

# New Collaboration is Knowledge-Based: What, Why and How

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**Abstract:** Collaboration is changing and increasingly emerging as what we call “New Collaboration”, a knowledge-based and community-oriented way of working together (especially digital, online collaboration). Unfortunately, organisations use only a small percentage of the potential of New Collaboration. Why? Because they do not understand how knowledge sharing and collaboration are related and in particular, how they actually proceed; their intertwined process. In previous work, we began to answer these questions by proposing a definition, two conceptual models and a process model (Pyramid Model) of New Collaboration. In this paper, we will continue to build on this foundation by first elaborating on our concept of collaboration in more detail. Secondly, since collaborators construct and maintain a Joint Knowledge Base (JKB), we will describe how this knowledge structure emerges through engagement during a process of negotiation of meaning and what are the advantages of considering the negotiated JKB to be a taken-as-shared rather than simply a shared structure. Against this background, in the third part we will then be ready to focus on another essential component of our pyramid model: artefact-mediated interaction. This is where cognitive, social and leading presence come together and produce a boundary object, the most visible part of the whole collaboration process.

**Keywords:** new collaboration, knowledge sharing, joint knowledge base, collaboration process, artefacts-mediated interaction.

## 1. Introduction

In the wake of the emergence of knowledge work, collaboration too is changing and increasingly emerging as a new way of *working and learning together* which we call “New Collaboration” (Bettoni et al. 2018). Unfortunately, the business and education world do not understand the complexity of collaboration and are still mostly unaware of this evolution. As a consequence, they are using only a small percentage of the potential of New Collaboration. If we want to fully exploit New Collaboration, we need first of all to become aware of its emergence and secondly to better understand its structure and dynamics. But what is New Collaboration? What are its essential elements (structure) and how does New Collaboration unfold (method)? In previous work, we proposed a knowledge-based and community-oriented understanding of New Collaboration which we described by means of three models; a system model, a presence model and a process model: The Pyramid of New Collaboration (Bettoni et al. 2018; Bettoni & Obeng 2019). The Pyramid of New Collaboration is a means-ends hierarchy of the inner workings of the process of collaboration. The Pyramid is made up of seven levels: 1. Physical Space, 2. Social & Leading Presence, 3. Artefacts-Mediated Interaction, 4. Co-Construction of Knowledge, 5. Negotiation of Meaning, 6. Knowledge Sharing and 7. Collaboration. Each level is both a means and an end (means-ends duality): it’s an end when referring to the level below it and a means in relation to the level above it. In that approach, knowledge sharing serves as an essential means for performing collaboration; thus, understanding knowledge sharing, and in particular the sharing of *tacit* knowledge (Bettoni et al. 2018), is essential for better understanding New Collaboration.

But how are the sharing of tacit knowledge and collaboration related and specifically how do they actually unfold; how is their process intertwined? Unfortunately, little is known about these issues. For example, you can find surveys about the application of digital collaboration in business in which e-mail (which promotes *divergent* interaction) is still considered to be the most important collaboration tool (Roten et al. 2016, 3-4). But New Collaboration requires a completely different type of interaction, *convergent* interaction (Bettoni et al. 2018): hence, considering and practising e-mail as the main collaboration tool clearly suggests that New Collaboration is still going unnoticed or at least is not well understood and not put sufficiently into practice. The business world in which we are living today is a world of volatility, uncertainty, complexity and ambiguity (VUCA). It is a new world which changes faster than we can learn and where business outputs “*depend on a wider and wider range of knowledge, skills, values, technologies and competences*” (Obeng 1997:3-9). Recent surveys show that, in order to cope successfully in this new world, organisations should develop collaborative

cultures, embrace collaborative practices (IDC 2016:42) and invest in collaborative business models (Swisscom 2017:11). This is exactly what New Collaboration could support and why we should become aware that New Collaboration is already happening, take it seriously, understand its structure and dynamics and then fully exploit its potential.

## 2. Concept

In the VUCA world, successful people are increasingly collaborating in a new way: they work together on a shared task without splitting it. And because the task (the unit of work) is not split, the related knowledge needed during the performance of the task must also form a unit and be maintained as a unit. For this reason, New Collaboration requires the individual knowledge of the collaborators to be integrated into a shared knowledge structure. In this sense, we say that New Collaboration is *knowledge-based*. The practice of constructing and maintaining this task-related knowledge as a shared knowledge structure has three relevant dimensions: (1) the *mutual engagement* of the group in a conscious, continuous effort to pursue (2) a *joint enterprise* (shared tasks) which, over time, leads to the development of (3) a *shared repertoire* (symbols, words, concepts, stories, ways of doing things, routines). Since these are the three dimensions of practice in Wenger's community of practice model (Wenger 1998:72ff), it is in this sense that we say that New Collaboration is *community-oriented*.

### 2.1 Definition of New Collaboration

The aforementioned characteristics of the concept of New Collaboration are summarised in the following definition (adapted from Bettoni et. al. 2016, Bettoni 2017): *New Collaboration is a way of working together at the same, shared task without splitting it, whereby concurrently being mutually engaged as a community for constructing and maintaining a Joint Knowledge Base as a basis for accomplishing that task.* This definition has its roots in the seminal work by Roschelle & Teasley (1995) which investigated collaborative problem solving almost 25 years ago. At first sight, this concept of collaboration may seem excessively resource-intensive; imagine, for instance, a research department; what could it mean here, "*working together at the same, shared task without splitting it*"? Should every researcher work on every research project and on every work package in a project? Of course not. There are tasks which were, are and will also in future be better assigned to one individual.

But the trend is clearly moving towards increasingly *knowledge-based work units* (Jacobs 2019) and because knowledge evolves so rapidly and remains mostly tacit (less time for documenting) due to the high rate of innovation, these tasks tend to require the contribution of more than one individual. This is exactly the type of situation in which the application of New Collaboration would be appropriate: a knowledge-based work unit performed by a group in a fast-changing business environment. A good example are tasks of the troubleshooting type, a pattern which involves matching problem situations or symptoms with probable causes and devising actions required to resolve the problem (Jacobs 2019). When problem-solving requires interaction with other people, what you have is often a consulting situation. Sometimes just a phone call or e-mail to one colleague may be enough; but in many cases you need more time and to involve more than one person. You may need a prolonged, problem-solving interaction with a group and this can seldom be done one-to-one on the phone; it requires a meeting. So, with increasingly knowledge-based tasks, the number of (problem-solving) meetings is also increasing. Afraid of bad meetings? Don't worry: New Collaboration also applies to meetings and has recently been proposed as a solution to the paradox of meetings (Bettoni & Obeng, 2020).

### 2.2 Structural Model of New Collaboration

The above definition and explanations help to clarify what kind of activity we are seeking to understand. Further help is provided by identifying the main *elements* of collaborative activities. To this aim, we propose a *structural model* of collaboration which is a slightly adapted version of the 4T model used for the design of collaborative learning (Persico & Pozzi, 2010; Pozzi et al. 2016). Our version distinguishes between Task, Team, Time, Technology and Joint Knowledge Base as the five main elements (dimensions) of any collaborative activity:

- the **Task** to be accomplished by the group which usually envisages the production of a final output;
- the **Team** or group of people selected to accomplish the Task;
- the **Time** schedule according to which collaborators are required to carry out the activity;

- the **Technologies** enabling the activities which include *spaces* where the interactions will occur (physical building or online) and *tools* (methods, devices) used to carry out the activities.
- the **Joint Knowledge Base** which is constructed and maintained by the group *sharing knowledge* during its interactions.

These are the 5 elements on which the design of collaborative activities needs to focus *before* collaboration, which need to be facilitated *during* collaboration and which must be evaluated *after* collaboration has taken place.

### 3. Joint Knowledge Base

In our presence model of knowledge sharing (Bettoni et al. 2017), we suggested that a successful knowledge sharing experience occurs through the integration of three essential elements: cognitive presence, social presence and leading presence, an approach inspired by a process model of collaborative construction of knowledge in a community of learners (Swan, Garrison & Richardson, 2009). In this model, the point of view was based on aggregation in a *hierarchy of activities* required for the process. Here we want instead to consider how the collaborators, when performing these activities, contribute to the creation of a shared knowledge structure called a Joint Knowledge Base. The term *Joint Knowledge Base* (JKB) indicates the shared knowledge structure which is constructed and maintained during collaboration. According to Roschelle and Teasley (1995:76), collaborators interact through *language (conversation), physical action and combinations of words and action*. During these collective activities, each collaborator contributes to the construction of the JKB relating to the task at hand. And at the same time, the JKB functions as a basis for accomplishing the shared task on which the group is working and can also be seen as an essential condition of the possibility of successful collaboration. The JKB collects and organises into a system a set of knowledge elements which emerge during interaction within the group working together.

Recently, in the Pyramid Model of New Collaboration, we considered how the components of the presence model of knowledge sharing enable each other as foundations or preconditions within a hierarchy (pyramid) of means and ends (Bettoni & Obeng, 2019). In this pyramid, Knowledge Sharing is placed at level 6, immediately below the top level, as the fundamental activity which enables New Collaboration (level 7). It is here where collaborators construct and maintain the Joint Knowledge Base. But how do they do this? What is required? The answers to these questions are found at the underlying level 5, called "Negotiation of Meaning" (Bettoni & Obeng, 2019:126).

#### 3.1 Negotiation & Co-Construction

In order to be shared and be admitted as constitutive parts of the JKB, the knowledge elements must be evaluated as *meaningful* by the group. The meaning that they must have is not simply a specific relationship between a sign and a reference (lexical meaning) nor a grand principle of reason or ethics (philosophical meaning). They must *make sense* to the group in practical ways, especially in relation to the professional experience of each group member. This is why the knowledge elements can enter the JKB only if they successfully get through a 'sensemaking' process called a *negotiation of meaning* which comprises two highly interwoven activities: participation and reification (Wenger 1998) and is the first of the two main components of *cognitive presence* (Bettoni et al. 2018). In short: the elements of the JKB must go through a process of group cognition and can enter the JKB only as socially negotiated results of that process. *Participation* must be *about* something, some content, ideas, proposals; and *reification* also must be *of* something. So, what we need here in first place is to produce relevant content, hence to be creative and skilled in constructing (producing or modifying) knowledge.

Thus, the core process underlying and enabling the negotiation of meaning is the co-construction of knowledge and the second main component of cognitive presence. It comprises skills like: (a) shared language, (b) shared content / storage, (c) co-planning, (d) co-solving, (e) cowriting (Bettoni et al. 2018a:1137). During the course of such a co-construction of knowledge, each collaborator builds and maintains his/her own knowledge base so that, within a group, we have as many knowledge bases involved as there are collaborators. But the overall shared goal of working with the other collaborators on the same shared task leads within the individual knowledge bases to the emergence of areas which mutually converge (and resonate).

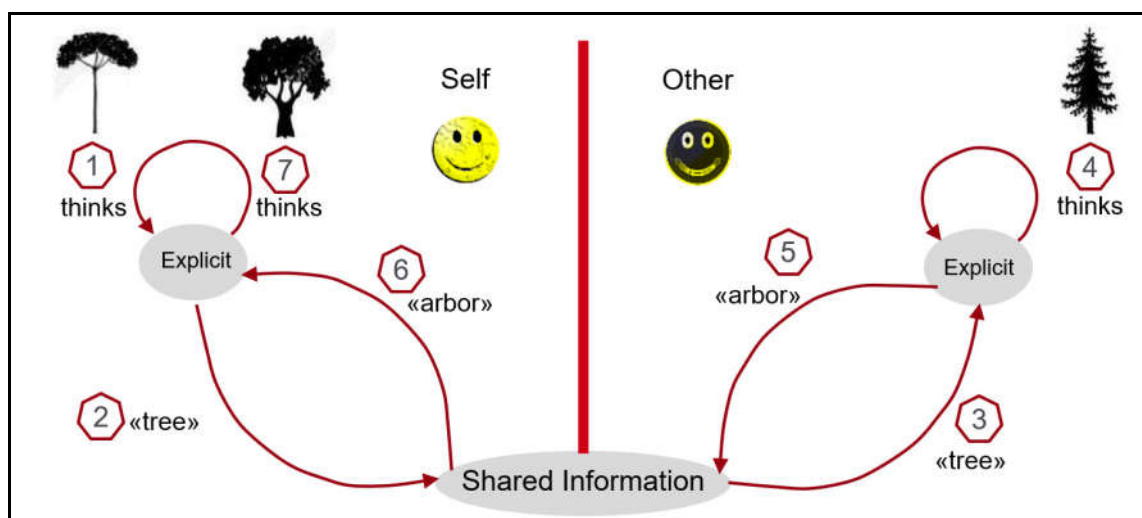
In these convergent areas, meanings do not necessarily overlap or match across all the individual knowledge bases of the group members and we should speak more accurately of taken-as-shared rather than shared

meanings. The notion of a taken-as-shared meaning implies that individual meanings “fit for the purposes at hand but does not require that they necessarily match” (Cobb 2000:166). It is in this sense that we speak of a “joint” knowledge base: the JKB is the collection of those knowledge elements which constitute a unity because their meanings *converge and fit across group activities* and enable meaningful conversation, action and interaction in relation to the purposes which emerge step by step during collaboration on a shared task. We will see later when discussing our communication model what the advantages of considering the negotiated JKB a taken-as-shared rather than simply a shared structure are.

A knowledge base is built and maintained by several *element-related* activities which are performed on the knowledge elements and are dynamically connected to each other in closed (control) loops: 1) *introducing* new elements (through assimilation or accommodation); 2) *modifying* existing elements when divergence arises during collaboration; 3) detecting divergence by *monitoring* ongoing interpretations of knowledge elements and *comparing* them with the intended interpretations for determining whether these fit; 4) last but not least, *rectifying* intended interpretations when there are conflicts (meanings do not fit). Let us look at this process more in detail by means of a communication model for the group activity of *conversation*.

### 3.2 Communication Model

Our communication model (see Fig. 1) is inspired by Ranulph Glanville’s and Gordon Pask’s Conversation Theory (Pask 1975; Glanville 1996). Conversation Theory is commonly illustrated and explained using two conversants only: a subjective self with another person (Fisher 2019). Both roles can also occur within one person, for example when we anticipate a conversation with someone or when we read an old article of our own which we wrote many years before and which now appears in a new light.



**Figure 1:** Communication model: a verbal interaction between Self and Other (based on Glanville 2007)

The conversation begins with the Self thinking of a tree (upper left tree in Fig. 1). Step 1: Mrs Self thinks of a Mediterranean pine. Step 2: She says "tree". Step 3: Mr Other hears "tree". Step 4: He thinks of a spruce. Step 5: He says "arbor" (Latin for "tree"). Step 6: Mrs Self hears "arbor". Step 7: She thinks of an olive tree. Within this sequence of seven steps, the thinking process is represented in the model as a simple curved arrow which starts from the explicit knowledge base of the Self and ends here, when the thought is completed. The word “tree” (spoken) is the only information transferred and shared: we conceive it as a “boundary object” (Wenger 1998:105ff) albeit a very simple one. Nothing else is transferred which is why in Fig.1 we have put a wall, a vertical separation, between the two conversants.

The diagram in Fig. 1 tries to depict something very important for collaboration and knowledge sharing: meaning cannot be just transferred; it must be (and always is) actively constructed. Heinz von Förster called it The Hermeneutic Principle: "The hearer, not the speaker determines the meaning of an utterance" (von Förster & von Glasersfeld, 1999:13) and what he meant was that the listener can interpret the utterance only in terms of the meaning he or she, the listener, ascribes to these words. This constructivist view of communication argues that “the repertoire of meanings which we attribute to words must be developed by each individual speaker on the basis of his or her own subjective experience” (von Glasersfeld 2007). In line

with this approach, a constructivist approach to knowledge management suggests that our experience determines our interpretation of something (a word, an object, a situation) more than the something we are perceiving (Bettoni & Eggs 2010). Thus, when the experience is similar, communication will succeed more easily but when the experiences of the speaker and listener are different, it is more probable that misunderstandings will appear and communication could more easily fail.

In our diagram, in Fig. 1 the listener (Mr Other in step 3, Mrs Self in step 6) generates his or her own meaning, in this example a different tree, a spruce instead of the Mediterranean pine intended by the speaker. Since Mr Other thinks of a different tree, he also replies with something else, a different word, which triggers Mrs Self to think of another tree too, an olive tree. She compares this new tree with her first tree and asks herself: are the two meanings (trees) similar enough for me to think "Mr Other understood me?"

This evaluation of the actual degree of similarity against an expected threshold of required similarity is the type of thought which enables and controls conversation as a circular interaction process (Gordon Pask was the first who looked at a conversation like this). If the answer is "yes" (similar enough), then conversation continues with new content. If the answer is "no", then the conversation sticks with the current content. Perhaps the first speaker, Mrs Self, if she is not aware of the aforementioned Hermeneutic Principle, will insist on her original meaning and declare "I made it perfectly clear that ...", a tactic which will mostly lead to more misunderstandings. Knowing that it is experience which determines individual meanings and that knowledge should be considered as *taken-as-shared*, rather than simply a shared structure, would enable Mrs Self to adopt a better option: changing the expression used, the boundary object; to do this, the first speaker could analyse the expression used by the listener and try to work out which experience could lead to his interpretation. She could also ask questions regarding their different experiences, thus introducing into the conversation a metacommunication which is consistent with the constructivist Hermeneutic Principle.

#### 4. Artefact-mediated Interaction

If we take seriously the notion that meaning is not transferred by communication, then we can recognise something very important for collaboration: that conversation is not enough when it comes to exploiting the potential of collaboration. We know this very well from meetings: they very often are not only unproductive and a waste of time (Kello 2015) but also last too long, mostly because collaboration and knowledge sharing are not working as they could and should (Bettoni & Obeng, 2020). What can we do to solve the problem of unexploited collaboration? A Constructivist Ethical Imperative (von Förster 1984) helped us to find an answer:

*"I shall act always so as to increase the total number of choices"*

How could we increase the number of choices in conversational interaction in a way which would solve the aforementioned communication problem? One way to do this consists of increasing the dimensionality of the interaction by adding a third dimension to the two dimensions of conversation (the Self and the Other). But which third dimension would be suitable? Facilitation techniques already answered this question a long time ago: the third dimension which they add to conversation is *physical action*, the second simple way of interacting which we already mentioned earlier. Although this approach increases the complexity of the interaction, we know from the practice of facilitation (Wagenaar & Hulsebosch 2008; Kaner 2014) that there are lot of tools and techniques (which can be easily learned) which help skilled facilitators in coping with this complexity and in making the interaction efficient and effective, in spite of the increased complexity.

##### 4.1 Mediated Interaction

When the *two* mentioned group activities, conversation and physical action, are combined into *one* single group activity, we obtain a new type of interaction which we call *mediated interaction* (combinations of words and actions in a group). A mediated interaction is a group activity where cognitive, social and leading presence come together and produce a boundary object, the most visible part of the whole collaboration process. The new dimension which physical action adds to conversation largely increases the number of choices and hence the opportunities for knowledge co-creation.

How can we exploit this increased potential? Storytelling and object-mediated interaction are two simple ways to do so. In *storytelling*, the physical action comes with the chain and flow of events which make up the story; we find it in the central conflict of the story as well as in its resolution. What we have here is merely a described and imagined physical action but it is there as a new dimension which increases the opportunities for activating imagination, stimulating further thinking, creating tacit knowledge, helping to rediscover

meaningfulness and orientation, awakening emotions, creating cohesion and strengthening memories. Among other types of stories, fairy tales are particularly suited to fostering collaboration because they bring and hold together individuals and their (tacit) experiences through references, metaphors and analogies which can easily be assimilated (Bittel & Bettoni 2014).

In *object-mediated interaction*, the physical action is performed on real objects which can be created, moved, modified and transformed in various ways. When the object is an artefact, like for instance a poster, a whiteboard or a panel in an office, then we speak of artefact-mediated interaction. In *artefact-mediated interaction*, the physical action performed by the collaborators consists of moving within a shared 3D space, sitting in small groups at tables, gathering in front of a panel or poster, writing cards, fixing them on a panel and then organising them according to a given problem-solving method etc. In doing so, they not only use existing artefacts; they also produce one or more of them as a result of their interaction. Such a product could be a set of marketing ideas organised in subgroups, a form for systematically organising information about project progress or a plan of actions for training new clients. We call it a *boundary artefact*, a special instance of the boundary object used by E. Wenger in his community of practice theory where he describes them as objects which can link communities together by allowing different groups to collaborate on a common task (Wenger 1998:105ff).

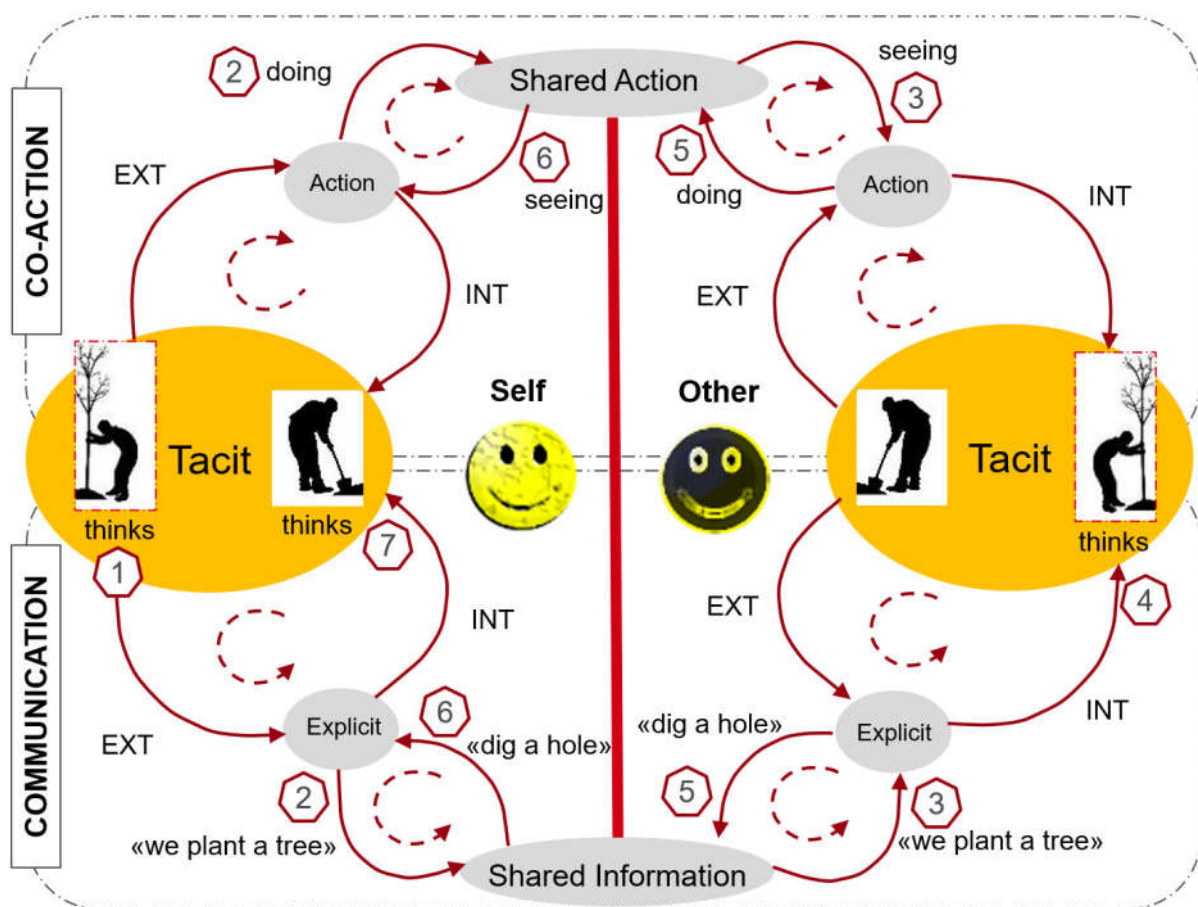


Figure 2: Collaboration model: an *object-mediated interaction* between Self and Other

#### 4.2 Collaboration Model

Our collaboration model (Fig.2) includes the communication model of Fig.1 but extends it by adding a model of co-action (upper half of the diagram) and some ideas taken from the SECI model of knowledge conversion (Nonaka & Takeuchi 1995) and from the IECS basic knowledge sharing model (Kharabsheh et al. 2016). Differing from the SECI model, in this model the collaboration process begins by explicitly considering two individuals, each with their own individual knowledge base (explicit and tacit knowledge) and looks at how knowledge conversions proceed first within each single person and then between them.

More precisely, a typical collaboration process starts within the individual and proceeds as follows (Fig. 2):

1. First, the model considers the knowledge conversion from explicit to tacit, called "internalisation" (to learn, to understand), abbreviated with the acronym INT in the diagram;
2. Second, the focus is put on the reverse knowledge conversion, from tacit to explicit, called "externalisation" (to document, to express), abbreviated with the acronym EXT. These two conversions, EXT and INT, form a loop, indicated in the diagram by the circular arrow (dashed line) and the loop can eventually lead to some thoughts related, for example, to planting a tree, indicated in the diagram - within the tacit knowledge base - by the silhouette of a person holding a young tree.
3. In a third step, the model looks at the knowledge conversion from explicit to explicit called "combination" which in our case is seen as an exchange of information in the sense of a conversation between two individuals.
4. At the same time, we also look at knowledge conversion from tacit to action, depicted in the upper part of the diagram. This conversation proceeds according to the same sequence as in Fig.1 but is intertwined with the process of co-action. Step 1: Mrs Self thinks of planting a tree. Step 2: She says "we plant a tree" and, at the same time, the action of catching, moving and holding the tree begins. Step 3: Mr Other hears "we plant a tree" and at the same time sees what Mrs Self is doing. Step 4: He understands what Mrs Self is doing and thinks that the tree needs a hole, a complementary idea. Step 5: He says "dig a hole" and begins to do it. Step 6: Mrs Self hears "dig a hole". Step 7: She thinks of a combination of her holding the tree and Mr Other digging a hole: they fit, the collaboration is successful. We see here that, thanks to co-action, in this case the conversation has been successful; moreover, thanks to this intertwining of communication and co-action, a fourth step of knowledge conversion called "socialisation" has also been successfully performed; this is the step in which tacit knowledge is shared between the two individuals by means of integrating the two types of interaction, conversation and physical action.

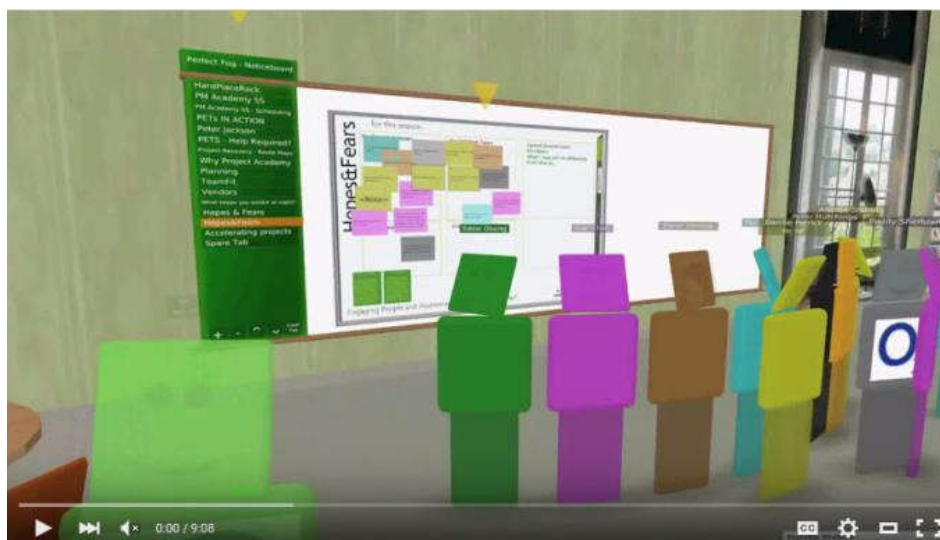
This collaboration model explains why artefact-mediated interaction is so important: not only does it make communication succeed, it is also the catalyst for *tacit* knowledge sharing, the essential activity for exploiting the full potential of collaboration.

### 4.3 QUBE: New Collaboration Online by Artefacts-Mediated Interaction

QUBE is an online commercial platform which successfully implements artefacts-mediated interaction, thus enabling the full potential of New Collaboration to be exploited. Collaboration on QUBE is based on 4 components (New Culture, New Tools, New Methods and New Behaviours). An example of the New Culture is the principle of "Write first, talk second" which requires that for any given topic of discussion, participants must first write their contributions on a panel and then conversation will start based on and referencing those written contributions. A New Tool is, for example, the sticky note facility and the panel on a wall: each participant can create as many sticky notes as he/she wishes, write a text on each and place the sticky note on a panel visible to all the other participants. A New Method is, for instance, the so-called "Hopes & Fears" method for collaboratively planning a session. Last but not least, an example of a New Behaviour is being fully attentive to what is going on instead of reading e-mails or surfing the internet during the meeting. In general, collaboration on QUBE proceeds as a group activity where cognitive, social and leading presence come together and produce a boundary object.

A typical session on QUBE, for instance a kick-off meeting, begins with session facilitators welcoming the participants as they arrive in the space. Each person in QUBE is represented by an individual avatar, a simple box figure (like LEGO mini figures but gender-neutral) which provides enough of a human form to foster the required level of identification. Using your avatar, you are able to communicate with other people just as you would in the real world. You can move around in the rooms of a building, physically interact and work shoulder to shoulder, literally brainstorming with many other people by means of whiteboards and sticky notes.

The facilitators welcome each one individually and make sure that they are ready to start. Then the avatars can visit the virtual collaboration space until the meeting starts. The room has been carefully prepared in advance. The whiteboards, panels, tables and chairs needed during the meeting are available on the walls and on the floor. Some whiteboards display poster tools called PETs (Performance Enhancing Tools), guidelines or procedures about how to accomplish a task described on a poster. PETs can easily be replicated on a whiteboard or wall when needed; each PET is linked with a specific documentation which describes "what is it?", "why do I need it?", "when do I use it?" and "how do I use it?" In this sense, a QUBE PET is a collaboration method and corresponds to what is often called a *collaboration pattern* in literature (Eppler & Schmeil 2010). What is special about a QUBE PET is that the collaboration involved is always an artefact-mediated interaction.



**Figure 3:** Group at whiteboard with Hopes & Fears PET by Pentacle (<http://www.pentacle.co.uk/>)

Regularly scheduled problem-solving and decision-making meetings with a project team are the most important requirement for effective and efficient collaboration (Gordon 1977). On QUBE these meetings, called “drumbeats”, eventually receive the high consideration which they deserve. Within such a drumbeat, we see exemplified how QUBE implements the collaboration model presented in the previous sections 4.1 and 4.2: conversation and physical action are combined during a meeting on QUBE to form a mediated interaction in which collaborators produce the aforementioned boundary artefacts (see 4.1).

A drumbeat starts with a previously appointed coordinator welcoming the team members as they arrive in the project space on QUBE and gather at the central meeting place, called the “home” (leadership presence, social presence). When the group is complete, they walk together to a panel which displays the PET “Hopes & Fears” where the coordinator asks: “what are your expectations and what are you afraid of in relation to this meeting?”. Each participant writes his/her contributions on cards and places them on the hopes or fears area of the panel (see Fig. 3). Like in the collaboration model presented in section 4.2, the collaboration starts within the individual, with the two knowledge conversions of “internalisation” (INT) - when a participant *reads* the cards that other participants place on the board – and “externalisation” (EXT) – when a participant *writes* his/her own contributions on cards and places them on the board, among the others. A team member will then order the cards in clusters and clarify their meaning with the help of the group, thus beginning the knowledge conversion of “combination”. Together the team then needs to discuss what could remove the Fears (social presence) before creating an agenda of steps for making the Hopes a reality (cognitive presence): this will require writing some new cards and placing them on the board as well as putting existing cards in a proper temporal sequence. The knowledge conversion of “socialisation” happens in these card-related actions: pointing to a card when talking about its content, moving cards to put them in a better order, creating clusters or sequences of cards, changing the size of a card, formatting its words, etc.

When the interaction at the panel “Hopes & Fears” is concluded, then the team starts working on the tasks defined in the agenda. PETs like “STICKY STEPS” or “5 Ps” help to clarify the problem in the beginning. The PET called “5 Ps” is a way of making sure that the teams have a shared understanding of the core elements of the project and the PET called “STICKY STEPS” is a quick and effective way to breakdown the required actions into smaller components and to make a first rough plan by distributing them over a time interval.

During the interactions, some specific questions will arise and provide opportunities for starting work in smaller groups. Small groups can move to an area in the same room provided with chairs and round tables and sit down here when they want to discuss something, for example how to proceed when dealing with the specific question they have selected to work on (cognitive presence, leading presence). Once they have decided this, they can move to another area of the space and gather in front of a huge whiteboard with sections separated by panels. At tables and within panels, the group members will only hear each other talking, without noise from other groups (a feature which is quite impossible in a real room). Shortly before the time assigned for the working in small groups has expired, a signal (flashing room light) lets the groups know that soon they will have to return to the plenary assembly, usually gathering in a circle in the middle of



the room. Here the group performs a so-called “spincasting” (social presence): each team member in turn has the opportunity to give brief feedback about the work carried out in the small groups (insight, remarks, questions, learning, etc.). This sequence of interactions in three steps (plenary with a PET, work in small groups with various PETs, plenary feedback by gathering in a circle) can also be applied during any phase of the collaboration. At the end of the meeting, a PET called RAPID will help the whole team to define the next steps and related tasks and plan when and who will accomplish them after the meeting (leading presence, social presence).

## 5. Discussion

In the VUCA world, the trend is clearly moving towards increasingly *knowledge-based work* in a fast-changing environment. In order to successfully cope with this evolution, organisations should develop collaborative cultures and embrace collaborative practices. New Collaboration can support this but in order to fully exploit its potential, we need to better understand its structure and dynamics, particularly the sharing of *tacit* knowledge: how are the sharing of tacit knowledge and collaboration related and specifically how do they actually unfold?

To answer this question, we have first provided a *concept* and a *structural model* of New Collaboration as a knowledge-based and community-oriented activity, focusing on the concept of a Joint Knowledge Base, the shared knowledge structure which is constructed and maintained during collaboration and is used as a basis for accomplishing collaborative tasks. By means of two dynamical models, a *communication model* and a *collaboration model*, we have tried to describe how the sharing of tacit knowledge and collaboration are related and specifically how their intertwined process unfolds. We have argued that conversation is not enough for exploiting the potential of collaboration and proposed the concepts of *mediated interaction* and of *artefact-mediated interaction* as a solution to this problem. Finally, we were able to show that this way of collaborating is not just theory but already daily practice: the commercially available collaboration platform called QUBE and the tools and culture which it promotes constitute a real world system which successfully implements artefacts-mediated interaction, thus enabling the full potential of New Collaboration to be exploited.

## 6. Conclusion

Our answer to the question of “how are the sharing of tacit knowledge and collaboration related and specifically how do they actually unfold?” has some limitations which will need to be well investigated in the evaluation of this research and addressed by future work. First of all, our model of a Joint Knowledge Base is only a rough sketch; for instance, how do knowledge areas which mutually converge and resonate emerge within many individual knowledge bases? To what degree must the meanings be consensual in order to enter the JKB? In these convergent areas, if meanings do not overlap or match across all the individual knowledge bases of the group members, what indicates their convergence and how does resonance manifest itself? Secondly, in mediated interaction, how do cognitive, social and leading presence come together and contribute to the production of a boundary object? In particular, regarding physical action, what does it add to the interaction when it is performed on cards which can be placed and grouped on a whiteboard? How does its effect relate to the motivations, roles and relationships of the participants? Last but not least, the way in which the intertwining of communication and co-action contributes to the knowledge conversion called “socialisation” will require further clarification in future work. This will be important to make it easier to share tacit knowledge in a variety of collaborative situations.

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