Agreeing is not enough
The constructive role of miscommunication

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Collaborative interaction pervades many everyday practices: work meetings, innovation and product design, education and arts. Previous studies have pointed to the central role of acknowledgement and acceptance for the success of joint action, by creating affiliation and signaling understanding. We argue that various forms of explicit miscommunication are just as critical to challenge, negotiate and integrate individual contributions in collaborative creative activities. Through qualitative microanalysis of spontaneous coordination in collective creative LEGO constructions, we individuate three interactional styles: inclusive, characterized by acknowledgment and praise; instructional, characterized by self-repair; and integrative, characterized by widespread self- and other-repair. We then investigate how different interaction styles leave distinct material traces in the resulting LEGO models. The inclusive interaction style generally results in concatenations of individual contributions with little coherence and core narrative. The instructional style produces coherent, but largely individually driven models. Finally, the integrative style generates more innovative models, synthesizing individual contributions in shared narratives or schemas.

Keywords: distributed Cognition; miscommunication; collaboration; creativity

1. Introduction

Many organizations, corporations and professions rely on the abilities of groups to collaborate on creative problem solving and these activities are regarded as central and valuable in the construction or design of new concepts, processes and products (Hargadon & Bechky, 2006; Nijstad & De Dreu, 2002; Sutton & Hargadon, 1996). However such activities can have a wide variety of outcomes. Sometimes
endless brainstorming results in a whiteboard full of scattered and incoherent ideas. At other times, a clear well-organized project is developed, but it ultimately stems from one authoritative participant only, thus begging the question as to whether the collaborative process has been useful altogether. Lastly – perhaps more rarely? – collaboration brings about new products that are the inventive synthesis of several individual contributions and thus come closer to realizing the full potential of collective creative processes. A central question thus concerns the conditions under which groups are able to realize the full synergetic potential of collective creativity and find solutions that exceed the sum of individual contributions (Hargadon & Bechky, 2006; Kurtzberg & Amabile, 2001).

Recently, a lot of research has been focused on the productivity of group creativity and brainstorms. Some studies suggest that there are no actual benefits of social interaction and that post hoc pooled lists of ideas from individuals are equally productive (Diehl & Stroebe, 1991; Pauhus, Dzindolet, Poletes, & Camacho, 1993; Szary & Dale, 2013). However, these and other studies point to the fact that the generation of ideas is only one aspect of group collaboration: high productivity in creative brainstorming activities is not always sufficient (Rietzschel, Nijstad, & Stroebe, 2006) and the selection, development and realization of ideas is just as important (Nijstad & De Dreu, 2002; Tylén et al., 2015).

In this study we investigate different types of interactional dynamics and how they shape the resulting outcome of collective creative processes. In particular, we focus on different kinds of feedback ranging from praise and acknowledgement to indices of miscommunication such as disagreements, misunderstandings and clarifications and how these leave behind distinct material traces in the products resulting from interactions.

2. Mechanisms for coordination in collaboration

Collaborative interactions are complex activities often intertwining many parallel social games. Interacting individuals have to adapt to each other and to the task at hand: taking turns in speaking and acting, converging on key terms, routines and procedures, as well as developing and consolidating a common ground (Clark, 1996; Clark & Brennan, 1991; Clark & Schaefer, 1989; Dale, Fusaroli, Duran, & Richardson, 2013; Fusaroli, Konvalinka, & Wallot, 2014; Fusaroli, Raczaszek-Leonardi, & Tylén, 2014; Hutchins, 2010; Mills, 2014). Furthermore, apart from solving the joint task or problem, interacting individuals also work to maintain face and consolidate social relations (Brown & Levinson, 1987; Goffman, 1967; Marsh, Richardson, & Schmidt, 2009). Several coordinative mechanisms involved in managing this complexity of interaction have been suggested: many
tend to emphasize affiliative processes, such as interactive alignment and positive feedback, while fewer have pointed to the constructive role of critical questions, explicitly addressing misunderstanding and disagreement.

It seems intuitive that a good collaboration strategy is to positively reinforce each other in interaction. Positive feedback, such as supporting comments, nodding and agreement, has been shown to play a central role. Diverse varieties of “yes”, “m-hm” and “ok” are used to coordinate and navigate joint activities (Bangerter & Clark, 2003; Clark & Wilkes-Gibbs, 1986), and similar forms of acknowledgement, affiliation and praise have been suggested to be essential in maintaining social relations (Brown & Levinson, 1987; Clark, 1996).

While it has been extensively argued that behavioral attunement and positive feedback facilitate successful collaborative problem solving (Bangerter & Clark, 2003; Roschelle & Teasley, 1995; Saget & Guyomard, 2006), the role of negative feedback and other forms of explicit miscommunication has received less attention. Standard views in the literature tend to regard requests for clarification or other types of negotiation of each other’s utterances as indicative of “trouble”, that is, breakdown of automatic attunement and coordination mechanisms (Garrod & Pickering, 2004; Pickering & Garrod, 2004). However, despite the potentially disruptive role of such miscommunication, its absence leaves the interaction vulnerable to unaddressed misunderstandings and unexplored alternative perspectives. Miscommunication might thus play a fundamental and constructive role in the joint exploration and development of ideas.

### 2.1 Common ground, miscommunication and repair in social interactions

Conversation is a collaborative effort and requires participants to coordinate their contributions in complementary patterns fulfilling different roles. When interacting with one another, interlocutors routinely work to establish common ground: shared knowledge, beliefs and plans for the activity (Clark & Brennan, 1991). Central to the establishment of common ground is detecting and correcting misunderstandings and disagreements between interlocutors, through mechanisms of repair (Cahn & Brennan, 1999; Clark, 1996; Clark & Schaefer, 1989).

The term ‘repair’ was first introduced in Conversation Analysis (CA) to refer to the variety of interactional devices that people use to resolve misunderstandings in conversation (Sacks, Schegloff, & Jefferson, 1974; Schegloff, 1987; Schegloff, Jefferson, & Sacks, 1977). Schegloff, Jefferson & Sacks (1977) defined central turn-taking principles of corrections of speech in dialogue, assigning a special role to (1) the initiation of repair: repair can be both self-initiated and other-initiated; (2) the completion of repair: repair can be both self- and other-completed; and (3) the position of repair in turn-taking: Repair is most often initiated and completed
within three turns. Another consistent observation is the preference for self-repair in conversation, that is, speakers prefer to repair their previous turn themselves before others do. Conversely, people generally avoid other-initiation of repair in order to ‘save face’ (Brown & Levinson, 1978).

Subsequently, the concept of repair has been adopted by a range of other disciplines outside CA such as experimental psychology and computational linguistics in investigations of how we establish common ground in interaction (Brennan, 2000; Cahn & Brennan, 1999; Clark, 1996; Clark & Schaefer, 1989; Mills & Healey, 2008; Themistocleous et al., 2009; Traum, 1999). In the present paper we build on this latter line of work, analyzing how different forms of repair are used in creative interactions to clarify misunderstandings and disagreements, and explore ideas.

2.2 Material traces of interaction dynamics

While one question concerns qualities of coordination and interactional dynamics in collective creative activities, another concerns the resulting products. Research in distributed cognition has studied collective activities in a range of contexts from the interpretation of brain scans (Alac & Hutchins, 2004) to courtroom practices (Goodwin, 1994) in order to investigate how individuals become intertwined in socially distributed reasoning processes (Bjørndahl, Fusaroli, Østergaard, & Tylén, 2014; Fusaroli et al., 2012; Fusaroli, Gangopadhyay, & Tylén, 2014). Also the role of material objects in social practices have been extensively studied with special attention to how material objects organize, structure and otherwise facilitate distributed cognitive processes (Alac & Hutchins, 2004; Goodwin, 1994; Hutchins, 1995a, 1995b). However, less attention has been directed to the way that distributed cognitive processes are reflected in outcome products of social interactions.

This aspect is not a trivial one, as it relates to aspects of conceptual ownership, that is, the cognitive origins of creative content such as ideas, concepts, and their manifestations in drawings, written materials and the like. In creative collaborations, the orchestration, negotiation and organization of individual ideas and contributions, are crucial in shaping the final product. In the following analysis we will thus track how multiple individual contributions (e.g. in contrast to a single, leading idea) are collectively developed and ultimately reflected in the final models. This gives us an index of the distribution of cognitive labor in a group and thus the distribution of conceptual ownership of the resulting model (Tylén & McGraw, 2014): who and how many contributed to the conceptual layout of the collaborative product and how is the distribution of participant’s conceptual contributions reflected in the final product?
Products of socially distributed creative processes further raise the problem of coherence. When several people work together in a creative process, their individual contributions might come to constitute a single coherent whole (as opposed to a collection of unrelated or scattered parts). The coherence of the outcome product provides thus a measure of how well a group manages to integrate and synthesize their individual contributions. In the following analysis, we will trace the distributed cognitive processes of groups in the products they make in order to establish how the outcomes of creative collaborations are shaped by particular interactional dynamics.

3. Building ideas together – materials and methods

In order to investigate relations between interaction dynamics and creative product outcomes, we analyzed video footage from an experimental setting, where participants jointly constructed LEGO models. The experimental elicitation of group activities has the advantage of combining unconstrained, spontaneous interactions with an element of experimental control, which makes contrastive, between-group analyses possible. The participants were all recruited among students of Aarhus University and did not know each other in advance. They were organized in mixed-gender groups of four to six.

Inspired by the workshop method LEGO Serious Play (Gauntlett, 2007), the task was to build models illustrating abstract concepts such as “Justice”, “Knowledge”, and “Collaboration”. On the one hand the task was open with no fixed solutions, but at the same time challenging since abstract concepts can be hard to define and instantiate. The groups were instructed to complete their models within 5 minutes, during which they could freely interact and use the LEGO blocks in any way they liked.

Approximately 20 hours of video footage was recorded from the six groups solving the LEGO construction tasks during the experiment. An initial screening of the corpus indicated broad trends in interaction dynamics differing between groups and tasks. These observations motivated the selection of a limited number of cases for qualitative microanalysis. The three cases presented in the following sections are representative of three recurring styles of interaction resulting in quite different outcomes. The cases all pertain to group interactions around the same task, the concept of “collaboration”, occurring at the same point in the study for all three groups. This allows us to compare systematic differences in interaction dynamics and resulting objects that are not trivially reducible to differences in context.

We conceive of interaction styles as locally established norms and procedures for how to interact. Any case of joint action presents participants with coordination
challenges: How should you deal with your co-participants? Who should contribute when, how and for how long? Such coordination problems are normally met with the rapid and implicit establishment of local and transient procedural conventions (Fusaroli, Raczaszek-Leonardi, et al., 2014; Mills, 2011, 2014). In the following, we focus especially on how members of different groups receive and react to each other’s ideas, comments and suggestions. Three general styles of interaction, inclusive, instructional and integrative, were identified that characterise the majority of the cases in the corpus. In the following, we analyse cases representing each of the styles and trace the distributed cognitive process in the resulting models in order to evaluate qualities of conceptual ownership and coherence of their resulting LEGO models.

In the transcripts, we will use the following conventions for annotation: Overlapping speech and gestures are in square brackets and aligned underneath each other. Descriptions of gestures are in italics. Pauses are indicated in regular brackets in milliseconds e.g. (1.5 sec) and very brief pauses by a full stop (.). Equal signs attached at the end of one turn and at the beginning of another indicate rapidly succeeding speech. Arrow up marks rising intonation and arrow down marks falling or rise-fall intonation. Underlining marks emphasized pronunciation of syllables or words.

3.1 The inclusive style of interaction

A common way of managing collaborative interactions is to focus on creating and maintaining affiliation for instance by adapting to one’s interlocutors’ ideas and behaviors, acknowledging and encouraging them through positive feedback. We identify an inclusive style of collaboration in those interactions where – in contrast to other group collaborations – the prevalent tendency is towards affiliation and acknowledgement: Ideas or proposals are generally met with acknowledgements and praise, social relations are prioritized, and, generally, everyone is included in the activity, proposing and carrying out projects to complete the task. The inclusive style is generally characterized by collaborative resistance to self- and other-initiation of repair. Interlocutors rarely engage in elaboration or clarification activities to explore, discuss or reject ideas and proposals.

3.1.1 Acknowledgement and praise

The inclusive style involves a predominance of positive feedback in the form of acknowledgment and praise. An illustrative example of this type of collective behavior is found in a sequence from the very beginning of a group session showing the presentation of and response to a joint project proposal (see Figure 1).
Participant S3 advances a proposal, immediately followed by S2 and S5’s acknowledgment, S1’s initiation of the building process and S4’s suggestion on how to implement it. The timing of acknowledgements as well as the immediate signaling of collective acceptance is not trivial. The utterance – “I’m thinking something with some bridges” (l. 1) – contains two unspecified elements “something”, that leaves the specifics of ‘what’ open, and “some”, which leaves open ‘how many’. Contrasted to other styles of interaction (see later examples), such unspecified elements often require or invite repair, at least in some form of elaboration. Preparing to initiate self-repair is generally indicated by hesitations or pauses within turn, however, no such indications are present here. S3 treats her own proposal as a fully formed and completed joint project proposal. Likewise, her interlocutors could have withheld their feedback to invite self-initiation of repair, or alternatively, could have initiated repair. Instead we see immediate acknowledgements and acceptance, which collaboratively construct the statement as a fully formed proposal, clear and agreeable enough to start the building activity. Indeed, S1 initiates the construction in line 4 and S4 follows up in line 5. Another example of this kind of promptly delivered acknowledgement and acceptance, which in turn does not leave much room for elaborations or repair can be observed in the following excerpt (see Figure 2).

Here, S5 advances a new joint project proposal. Again we observe an unspecified element “something” (l. 1), which in other cases of our data is most often followed up by further discussions or elaborations. However, in this case it is met with an immediately timed sequence of praise and acknowledgements, including
one from S5 himself (l. 6). Despite the fact that the idea put forth in this excerpt (“something that turns that the man is standing on top of”) is conceptually unrelated to the initial idea (“something with some bridges”, Figure 1), attempts at elaborating through self-repair as well as other-initiated requests for clarification or elaboration are absent. Instead the idea is simply met with praise and acknowledgement. Despite the overwhelmingly positive reception, the idea, however, does not make it onto the final model (see Figure 4). These observations could suggest that the participants are more concerned about maintaining positive face and social relations than conceptual coherence of the task solution central to the collaborative activity.

### 3.1.2 Resistance to other-repair

In the inclusive interaction style, participants are not only refraining from repair in terms of self-initiated elaborations and clarifications of ideas and proposals. Attempts at other-repair are even more effectively resisted. Consider the following excerpt (see Figure 3).

The example shows a collective effort of resistance to both other-initiation and other-completion of repair. Prior to this excerpt, S1 has suggested a new joint project; that they build “someone rope pulling” (at time 01:04), which is accepted. In line 1, S4 initiates a suggestion to expand on this. This other-initiation of repair is formulated in a way that invites participation in the elaboration of S1’s proposal, and furthermore, is delivered with emphatic “searching” postures (l. 2) and marked intonation (l. 1) attempting to engage the others. However, it is met with no response or partaking, rather, the other participants show disengagement by diverting eye-gaze and quietly talking about something else (l. 3). After S2 makes
an attempt at raising another point in the joint activity (l. 3), S4 reengages in his own request using enthusiastic and loud tones (l. 4 and 7), thus attempting to complete his previous repair activity by answering his own questions. Still, he is ignored (l. 4 – 9). S5 displays further evidence of disengagement by posing a question to S1 that, similar to S2’s unfinished comment in line 3, bears no evidence of having even heard S4’s repair attempts (l. 8). Ignoring directly posed questions put forth with emphatic loud speech and gestures by a participant are effortful actions in conversation and may potentially produce social tension. However here there is no effort to release such tensions. The situation is not resolved, but rather ignored until the topic changes. This is striking compared to other interactions in the corpus, where disfavored proposals are more often met with engagement and critical questions (for example see Figure 11). What seems to be a profound resistance to this type of other-initiated repair sequences overrides more general interactional norms, such as answering direct questions and actively attending to other people as they speak.
3.1.3 Marking and maintaining multiple individual conceptual ownerships

In both excerpts from Figure 1 and 2, ideas are presented using the first-person singular pronoun “I”. This formulation marks the individual’s conceptual ownership of the proposal (in contrast to formulations with the first person plural “we”; see later sections). In these cases the “owner” is often responsible for maintaining the proposed joint project for instance by instructing the others how to realize it, and accepting contributions from them. This lasts until a new proposal is advanced, thus generating shifting individual conceptual ownership as participants take turns to propose and be in charge of a joint project. Thus, the group never seems to reach a single conceptually shared group activity or outcome. Rather, this inclusive type of session consists of several unrelated ideas each with their individual conceptual ownership and little coherence between them. Also, the immediately timed acknowledging behaviors combined with absence of elaborations and clarifications observed in these examples seem to relate to this point: when a proposal is advanced in a way that suggests individual conceptual ownership, the proposer is simultaneously staged in a sensitive spot in risk of losing face. As people generally avoid other-initiation of repair in order to save face (Brown & Levinson, 1978) pressure is put on the group to acknowledge and praise proposals in order to maintain social relations.

3.1.4 Material traces of the inclusive interaction style

The interaction style observed in the examples above is characterized by individual proposals received with immediate acknowledgement and praise by fellow interlocutors. This creates an overtly inclusive interactional dynamics that show cooperative resistance to both self- and other-completion of repair. When repair occurs, it is kept short and quickly abandoned in favor of acknowledgement and praise (Figure 2). Below is an annotated presentation of the model made in the inclusive case.

The model consists of four different parts, “something with some bridges” (contributed by S3), “someone rope pulling” (S1) and “pulling a car” (S4), and “collaboration via (...) external satellites” (S5). Thus, the group outcome is best characterized as a concatenation of individual and largely unrelated ideas. The contributions are somewhat spatially separated and not conceptually bound together in a coherent narrative or structure, and thus bear little trace of actual collaborative interaction. Also, note that the individual contributions are not very rich, as they were never elaborated beyond their initial suggestions.

The model produced in this session features a concatenation of individual ideas, with little or no integration between them, thus not reflecting a central, collective idea or shared conceptual ownership. Rather, it displays a carefully divided ownership, where each participant contributes an individual part of the product outcome.
The instructional style of interaction

A second and quite different style of interaction is also richly represented in the corpus. Rather than several participants taking turns in proposing ideas to the group, the group settles on a single joint project with a primary epistemic authority, a kind of instructor, guiding the collective construction activity. We term this the instructional style. Like the inclusive style, the instructional style also involves extensive use of positive feedback, in the form of acknowledgement and praise. However, we also encounter a distinct tendency of the instructor to engage in elaborate self-repair with the effect that the primary conceptual ownership is continually maintained, and little room is left for other participants’ conceptual contributions. Consequently, the conceptual part of the task is maintained by a single participant instructing the others while they mainly partake in the instrumental activity of building the LEGO model.

3.2.1 Initiating and maintaining a joint project with elaborate self-repair

An example from a case showing the instructional style of interaction can be found in Figure 5 below.

S1 advances a joint project proposal and, contrary to the examples of inclusive style, immediately engages in elaborations and specification of the idea, notwithstanding early acknowledgments and acceptance from the other participants. S3 even interrupts S1 with acknowledgements, suggesting the initiation of the building phase (l. 11). While such early acknowledgements were frequent also in the inclusive style sessions, S1’s reactions are very different. S1 does not stop elaborating her idea to move on to the building phase, but rather employs extensive...
3.2.2 The power of gesture and resistance of other-repair

In the excerpt in Figure 5, S1 introduces an idea: building “something kinda like an assembly line”. The verbal proposal is accompanied by a series of rolling gestures and points connected by circles drawn in the air (l. 4–5). These co-speech gestures both reinforce and specify the verbal content “assembly line”, adding a circular dimension to the notion of the presented idea. But they also play a coordinative function in the interaction. The gestures both accompany speech and mark the beginning of further elaborations, with the effect of holding on to or regaining the turn (as seen in Figure 5, l. 1–3, and l. 13–14). Likewise, in the following
example (see Figure 6), gesture can be seen to carry a role in getting back the turn, in this case to resist other-completion of repair and, subsequently, resist another participant’s contribution to the joint project.

Two aspects of this sequence are especially noteworthy. First of all, the example shows how S1 is resisting the other-initiation and especially other-completion of repair with self-repair. S5 takes up and names the circular form attributed to the “assembly line” proposal that was present in S1’s gestures, and provides a new term “a ring” to the idea. However, while S1’s acknowledges S5’s contribution (lines 3, 8, and 12), she also repeatedly works to regain the turn and complete the repair herself (l. 7, 9, and 13–16). Second, S1’s repair does not integrate the “ring” modulation introduced by S5. On the contrary, S1 consolidates her own formulation,
repeating her previous gestures more articulated and emphatically, thus reformulating and taking ownership over S5’s contribution. In other words, even though S5 to some extent manages to contribute to the project, S1 reinforces her authority and conceptual ownership.

3.2.3 Maintaining an individual conceptual ownership of a proposal
In the examples in Figures 5 and 6, S1 continually takes back the turn and re-engages in self-repair, showing resistance to accommodate contributions from other participants. Thereby she reinforces her own role as the one in charge of the project and maintains her individual conceptual ownership of the conceptual content. As a consequence, S1 speaks more than any other participant, and gestures more both during own and others’ turns. Crucially, she continually takes over the turn and markedly completes the different conversational projects in order to sanction other participants’ contributions by reinterpreting or reducing them to her own suggested framing (for similar observations, cf. Bottger, 1984; Curhan & Pentland, 2007; Kim, Chang, Holland, & Pentland, 2008).

Maintaining an individual conceptual ownership throughout a collective project can create social tension expressed in signals of disengagement, such as interlocutors looking down and away from the interaction, avoiding speaker’s face and gesturing hands. Examples are presented in both Figure 5 and 6, for instance in S2 and S3’s downward gaze. The following excerpt (see Figure 7) provides an example of how this tension is managed and diffused using praise to reengage participants in the individually maintained joint project.

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In the example, S1 attempts to accommodate the social tension by providing praise of S3’s contribution to the model, while intently looking at him, smiling and pointing (l. 4–5). The sequence ends in further small laughs and smiles (l. 6–7), signals of positive social attunement. Acknowledgment and praise from the instructing participant seem to have the function of (re)engaging other participants to contribute to the project especially in sessions where a single person is maintaining the conceptual ownership. The role of other participants becomes to propose and build elaborations complying with – rather than challenging – the overall conceptual layout.

3.2.4 Material traces of the instructional style

The instructional style of interaction exemplified in the excerpts from Figures 5, 6 and 7 is characterized by a single group member maintaining the conceptual ownership over a project proposal throughout the session, leaving only the instrumental acts of building distributed across participants. This involves extensive self-repair from the one “instructing” participant as well as maintaining resistance to other-completion of repair.

The LEGO model produced in the session visited above is fundamentally different from the “concatenation” model produced in the inclusive session. Contrary to the inclusive session, the outcome of the instructional session is very coherent and structured, with all parts conceptually integrated in a unified whole: the “assembly line” frame, see Figure 8.

Figure 8. Model 2: A coherent exemplification of the target concept

This model displays a single coherent idea, a situated and concrete exemplification of “Collaboration”. The model represents an “assembly line” (S1) where “all the time one is dependent on the one next to [one another]” (S1) and further that the “people collaborate well” (S1) so “the boss” (S3) “becomes rich” (S1).
As shown in Figure 8, the “assembly line” idea, which was introduced in the very initial phase of the interaction by a single person S1, came to guide the remaining collective construction work without much conceptual development. Thus, while all participants engaged more or less equally in the instrumental activity of building the model, the conceptual ownership is maintained by a single individual, S1. Thereby, the group does not seem to realize its full potential for collaborative creative exploration and design of the product.

3.3 The integrative style of interaction

A third style of interaction found in the corpus is characterized by extensive presence of apparent miscommunication such as clarification requests, disagreements, questions and explicit negotiation of ideas and proposals. We call this the integrative style, since sessions of this type typically involve development and integration, rather than simply presentation and concatenation of ideas. Contrary to the preceding examples, the integrative style shows frequent other-repair, carried out in ways that is not giving rise to detectable social tension in the group. These sessions display lower amounts of verbal acknowledgement and praise, more minimal response (“mm” or “m-hm” rather than “yes!”), and high levels of non-verbal, positive feedback for instance in the form of engaged eye-gaze and body-poses.

3.3.1 Distributed proposals of joint projects

Contrasted with the previously described types of sessions, integrative sessions are characterized by very different initiations of joint projects. Rather than starting with an individual advancing a proposal (cf. Figures 1 & 5), integrative sessions start with participants posing direct questions to the group and taking turns in proposing parts of ideas as well as LEGO blocks to be included in the model. Consider the following excerpt (see Figure 9).

Following on S6’s open question “What is collaboration to you?”, S3 suggests “to use both LEGO figures” (people), S5 hands out a shovel that “could be about working”, that S6 elaborates with “doing something together”. In this case, there is no coherent idea presented from the very start: rather, the participants intersubjectively co-construct a frame by contributing partial verbal concepts and LEGO blocks and assigning them meaning and roles in an evolving joint model. A central point is the way partial proposals are delivered. More than once (see l. 6 and 10) proposals are formulated in short phrases with ellipsis, leaving them open for repair and completion by others. This has the effect that no individual hold on to the turn, but leaves the conversational floor open for others to jump in. Also, some acknowledgements are provided (l. 4), but only rather minimal, by one group member, and noticeably not every time a proposal is put forth and not in an overly affiliating
way. This distributed way of collectively initiating the joint project leads to a very different organization of the distributed cognitive labor, where partial proposals made by different participants are continually connected and synthesized.

3.3.2 Distributed epistemic processes and other-repair

When we turn to the question of conceptual ownership, a further difference from the inclusive and instructional sessions can be observed in the use of personal pronouns. Consider the following excerpt (see Figure 10).

As in the previous excerpt (Figure 9) a proposal is put forth marking a shared or group oriented conceptual ownership: S2 uses the first person plural “we” and integrates a new feature, “when you work together then you achieve a higher goal” with the previous suggestions. Her turn constitutes a kind of other-repair: connecting and reframing elements proposed by other participants in Figure 9. However, the proposal remains somewhat vague and the abstract character of “higher goal” invites for further repair. Indeed, the other participants promptly provide elaborations of the model (ll. 8–11). This seems a recurrent feature of the integrative style: proposals are put forth in ways that leave room for others to contribute and complement ideas.
While self-repair is the preferred way of handling unclear information in conversations and other-completion of repair is generally avoided (Schegloff, et al., 1977), in the integrative sessions, participants recurrently elaborate and repair each others proposals and ideas. Using the pronouns “we” and generic “you”, participants are continually promoting shared conceptual ownership of the project. This may be part of the reason why the elaborate other-initiation and completion of repair is easily managed compared to inclusive and the instructional sessions: If ideas are already conceived of as being common property there might be less need for explicit verbal affiliation and praise (as in Figure 2 and 7) and critical comments are not experienced as face-threatening and they are not to the same extent addressing a single conceptually responsible participant.

3.3.3 Constructive consequences of other-initiation and other-completion of repair

Another central characteristic of the integrative style of interaction is the recurrent use of other-initiation of repair, in the form of clarification requests. In the example
below (see Figure 11), S5 puts forth a suggestion that apparently does not make sense in relation to what they had been doing in the session so far evidenced by reactions from the other participants: his suggestion receives both other-initiation of repair (clarification request) and an attempt at other-completion (re-construal of the idea by another participant).

Figure 11. Excerpt 9

Three aspects of this sequence are particularly noteworthy: First, with his question in l. 1, S5 is openly exploring and questioning the overall conceptual framing of the current task. This stands in opposition to the instructional style where only suggestions or elaborations that conformed to the overall conceptual framing were accepted. Second, S5’s proposal is met with a direct clarification request in the form of a wh-question. Posing open-class clarification requests that directly
challenge the content or relevance of the previous turn is in fact a recurring phenomenon in the session, as well as in other sessions displaying the integrative style of interaction. It does not seem to be received as face-threatening and does not create detectable social tension. The direct questions in Figure 11 are met with engaged direct eye-gaze and answers from multiple participants, in contrast to the ill-received question in the inclusive session, which is met with disengaged eye-gaze and no answers (Figure 3). In other words, there seems to be more room in the interaction for negotiating new, opposing or original ideas.

A third phenomenon present in the excerpts from Figure 10 and 11 above and further elaborated in the excerpt from Figure 12 below, concerns “other-completion” of repair. In cases of clarification requests, the participant being questioned – in this case S5 – is regularly expected to respond (with self-repair). However, here both S3 and S6 initiate other-repair in S5’s place. Again, these observations seem related to the special style of integrative social dynamics where conceptual ownership of the model is distributed and shared, and as a consequence repairable utterances are more open to other-repair. Below is an excerpt (see Figure 12) that follows the sequence initiated in the excerpt from Figure 11 and further highlights the constructive character of the integrative style.

In the example above, S3 initiates an elaborate other-completion of repair in response to the discussion of “oppositions” introduced by S5 in the preceding example (excerpt from Figure 11). At a central point, her gestures enact the meaning initiated by the verbal phrase “like this” followed by a pause inviting addressees to attend to her hands: an upward movement indicating the “higher goal” of collaboration. The gesture is subsequently followed by the word “good”. Together, her speech and gesture form a composite metaphor “up is good” (Lakoff & Johnson, 1999). Interestingly, S3’s following gesture is used to invite further exploration of the opposite of collaboration (Figure 12, l. 1–9): While concluding “what happens when you don’t collaborate” (l. 10), she makes a gesture sweeping down, outward, and away from the “higher goal” represented in the model. In their following contributions, the participants S2, S4 and S6 pick up S3’s idea, mutually completing the repair: S3 builds the concrete addition to the LEGO structure, while S4 and S6 each provides parts of the conceptual reinterpretation of the model signifying “individual paths” that lead away from the “higher goal”.

The gestures produced in the mutually completed other-repair in this example thus (1) produce critical content not represented in speech and thereby (2) catalyze thought processes not yet formulated verbally and conceptually. More than a tool for accompanying speech, S3’s gestures express an exploration of not yet fully formed ideas that become open to elaboration and concretization by other participants.
Figure 12. Excerpt 10

Excerpt 10 (02:16 - 02:32)

1 S3 Man ka og så godt vise at [samarbejde]
   Also you can show that collaboration
2 [Brings both hands towards model]
3 ska være sådan [her (1 sec)] [godt (.5 sec)]
   has to be like this good
4 [Does an upward motion with both hands]
5 [Repeats]
6 56 mmm↓
7 55 mm
8 S3 ved at vise [det modsatte o.s]
   by showing the opposite
9 [Does an outward motion away from model]
10 [hvad der sker hvis man ikke samarbejder]
   what happens when you don’t collaborate
11 [Repeats outward motion and then places her hands on the table and looks at S2]
12 S2 [mmn↓(.) [Så ka]]
13 [Points to model]
14 S4 [Ska vi så ikke lave en vej der går]
   Then how about we make a road that leads
15 [Points to model and makes a line away from it]
16 [ikke går op] [men sådan går henad og hvor der er [noget sån-så]
   not upwards but like along that way and where there is something like-like
17 [Traces up the model]
18 [Traces outwards away from the model]
19 S6 [Men ellers så sku det være noget]
   But otherwise it could be some-
20 med så hvis de tager deres individuelle vej så kommer de ikke op
   thing like if they go their individual ways then they won’t get up
21 S4 Ja så kommerde ikke op
   Yeah then they won’t get up
3.3.4 Material traces of the integrative style

In summary, these instances of other-initiation and other-completion of repair is shaping the collaborative activities in a more explorative and cognitively distributed way. Using repair to explore the meaning potentials of preceding formulations and gesture to publicly elaborate abstract metaphorical relationships puts thinking processes out in public space, making it an intersubjective endeavor (Fusaroli, Gangopadhyay, et al., 2014).

The model resulting from this interaction represents a single coherent idea rather than a concatenation of ideas (Figure 13). However, it is almost impossible to relate any part of this model to contributions by any single participant. Rather, the conceptual structure is a synthesis of parts and ideas contributed by several participants, thus reflecting a high degree of integration of contributions in the group. The model is best characterized as emergent syntheses of multiple proposals and ideas developed throughout the construction session.

Furthermore, the model represents “Collaboration” in markedly more abstract and metaphorical terms than the preceding cases. Rather than an instance or example of collaboration, it attempts a conceptual schema of the dynamics and results of collaboration: “When you work together, you achieve a higher goal” and “when you don’t collaborate” “(…) you don’t get up [the ladder]”. In other words, if people collaborate, they can reach a higher goal, than they would on their own.

Figure 13. Model 3: a synthesis of ideas with abstract metaphorical relations

Furthermore, the model represents “Collaboration” in markedly more abstract and metaphorical terms than the preceding cases. Rather than an instance or example of collaboration, it attempts a conceptual schema of the dynamics and results of collaboration: “When you work together, you achieve a higher goal” and “when you don’t collaborate” “(…) you don’t get up [the ladder]”. In other words, if people collaborate, they can reach a higher goal, than they would on their own.
In summary, the model produced in the integrative interactional dynamics shows traces of multiple intertwined conceptual ownerships integrated into a single coherently developed idea. In addition the model represents the target concept in a more abstract and nuanced way, compared to the previous two examples.

4. Discussion

Collaborative creative interactions can lead to very diverse outcomes. Sometimes an “anything-goes” collaborative spirit reins resulting in collections or concatenations of individual contributions with little conceptual coherence. At other times, one person dominates the interaction and controls the discussion. This may yield a coherent result, but it is not always clear whether the collaboration added anything to what the leading individual would have achieved alone. Finally, sometimes groups achieve an outcome that realizes the full potential of collective creativity. We argue that this happens when individual groups members push, poke, elaborate and challenge each other’s ideas to explore to a larger degree the hidden implications and meaning potentials. In these cases, the result is emergent upon the interaction as a whole. It is often not possible to trace back specific parts to any individual group member; rather the result is an integrated and coherent synthesis of all the individual contributions with largely shared conceptual ownership.

In the preceding sections we have investigated the interactional dynamics that are associated with these diverse outcomes. Depending on the specific kind of joint action, local procedural conventions will often evolve from diverse implicit and intertwined agendas. In task-oriented interactions like the ones studied here, the task itself could be imagined to constitute the most important factor regulating group behaviors. Group members are preoccupied with completion of the task and adjust their behaviors to accommodate this end (Fusaroli & Tylén, in press). However, whenever people interact there are also other factors at stake: in order for the joint activity to be enjoyable, interacting participants actively work to maintain affiliation and good social relations in the group. Participants might for instance hold back their critique of a group-mate’s proposal in order to keep a good atmosphere even if the proposal is misplaced. Not least, participants are often concerned about their own individual reputations: how fellow group members perceive them and how their speech and actions are interpreted. All these factors strongly contribute in shaping collective and individual behaviors.

Sometimes the different pressures on group behavior – task constraints, social relations and individual reputations – work in perfect concert: achieving
the right social atmosphere might enhance collective task performance. However, often they are in competition. Strongly prioritizing social relations will take away attention from the task and make us blind to deep mishaps, such as breaks in coherence or even change of interlocutors (Galantucci & Roberts, 2014). In the inclusive case, participants are biased towards acknowledgements, acceptance and praise to maintain a positive vibe in the group, rather than actively and critically discussing each other’s ideas. Similarly, in the instructional case we observe how a participant’s preoccupation with her own reputation can create a strong bias against other-repair. Rather than allowing others to jump in, moderate and take partial ownership of ideas, the participant holds on to the turn (and ownership) by engaging in extensive self-repair.

Interestingly, interactional styles are not stabilized once and for all in any given group. Over the course of experimental sessions, the different agendas pull and push the groups’ behavior in dynamic ways. The interaction styles identified in the analyses above are thus properties of experimental sessions rather than groups: the same group often changes and evolves its dynamics throughout the experiment. In particular, one general trend is observed in the corpus: While early sessions have a slight overrepresentation of the inclusive style, the instructional and integrative styles of interaction are more frequent in later sessions. This could be interpreted as an effect of the evolving social dynamics in the groups. Group members do not know each other in advance, so in the beginning of the experiment they are more concerned about building up affiliation and good social relations. In this sense, an overtly inclusive style of interaction might be indicative of less well-functioning social dynamics requiring the participants to invest more resources in social relations, even at the expense of the task (for a similar perspective, cf. Michael et al., 2015; Reich, Berman, Dale, & Levitt, 2014). However, as the participants grow more confident with each other, repair becomes more acceptable and the task gets more priority.

Both the instructional and the integrative interaction style are associated with resulting models representing a coherent idea or narrative, which can be considered a good solution to the task. However, the resulting models differ on other important parameters. Models produced through the instructional style of interaction often bear close resemblance to a single, central idea presented by the ‘instructor’ in early phases of the session. In the examples visited in Section 3.2, the concept of ‘collaboration’ is instantiated by an assembly line with LEGO characters organized in a circle to signify reciprocal dependency relations (see excerpts from Figures 5 and 6 and the model from Figure 8). Although the model undergoes some elaboration and ornamentation during the collective construction session, it does not come to integrate new elements or perspectives that challenge
or change the overall conceptual schematization. In effect, the model remains a rather concrete and literal exemplification of the target concept. In contrast, the prolonged negotiations and repair sequences characteristic of the integrative style interactions tend to result in models synthesizing multiple ideas and perspectives, which are continuously introduced through the building process. These models are consequently more complex, metaphorical and abstract in their conceptualizations of the target concept. In the case analyzed above, the group represents Collaboration as way of reaching “a higher goal” (Figure 10 and 13) while “individual paths” stay on ground and lead to less desirable places or outcomes.

In several contexts, abstract solutions are considered more advanced and favored over concrete solutions, since they are more economic or effective (Alibali, Spencer, Knox, & Kita, 2011), easier to generalize to new applications (Garrod & Doherty, 1994) and cope better with complex problems (Koedinger, Alibali, & Nathan, 2008). Interestingly, earlier experimental studies have found that when compared to individual performance, collaborative efforts often yield more abstract solutions (Schwartz, 1995). While our findings resonate with these observations, they also point to possible refinements: higher levels of abstraction do not seem to be a predicted effect of collaborative interactions per se. Rather, abstract models are particularly associated with cases of genuinely collaborative and distributed epistemic processes (as in the case of the integrative style of interaction), while other styles of interaction yield less abstract outcomes. In particular, we show how certain modes of apparent miscommunication, in the form of clarification requests, elaboration and repair, seem crucial in establishing productive processes of abstraction. These ideas are supported by recent experimental findings that other-initiated repair (in the form of clarification requests) in early phases of the experiment catalyzes firm grounding of shared reference systems, which enable participants to advance higher levels of abstraction (and thus better solutions to the task) in later phases (Mills, 2014). Similarly, another experiment investigated the role of disfluencies and repair in instructions (Brennan & Schober, 2001). The authors found that repair can have a positive effect on understanding other’s utterances. Together, these findings challenge the simplistic idea that good coordination is only a matter of attuning, acknowledging and providing positive evidence of understanding. They suggest that various forms of apparent miscommunication in terms of corrections, explicit disagreement and clarification requests might be crucial in achieving interactional coordination, as well as establishing common ground and solving joint tasks. This hold for creative collaborations as well: It is not always enough to just “go with the flow” – in order to realize the full potential of collective creativity, we should engage interaction environments that welcome and enact constructive miscommunication.
5. Conclusion

Acknowledgements and other forms of positive feedback have been regarded indicative of well-functioning conversations. Intuitively, conversations displaying little or no explicit miscommunication and disagreement may strike us as “fluent” and “easy” (Garrod & Pickering, 2004). However, as is shown in this study, various forms of explicit miscommunication (especially other-initiation and other-completion of repair) provide essential affordances for distributing cognitive processes, affordances that are not present in collaborative environments dominated by acknowledgement and praise. In the context of collaborative creativity, repair activities thus come to serve the purpose of collective exploration of not-yet-fully-formed ideas: by formulating contributions that invite for other-repair and elaborations, the participants develop thought processes into an intersubjectively distributed activity that eventually leads to a more coherent, complex and abstract outcome.

With this study, we argued the case that repair and other aspects of communication should not be relegated to the periphery of the study of communication. Rather, they seem desirable and constructive aspects of creative collaborative endeavors and necessary components of truly distributed epistemic processes.

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