that::: /// [1] {Ulrick: we don’t open it} / yes that’s it we’ll open it later (...)




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Figure 2. Metaphor introduction phase transcript and illustration of gesture 1.

During this phase, Nourra first formulated a verbal comparison for defining the target concept of *forgetting*. Then Nourra added a gesture to her speech (see illustration), which expressed the *source concept* ‘to open a file’. While this gesture was synchronous with the words “except that:::”, which conveyed Nourra’s hesitation, Ulrick immediately suggested a verbal formulation for it: “we do not open it”. A bimodal metaphor was co-constructed about the notion of *forgetting*, and our view is that the process of monitoring synchronization described by Semin and Cacioppo (2008) allowed Ulrick experience the gestural *source concept* represented by Nourra and helped him access to the associated verbal concept. In addition, we note that the moderator illustrated the child’s speech with one gesture that expressed the *source concept* ‘to put a file aside’. We also note that the child imitated this gesture, immediately and many other times, which can also be explained as a monitoring synchronization process. On the reflective plane, Nourra was defining the concept of *forgetting*, exemplifying Tozzi’s *conceptualization*.

#### Metaphor specification and conceptual distinction: *remembering* is like “opening the file”

Figure 2 presents the verbal transcript and illustration of four key gestures of the metaphor specification phase.

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379 : Nourra: Well, remembering it’s:: it/ what I was talking about // here it’s opening the file //  
 [2a, moderator gesture]  
 380: moderator: rather than putting it aside [2b] it’s {Nourra : yeah} to open it  
 381: Nourra: it was [2c] put aside and [2d] now we open it

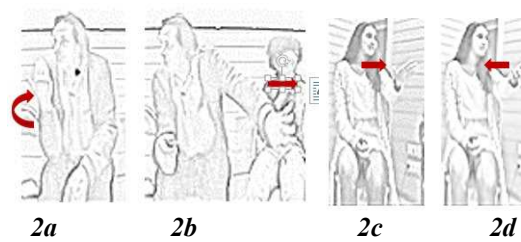


Figure 3. Metaphor specification phase verbal transcript and illustration of gestures 2a, 2b, 2c et 2d.

During this phase, Nourra created an extended the metaphor previously introduced. She used the same verbal *source concept* ('to open a file') as for defining the notion of *forgetting*, but this time for specifying the opposite concept of *remembering*. Even though the reflexive task was still conceptualization, it was now more specifically a task of distinguishing concepts. Subsequently, our coding scheme allowed us to reveal a collective synthesis. The moderator synthesized and rephrased the conceptual distinction between *forgetting* and *remembering* through a sequence including two bimodal metaphors. In the first bimodal metaphor, he repeated his gesture done during the metaphor introduction (see illustration of gesture 2b above) but adding the words "rather than putting it aside". This first bimodal metaphor was opposed to a second one, in which he created a palm up gesture representing the *source concept* of *openness* to the words "we open it". Again illustrating the monitoring synchronization process mentioned above, Nourra immediately validated this bimodal synthesis of conceptual distinction made by the moderator. She said: "it (the file) was put aside but now we're opening it", while doing gestures similar to those of the moderator, conveying the *source concepts* 'to put a file aside' and 'to integrate something'. Hence, during this phase, the student and the facilitator through verbal and gestural modalities were gradually and collectively constructing a bimodal metaphor.

#### Metaphor exploitation and conceptual network elaboration: moving files in a big archive

Finally, in speech turn 391, another child used the file extended metaphor for creating a complex conceptual network. Figure 4 below shows the verbal transcript and two key gestures of this metaphor exploitation phase.

391: Jean-Luc: (...) actually according to me remembering well I'm going to cite this example again it's like // memories are like a huge archive and when you think you move from one file [3a] to another and therefore // heum sometimes when you try to think about something // you can't open this file and / and this is when you forget something and sometimes // uh when you succeed in remembering something you succeed in opening the file and this is because you have moved from one file [3b] to another



Figure 4. Metaphor exploitation phase verbal transcript and illustration of gestures 3a and 3b.

During this third phase, Ulrich created a new bimodal synthesis of the conceptual distinction between *forgetting* and *remembering* by taking up speech and gestures of his classmate. He added two similar bimodal metaphors through which *thought* was apprehended in the terms of the *source concept* 'moving from one file to another'. In addition, he also expressed the target concept of *memory* successively through the gestural *source concept* of 'cycle' and the verbal one of 'archive'. Jean-Luc created a conceptual network connecting the concepts of *forgetting*, *remembering*, *memory* and *thought* by taking up Nourra's relevant speech and gestures, and adding complementary bimodal elements in order to contribute to the collective advancement in conceptualization of the notion of *forgetting* and *remembering*. This result could illustrate the complementarity of monitoring synchronization and goal-mediated synchronization implied in the Semin and Cacioppo's Social Cognition model.

## Discussion and concluding remarks

Studying the bimodal co-construction of metaphors along a CPI reveals how strongly embodied metaphorical reasoning plays a role in collaborative learning and conceptual change. Using the resources of their environment

and the interactions with each other, the participants used many source concepts in their exploration of the abstract concept of ‘thinking’, and were able to build heuristically a *conceptual synthesizing metaphor* through the *cognitive model* ‘to use files’. The feature of the model that they used the most throughout the bimodal construction of this metaphor was ‘to open a file’, which corresponds to the only feature that was expressed both verbally, gesturally and collectively from its introduction phase onwards. This result supports and complete the bimodal metaphors salience hypothesis: metaphorical gestures, especially if produced by a hearer and not the speaker, plays a great role in making reasoning visible and therefore fostering collaborative learning. Further research might include multi-level studies of bimodal metaphorical reasoning in other collaborative learning contexts. Gathering more data with, when relevant, statistical treatment on the frequency and re-use of some metaphorical features may result in a theoretical generic modelisation of metaphorical reasoning together. For now, practical implications of this exploratory study still need to be addressed: how can the CSCL community seriously take into account the strongly embodied nature of metaphorical reasoning together at designing online educational interactions? A key might be to paid attention to the contextual resources offered by such environments for embodied metaphorical thinking.

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