

# **“I Cannot Explain Why I Like This Shape Better Than That Shape”: Intercorporeality in Collaborative Learning**

Jacob Davidsen and Thomas Ryberg  
jdavidsen@hum.aau.dk, ryberg@hum.aau.dk  
Aalborg University – eLearning Lab

**Abstract:** While the exchange of utterances between collaborators have been viewed as the primary vehicle for meaning-making in CSCL, we have been encouraged by the CSCL19 theme to expand this understanding to include intercorporeality as way of foregrounding bodies in collaborative learning. We find that collaboration, meaning-making and problem solving is also occurring even when collaborators are lacking words for expressing their thoughts in talk. Thus, we promote the idea of viewing CSCL as a field concerned with intercorporeality in meaning-making practices. Through a detailed analysis of a group of architectural engineering students, we unpack how they prepare for a critique session by building upon each other's utterances, gestures and manipulations of objects in their design studio thus displaying intercorporeal memory and understanding. Based on the analysis we discuss three themes related to intercorporeality in CSCL: Ecologies of technologies, Historical development of the bodily-material resources and Subtle manifestations of intercorporeal understandings.

## **Introduction**

In recent years, we have witnessed a re-newed interest in embodied aspects of interaction in CSCL (Davidsen & Ryberg, 2017; Flood, Neff, & Abrahamson, 2015). To some extent this development has been driven by the advent of technologies for supporting collaborative learning such as interactive tabletops (Higgins, Mercier, Burd, & Hatch, 2011), but also from theoretical and methodological orientations towards embodied interaction analysis (Streeck, Goodwin, & LeBaron, 2011). To some degree, the theoretical pillars of CSCL have included and mentioned multimodal and embodied elements of interaction (e.g. Teasley & Roschelle, 1993), but the analysis of the role of the body, the environment and the relations between bodies and environment have been backgrounded in comparison to talk. Encouraged by the CSCL19 theme of 4E learning (Embodied, Enactive, Extended, and Embedded), we add to the re-newed interest in this more ‘holistic’ research agenda of CSCL by presenting a study on the intercorporeality of collaborative learning in ‘architecture and design’ education. Based in our study we suggest that intercorporeality offers a fresh methodological and theoretical stance on collaborative learning by zooming in on how bodies affect each other in collaboration. Thus, this is an attempt to foreground bodies in collaborative learning widening the talk-based focus in CSCL to include and emphasize intercorporeal memory and understandings.

In this paper, we study a ‘design studio’ featuring collaborative activities amongst students in the ‘architecture and design’ program at Aalborg University. The setting and collaborative activities are highly multimodal and composed of both talk, bodies and materials. While many of the activities in the studio are supported by digital technologies, and other highly specialized technologies, we want to broaden the perspective of CSCL by focusing on the material surroundings, bodies, talk, digital and analogue technologies supporting the collaborative activities. The group of six students are in midst of preparing design concepts for an upcoming critique seminar with fellow student groups and teachers. In doing so, they are working together in different collaborative constellations – as a whole group and in pairs depending on the type of activity and work tasks they face. To get a better understanding of how the students are collaboratively preparing for a critique seminar, we study their intercorporeal work in the studio – integrating the Embodied, Enactive, Extended and Embedded aspects into one analysis. Further, we suggest that intercorporeality can function as a theory highlighting the intimate and ‘inter-kinesthetic’ relations between bodies in collaborative learning.

In the paper we are focusing intercorporeality and in particular on how collaboration, meaning-making and problem solving is possible even when the participants lack words for expressing their ideas and arguments. This includes showing how bodies, technologies, objects, gestures, touches, and other bodily-material resources are contributing to the formulation and understanding of ideas and design concepts in creative collaborative design processes between students.

## **From talk to embodiment to intercorporeality in CSCL**

Since the early years of CSCL, researchers have studied the subtle processes constituting collaborative learning with technologies in face-to-face settings and online learning environments. Much work have focused on talk (spoken or written) between the collaborators, but there is also a growing body of studies integrating embodied elements in the analysis of collaboration. Basically, we see a development in the focus of CSCL studies from talk to embodiment, but our goal with this paper is to add an additional perspective to these established analytical foci by introducing the idea of intercorporeality in collaborative learning as a way of focusing on the intimate, ‘inter-kinesthetic’, and affective bodily aspects of collaboration.

As CSCL is concerned with collaborative activities in both online and physical environments, there is a range of different methodological and theoretical stances available for analyzing and designing for collaborative learning (Wise & Schwarz, 2017). On a general level CSCL is divided between three types of studies: experimental, design and naturalistic (Stahl, Koschmann, & Suthers, 2006). Across the types of studies and characteristics of the learning environments (e.g. face-to-face or online), there is a strong orientation towards analyzing talk. Stahl (2006, p. 6 italics in original) suggested that “*meaning is created across the utterances of different people*”, emphasizing the interest in talk and text in CSCL. However, as argued by Flood, Neff and Abrahamson (2015) there is a need for CSCL to develop ways of “representing and cataloguing choreographies of embodied interaction” (2015, p. 96) in order to better design for collaborative embodied interaction in CSCL environments. One example of such a catalogue of embodied interaction in CSCL is found in Davidsen and Ryberg (2017), who explored children’s collaborative activities in front of a shared touch-screen. The authors suggested that bodily-material resources and in particular hands are used as resources for ‘communicating and illustrating’, as ‘cognitive auxiliary tools’ and as a way ‘shepherding’ each other.

Beyond the field of CSCL there is an extended and growing body of research focusing on embodiment and how the elements in the environment are used by the participants. While these studies are not addressing collaborative learning per se, they are focusing on the ways people accomplish tasks together in various settings and how they competently master a practice. For example, in a series of studies in the past 40 years Goodwin (2017) has shown how people build upon each other’s embodied interactions through different media and resources at archeological sites, court rooms, oceans vessels, etc. In addition, a recent collection of papers (Meyer, Streeck, & Jordan, 2017a) address the notion of intercorporeality in human interaction in diverse practices (e.g. families, self-defense training and auto repair workshops). The paradigm of intercorporeality is first of all rejecting a transmission view of interaction, but it is also opening up the field of embodied interaction by fleshing out that bodies are not alone – they are within an “inter-kinesthetic field” (Behnke, 2008). Meyer, Streeck and Scott (2017b) argue that intercorporeality is “not only the presences, movements, and micromovements of other (inanimate or animate) bodies in my peripersonal space, but also the sedimented traces of such presences and movements in the architectures and the artifacts around my body” (2017b, p. xvii) – what Fuchs (2017) refer to a intercorporeal memory. Meyer et al. (2017) further critique the use of established concepts (also frequently used in the CSCL literature) as ‘coordination’, ‘alignment’, ‘intersubjectivity’ and ‘joint attention’ as they are not doing justice to the synchronous, simultaneous, improvisational and bodily actions of the participants. For instance, in an analysis of ‘Intercorporeality at the motor block’, Alkemeyer, Brümmer and Pille (2017) find that the character and nature of movements in the situation fosters communication and understanding among the members of the practice. The authors suggest that “These respective movements can be understood as a collective way of thinking, reflecting and problem-solving by means of gestural demonstration and experimentation” (Alkemeyer et al., 2017, p. 227).

The paradigm of intercorporeality seems to offer a fresh perspective on collaborative learning mediated by technology. With intercorporeality the lens is widened in CSCL and it is a call to go beyond talk and embodiment to start focusing on the intertwined nature of bodies in collaborative activities. Integrating intercorporeality necessarily also requires a broader view on what can support collaborative learning in CSCL environments. Instead of solely studying interaction with one technology or application, it is necessary to follow the methodological and theoretical guidance from embodied interaction analysis and intercorporeality to study talk, bodies and material surroundings as one complex analytic unit.

## Context of the study and data collection

In this paper, we examine a group of ‘architecture and design’ students in their 5<sup>th</sup> semester at Aalborg University. The overall pedagogical idea of Aalborg University is based on Problem Based Learning (PBL). PBL is often considered a pedagogical approach supporting students in obtaining transversal competences such as collaboration, communication, critical thinking and problem-solving skills (Du, Emmersen, Toft, & Sun, 2013; Guerra, 2017). Each semester students will work on a group project supervised by a researcher. Besides receiving feedback and critique from the supervisor the group will also present, discuss and evaluate their project in formal critique sessions. The project is finally evaluated in a group exam where the group will

present, discuss and reflect upon their work together with the supervisor and an external examiner who will ultimately assess and grade the project.

Over a period of six weeks, we video observed three groups working in their open learning environment. We zoom in on one of the groups. The group was allocated a studio in a large open learning environment together with 13 other groups at the semester. Each group decorated and furnished the studio for their specific needs and the group we study in this paper used several notice boards and tables to support their collaborative activities (Figure 1). Each of the notice boards had different purposes, e.g. a shared calendar, a to-do-list, printed photos for inspiration, drawings, etc. On the center table, the students gathered for collective activities, but also to work in pairs or as individuals. On the table in the center, the students had their laptops, different drawings and styrofoam models. Next to the center table, a smaller table was placed for individual work. Over time the room would clutter with all sorts of materials in the studio, telling a unique story of the process of the individual group.



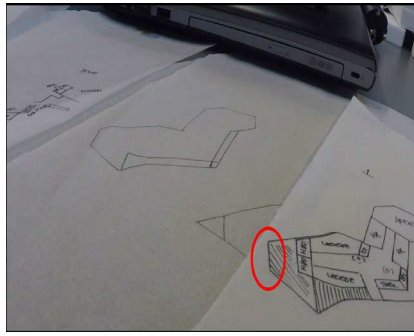
Figure 1. Photo of the group members at the center table.

In the studio, we positioned 4 fixed video cameras and one of the students wore a chest-mounted GoPro on several occasions. As the collected data is extensive (+ 150 hours for this group alone), we have decided to limit our analysis to a period of two days where the group is preparing for an architectural critique session. Specifically, we analyze a 33 seconds long sequence, which serve the purpose of illustrating how they work together in the context of their design studio preparing for a presentation at the critique seminar. Previous studies have analyzed the pedagogical nature of critique sessions in architectural education (Lymer, 2009; Lymer, Ivarsson, & Lindwall, 2009), but in this paper we focus on the work the students do to prepare for the critique session. We find the preparation work particularly interesting for studying the intercorporeality of collaborative learning, as the students have to develop design concepts together for a shared presentation. In addition, the students are working under a certain time pressure, as there is fixed deadline. The preparation work requires working towards a somewhat shared idea of the design concept through collaborative activities managed independently by the students. One day prior to the critique session, the group is narrowing down the number of design concepts they will present. To scaffold this activity the student group split into three pairs – each pair developing a concept to present to the other group members. In this way they are simulating or rehearsing for the actual critique seminar. In the analysis, we zoom in 33 seconds where Heidi and Sine have just presented their new idea to the other group members, and now the others start critiquing their design concept.

### Contextualizing the sequence

Before the analysis of the interaction, we briefly present the overall structure of the sequence followed by a transcript (Figure 3). The transcript builds on conventions from Conversation Analysis (Jefferson, 2004) and in particular the work of Goodwin (2017) in relation to the use of frame grabs in the transcript. Thus, we have included frame grabs from the video footage in the transcript to make the intercorporeal and simultaneous aspects of the collaborative activity ‘somewhat’ visible – each photo is numbered (P.number) for reference in the analysis.

Heidi and Sine just finished presenting their design concept, and now the rest of the group members start critiquing the design concept. The phase of critiquing the design is both oriented towards highlighting ‘flaws’ and collectively developing better ideas.

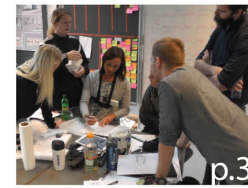
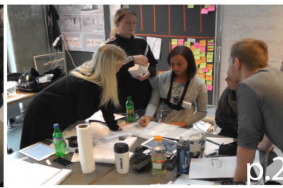
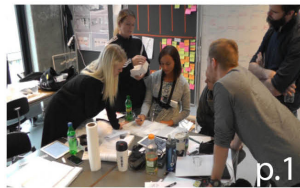


**Figure 2.** Shape of the building without the triangular tip (marked with the red circle) on the left, the original shape of the building in styrofoam on the right.

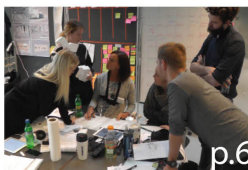
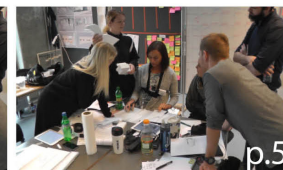
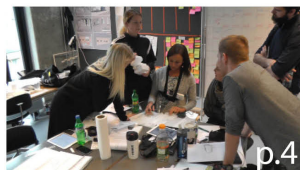
Initially we want to draw attention to the main aspect of the re-design made by Heidi and Sine, who have changed the overall shape of the building by cutting off the triangular tip (see Figure 2 left). This is a quite dramatic change, as the group has been working with the other shape for a couple of days (see Figure 2 right). What follows is an extract of interaction, where the group is discussing the shape of the building and in particular what the triangular tip should accommodate. Ina is evaluating the re-design by picking up the styrofoam model to express her concerns. Ina is also pointing out that they could maintain the shape of the building by extending the window section following the original shape. Much of this discussion is oriented to both the design and the functionality of the triangular tip. While the triangular tip is ‘fulfilling’ the shape of the building it is also a difficult space to use. Ina suggests incorporating a staircase or a transparent elevator shaft in the triangular tip, but again the shape is obstructing her idea. Sven and Sine joke about a transparent elevator with a triangular shape. Now, Ina returns to her defense of the original concept.

### Transcript of the extract

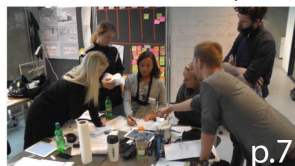
- 1 I so you like (.) cause I do really like that you like complete the shape in it



- 2 I cannot explain why I like this shape better than that shape



- 3 it is just cause I believe it completes the concept  
4 H yes  
5 I which I believe is very strong right now  
6 S it could be like a raised platform over there



- 7 I yah it could be [something wild growing in there]  
8 S [it (.) there could also be something] wild was growing

9 H but that could you also do  
 10 I or a tree  
 11 H yes that that could damn well be tree  
 12 S you just need to say green to Heidi  
 13 All (((laughing)))  
 14 M it was actually (.) it is the one you have there with Sines idea (.) that one with just like a round one

15 SV yes  
 16 M so if you just have that as a square (.) square triangle (.) it could very well be good

17 H I actually think it could be very cool

Figure 3. Transcript of the sequence.

### Analysis: “I cannot explain why I like this shape better than that shape”

While discussing Heidi and Sine’s design concept they use a range of different materials in the environment (Embedded and Extended); a styrofoam model consisting of several separate layers, existing drawings on the tables, noticeboards, an Ipad, and pencils for adjusting drawings or making new ones. The ecology of resources supporting their collaborative activity is diverse and continually configured and arranged to the specific needs of the activity. The combination of materials, bodies and talk facilitate their preparation for the formal critique session. While talk is of course crucial for meaning making, it is also clear, as we shall show, that intercorporeality establishes dimensions of sociality and collective knowing not present in their talk.

In the beginning of the extract (line 1), Ina is stressing that she would like the shape ‘to be completed’ saying “so you like (.) cause I really do like that you like complete the shape of it”, while simultaneously touching (almost embracing) the triangular tip of the styrofoam model with her right hand (P.1, 2 and 3). Actually, Ina repeats her touch of the figure twice, which indicates the importance of keeping the triangular tip and further illustrates what area of the building she is thinking of to the rest of the group members. In line 2, she says “I cannot explain why I like this shape better than that shape (.) it is just cause I believe it completes the concept” and then (p. 4) she separates the top layer of the styrofoam model from the rest by twisting it so the two-dimensional layout of the building is facing her fellow group members (p. 5 and 6). Ina is not utilizing any scientific or academic terms in trying to convince the other group members about keeping the triangular tip. Mostly, she is relying on everyday language combined with her bodily manipulation of the styrofoam model in front of the other group members. When she separates the layers and say “which I believe is very strong right now” (line 5), she is further linking the styrofoam model with the design concept developed by the group. The ‘flat’ two dimensional figure of the building is similar to the one on paper in front of Heidi and Sine, which could indicate that Ina is coupling the two different forms of the models.

The intercorporeal understanding between the students furthermore become visible as the other group members build on Ina’s insistence on keeping the triangular shape of the building. First Sven, points to the drawing in front of Heidi saying “it could be like a raised platform over there” (line 6, P. 7), which is



establishing a connection between the styrofoam model in Ina's hands and the drawing on the paper in front of Heidi. Then Ina adds the idea of something green, saying "yah it could be something wild growing in there" in overlap with Sven saying "it (.) there could also be something wild was growing". Sven is further embodying the idea of a tree by moving his hands up into the air showing the shape of a tree (P. 8-12). Ina replicates a similar movement raising both her hands in the air looking in the direction of Sven (P. 10). The concrete manifestation of the tree shows that their understanding is "based on embodied intersubjectivity" (Fuchs, 2017, p. 17). Heidi accepts their suggestion saying "but that you could also do", but then Ina makes the suggestion more concrete saying "or a tree", which is followed by Heidi saying "yes that that could damn well be a tree". Sine then says "you just need to say green to Heidi" indicating that Heidi is favoring green/wild elements in their design. In response to this Heidi, Sine and Sven starts laughing.

Then, in the final part of the sequence after Heidi, Sine and Sven laughed (line 13), Mette builds on the interactional work by Ina, Heidi and Sven by referring to a previous drawing (made by Sine) hanging on the notice board opposite to where the group is located. Mette says "it was actually (.) it is the one you have there with Sines idea (.) that one with just like a round one" pointing to the area of the notice board (P. 13) (later – not part of this sequence – Ina is including Sine's drawing again, but she walks to the noticeboard and points to the drawing to integrate it into their discussion). Thus, the collective spatio-temporal history of the group is made present and relevant for their current work on the functionality of the triangular tip of the building. The original idea drawn by Sine is a cylinder shape going through the floors of a building (P. 13), which is now transformed into an idea illustrating a possible functionality of the triangular tip. Mette elaborates "so if you just have that as a square (.) square triangle (.) it could very well be good" while she is making imaginary cuts and environmentally coupled gestures (Goodwin, 2007) on the styrofoam model with her left hand. The cuts are detailing the triangular tip on the styrofoam model and the gestures are showing the idea of adding something green going through the floors of the building. These imaginary cuts and gestures are repeated twice through P. 18-22 as a way of communicating and illustrating the connection between the drawing on the notice board and the idea of adding something green (a tree) in the triangular tip.

Throughout the 33 seconds of interaction the 4Es are in play in several ways: the group is building on the immediate presence of each other's bodies (Embodied) and the history Embedded in the material surroundings (Extended and Enactive). In addition, it is visible that the students repeat their movements as a way of arguing, problem solving and designing together. They display what could be referred to as an intercorporeal form of knowing (Hindmarsh & Pilnick, 2007). As noted by Jornet and Steier (2015) such bodily engagements constitute the 'infrastructure' supporting collaborative activities over time. Thereby, talk, bodies and material surrounding mutually provide the ground for their collective designing and thinking – from the initial idea of something green to something wild and then finally a tree. Further, it is also evident that the students refer to and make use of an ecology of technologies – the infrastructure supporting their collaborative activity is manifest in many different mediational resources.

## Discussion

In the following sections, we broaden the analytical focus by discussing three themes, which could have an impact on the CSCL research agenda: Ecologies of technologies, Historical development of the bodily-material resources and Subtle manifestations of intercorporeal understandings.

### Ecologies of technologies

As argued by Suthers (2006) CSCL is a field consisting of a learning element and a technology element. Based in our analysis, it seems that CSCL should not only be concerned with digital technologies in collaborative learning. In the sequence, the students are using many different technologies and materials to support their collaborative activities. In line with the 4E agenda, it seems relevant that CSCL studies in "natural settings" (Stahl et al., 2006) should open and widen the analytical focus to more than just one computer application. This include studying and designing technologies embedded in a particular environment, but also to accept that supporting collaborative learning is complex in nature, i.e. the computer application is not the only variable influencing the processes of collaborative learning.

### Historical development of the bodily-material resources

A crucial moment in the students' collaborative activity is happening when Mette is referring to and including a drawing made by Sine previously. To paraphrase Goodwin (2017) they are making use of materials made available from the predecessors by re-instantiating the drawing in their current activity. This is in line with Meyer et al. (2017a, p. xvii) arguing to incorporate the "sedimented traces of such presences and movements in the architectures and the artifacts around my body" in analyzing intercorporeality. In these face-to-face settings

it seems highly relevant to study more than the “*meaning (...) created across the utterances of different people*”. (Stahl, 2006, p. 6 italics in original). Following the line of work informed by embodied interaction analysis (Streeck et al., 2011) and intercorporeality (Meyer et al., 2017a), we find it necessary to incorporate a more historical and developmental view of the bodily-material resources that collaborators integrate and build upon in their collaborative activities. In the sequence with the architecture and design students, we find that students are making certain bodily-material resources relevant in their interaction for supporting their collaborative work, e.g. Ina’s repeated touch of the triangular tip, Ina and Sven embodying the shape of a tree and Mette’s reference to the spatio-temporal resources in the studio. This indicates intercorporeal understanding and memory in the collaborative activities.

## Subtle manifestations of intercorporeal understandings

The subtle manipulation of the styrofoam model indicates an intercorporeal understanding among the students and it seems the imaginary cuts and gestures are arguments in their own right in this collaborative activity. While, the video is allowing access to the subtle bodily manifestations of intercorporeal understanding, we are still limited in our way of representing these details in a paper format. As argued by Flood et al. (2015) there is a need for CSCL to develop ways of “representing and cataloguing choreographies of embodied interaction” (2015, p. 96). In most CSCL studies the product of representation is manifested in a transcript (sometimes including frame grabs from the videos). In this paper, we also rely on a transformation from video to text, which is hardly showing the repeating gestures and touches on the styrofoam model. Thus, CSCL need to further develop ways of making the subtle manifestations of intercorporeal understandings visible to better understand the nature of collaborative learning and to design better environments for CSCL in the future.

## Conclusion

With this paper we seek to broaden the methodological and theoretical cartography of CSCL by introducing the concept of intercorporeality in collaborative learning. With intercorporeality we explore the relations between the Embodied, Enactive, Extended, and Embedded aspects of CSCL. Further, we are able to zoom in on the relations of bodies and how they affect each other – studying their ‘inter-kinesthetic fields’ (Behnke, 2008) in relation to collaborative activities. In the analysis, we have shown that the students in preparing for a collective presentation of design concepts are embodied and embedded in their local environment using materials to foster intercorporeal understandings. Furthermore, that the students are making sense through talk, bodies and the material surroundings which show signs of their intercorporeal understanding. Most importantly, we made visible that the students understand each other through their gestures and touches on the shared material (e.g. the styrofoam model). They are able to collaborate and problem solve even when they are lacking words for expressing their ideas. This aligns with the findings from Hahn and Jordan (2017), who suggested that objects could foster and extend bodily meaning-making processes.

Historically, CSCL has been concerned with “meaning and the practices of meaning making in the context of joint activity” (Koschmann, 2002, p. 20) manifested in primarily language. In the future, CSCL could be oriented towards unpacking the intercorporeal dimensions of collaboration, meaning-making and problem solving. We believe that this paper is a modest contribution in expanding the theoretical, methodological and analytical unit of CSCL to include and emphasize how collaborators make sense and solve problems in an intercorporeal modus. In future studies, it would be of great interest to revisit some of the established theories in CSCL (e.g. Group Cognition (Stahl, 2006) and Knowledge Building (Scardamalia & Bereiter, 1994) through the lens offered by intercorporeality.

## References

- Alkemeyer, T., Brümmer, K., & Pille, T. (2017). Intercorporeality at the motor block - On the importance of a practical sense for social cooperation and coordination. In C. Meyer, J. Streeck, & J. S. Jordan (Eds.), *Intercorporeality: emerging socialities in interaction* (pp. 203–235). New York, NY: Oxford University Press.
- Davidson, J., & Ryberg, T. (2017). “This is the size of one meter”: Children’s bodily-material collaboration. *International Journal of Computer-Supported Collaborative Learning*, 12(1), 65–90.
- Behnke, E. A. (2008). Interkinaesthetic Affectivity: A Phenomenological Approach. *Continental Philosophy Review*, 41(2), 143–161.
- Du, X., Emmersen, J., Toft, E., & Sun, B. (2013). PBL and critical thinking disposition in Chinese medical students – A randomized cross-sectional study. *Journal of Problem Based Learning in Higher Education*, 1(1), 72–83. <https://doi.org/10.5278/ojs.jpblhe.v1i1.275>

- Flood, V. J., Neff, M., & Abrahamson, D. (2015). Boundary Interactions: Resolving Interdisciplinary Collaboration Challenges Using Digitized Embodied Performances. In O. Lindwall, P. Häkkinen, T. Koschmann, P. Tchounikine, & S. Ludvigsen (Eds.), *Exploring the Material Conditions of Learning: Opportunities and Challenges for CSCL* (Vol. Vol 1, pp. 94–100). Gothenburg: The international Society of the Learning Sciences.
- Fuchs, T. (2017). Intercorporeality and interaffectivity. In C. Meyer, J. Streeck, & J. S. Jordan (Eds.), *Intercorporeality: emerging socialities in interaction* (pp. 3–23). New York, NY: Oxford University Press.
- Goodwin, C. (2007). Environmentally coupled gestures. In D. McNeill, S. D. Duncan, J. Cassell, & E. T. Levy (Eds.), *Gesture and the dynamic dimension of language: essays in honor of David McNeill* (pp. 195–212). Amsterdam ; Philadelphia: J. Benjamins Pub. Co.
- Goodwin, C. (2017). *Co-operative action*. Cambridge University Press.
- Guerra, A. (2017). Engineering grand challenges and the attributes of the global engineer. *Proceedings of the 45th Sefi Annual Conference 2017*, 1222–1235.
- Hahn, T., & Jordan, J. S. (2017). Sensible objects: Intercorporeality and enactive knowing through things. In C. Meyer, J. Streeck, & J. S. Jordan (Eds.), *Intercorporeality: emerging socialities in interaction* (pp. 267–287). New York, NY: Oxford University Press.
- Higgins, S., Mercier, E., Burd, E., & Hatch, A. (2011). Multi-touch tables and the relationship with collaborative classroom pedagogies: A synthetic review. *International Journal of Computer-Supported Collaborative Learning*, 6(4), 515–538. <https://doi.org/10.1007/s11412-011-9131-y>
- Hindmarsh, J., & Pilnick, A. (2007). Knowing Bodies at Work: Embodiment and Ephemeral Teamwork in Anaesthesia. *Organization Studies*, 28(9), 1395–1416. <https://doi.org/10.1177/0170840607068258>
- Jefferson, G. (2004). Glossary of transcript symbols with an introduction. In G. H. Lerner (Ed.), *Conversation Analysis: Studies from the first generation* (Vol. 125, pp. 13–34). Amsterdam ; Philadelphia: John Benjamins Publishing Company.
- Jornet, A., & Steier, R. (2015). The Matter of Space: Bodily Performances and the Emergence of Boundary Objects During Multidisciplinary Design Meetings. *Mind, Culture, and Activity*, 22(2), 129–151.
- Koschmann, T. (2002). Dewey's contribution to the foundations of CSCL research. In *Proceedings of the Conference on Computer Support for Collaborative Learning: Foundations for a CSCL Community* (pp. 17–22). International Society of the Learning Sciences.
- Lymer, G. (2009). Demonstrating Professional Vision: The Work of Critique in Architectural Education. *Mind, Culture, and Activity*, 16(2), 145–171. <https://doi.org/10.1080/10749030802590580>
- Lymer, G., Ivarsson, J., & Lindwall, O. (2009). Contrasting the use of tools for presentation and critique: Some cases from architectural education. *International Journal of Computer-Supported Collaborative Learning*, 4(4), 423–444. <https://doi.org/10.1007/s11412-009-9073-9>
- Meyer, C., Streeck, J., & Jordan, J. S. (Eds.). (2017a). *Intercorporeality: emerging socialities in interaction*. New York, NY: Oxford University Press.
- Meyer, C., Streeck, J., & Jordan, J. S. (2017b). Introduction. In C. Meyer, J. Streeck, & J. S. Jordan (Eds.), *Intercorporeality: emerging socialities in interaction* (pp. xv–xlix). New York, NY: Oxford University Press.
- Scardamalia, M., & Bereiter, C. (1994). Computer Support for Knowledge-Building Communities. *Journal of the Learning Sciences*, 3(3), 265–283. [https://doi.org/10.1207/s15327809jls0303\\_3](https://doi.org/10.1207/s15327809jls0303_3)
- Stahl, G. (2006). *Group cognition computer support for building collaborative knowledge*. Cambridge, Mass.: MIT Press.
- Stahl, G., Koschmann, T., & Suthers, D. (2006). CSCL: An Historical Perspective Computer-supported collaborative learning. In R. K. Sawyer (Ed.), *Cambridge handbook of the learning sciences* (pp. 409–426). Cambridge handbook of the learning sciences. Cambridge, UK: Cambridge University Press.
- Streeck, J., Goodwin, C., & LeBaron, C. (2011). Embodied interaction in the material world: An introduction. In J. Streeck, C. Goodwin, & C. D. LeBaron (Eds.), *Embodied interaction : language and body in the material world* (pp. 1–26). New York: Cambridge University Press.
- Suthers, D. D. (2006). Technology affordances for intersubjective meaning making: A research agenda for CSCL. *International Journal of Computer-Supported Collaborative Learning*, 1(3), 315–337.
- Teasley, S. D., & Roschelle, J. (1993). Constructing a Joint Problem Space: The Computer as a Tool for Sharing Knowledge. In C. O'Malley (Ed.), *Computer-supported collaborative learning* (pp. 229–258). Springer New York.
- Wise, A. F., & Schwarz, B. B. (2017). Visions of CSCL: eight provocations for the future of the field. *International Journal of Computer-Supported Collaborative Learning*, 12(4), 423–467.