Innovating Collaboratively and Collectively

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Abstract: This paper explores how innovative ideas may be produced in dialogic interactions. Several dialog processes that may be considered innovating are proposed, along with how they may be coded. Some preliminary evidence will also be presented.

Keywords: Innovating, dialogic interactions, collaborative interactions

Introduction

Innovation is defined by wikipedia as a new way of doing something or creating new ideas or products (en.wikipedia.org/wiki/Innovation). In this paper, we narrow the definition of innovation to doing or creating an "idea" that is novel only to the individuals or to the dyad or group in which the individuals participate, but may not be novel to the curriculum, the community or even a larger context. This can be referred to as a "local" innovation. We define innovation in this local way in order to make the construct of innovation tractable in a research laboratory. We also add the constraint that not only must an innovation be novel, but it also must be useful, in that it solves a problem or serves some desired function. For now, we sidestep a careful definition of what an "idea" is, and only refer to it as a domain-relevant concept that participants in a dyad or a group recognize.

Innovating, or creating a new idea or product, has been touted as powerful in the context of a group, and used in many companies. In particular, there is the belief that there is a construct called "group genius" [6] in that the collective product cannot in theory be created by the sum of all the individuals in the group, and that the processes of creating group innovation may be difficult to reproduce. The goal of this paper is to offer a theoretical conception of how innovations might be produced by dyads or groups, and why innovations may be difficult to reproduce. To simplify our understanding and analyses, we begin by narrowing our discussion to a group size of two or dyads. We will consider the *processes* of innovating as revealed in the dialogic exchanges between collaborative partners, and the *product* of innovating as the idea that is created. Below, three scenarios of interacting dialogs are presented, and for each scenario, we consider the processes of interactions that have produced an innovative idea, whether those processes can be implemented or reproduced, and whether the processes guarantee an innovative product or idea. Some preliminary evidence will be presented. We close by addressing several limitations with both our theoretical conception and our coding methods.

1. Three Scenarios of Innovating Collaboratively

1.1 An Individual Innovating in the Context of a Partner

When an innovative idea is created by dyads, one can ask whether it was generated by the dyads jointly or by an individual with help from the partner. It is often assumed that it is not the lone genius that comes up with an insight, but instead "it's group genius that generates breakthrough innovation" [6, p. 7]. However, we claim that in many instances, innovations are created by an individual with serendipitous contributions from a partner. For example,

suppose Partner A is a good cook and wants to make pesto with basil but she forgot to buy basil and Partner B knows they are having guests and pesto is on the menu. Suppose this conversation occurs after Partner A discovers that she does not have basil and Partner B walks in:

>   Partner B: "How is the cooking going?"
>   Partner A: "Oh, I forgot to buy basil."
>   Partner B: "By the way, look what the neighbor gave me from her garden, some fresh arugula."
>   Partner A: "I wonder if I can try making pesto with arugula."

By our definition, pesto made with arugula is an innovation, or a recipe that is novel and useful. The question is: Was it innovated collaboratively or individually in the context of a partner? In this case, it seems pretty obvious that the new recipe was created by Partner A alone, when she assimilated the input from Partner B that arugula is available. The cues that allow us to determine that this scenario should be depicted more accurately as *an individual innovating in the context of a partner* were that: Partner A had the goal of making pesto, and had reached an impasse in making pesto, and the arugula casually mentioned by Partner B was not intended for making pesto, and Partner B did not think of arugula as a solution. Thus, we could say that the processes of interactions that have produced this innovative recipe consist of Partner A assimilating the information of arugula's availability, and transformed her own idea of a pesto recipe, so the entire conception of the new arugula recipe is constructed by Partner A. Thus, Partner A is really a lone genius. It is not clear how we can reproduce this kind of serendipitous innovation processes other than perhaps by asking a lone genius to incorporate and reflect on inputs from others. Even if an individual can undertake such assimilation and reflection processes, there is no guarantee that an innovation will be produced.

1.2 Both Partners Mutually Build on Each Other's Contributions Sequentially

How might one define collaborative innovation then? A second way to conceive of group or dyadic innovation is that each partner builds on and elaborates upon what the other partner is saying, in a sequential WIKI sort of way, and the final outcome can be a new idea or product. A WIKI is an online collaborative community in which people can write about ideas and others can add or revise them. Thus, in a WIKI, each new contribution is an elaboration to an existing written idea. Many dialogs have this WIKI pattern of exchanges in which each partner builds on the other partner's ideas sequentially and mutually. In such a spiraling process, the partners can create a novel solution or product, even if they initially had no idea of how to construct a solution or a product. For example, when two partners have to build a bridge together in a way that minimizes cost, we often find that partners can build upon each other's ideas sequentially as follows [3]:

>   Mike: "cause usually, I don't know, do you want to try making the cross members smaller (diameter)?"
>   Dan: "Um, we could,--just the ones in the middle and not the ones on the end."

In this second scenario, one partner brought up the idea of making the cross members' diameter smaller, and the second partner built on this idea by constraining which ones to make smaller. Thus, the processes of interacting in this scenario can be described as each partner mutually building on the other's contributions sequentially.

Such spiraling processes of collaborating in which each partner elaborates by adding, revising, or refining the other's contributions are easy to prescribe and implement, and in fact, were precisely the instruction we gave pairs of students in a collaborative bridge design optimization task [3]. Although our design task was not conducive to assessing innovation,

we postulate that even when dyads followed instruction to collaborate in this mutually-sequential way, such dialogic interactions cannot guarantee an innovation.

1.3 Partners Each Contributing Independent Ideas and a New Idea Emerges

A third possible conception of innovating collaboratively is that the random contributions of two partners' ideas are combined so that a new idea emerges. The example below are comments given by two teens about the benefit of a new banking system, in the context of a learning environment requiring them to make decisions about whether a new banking system should be built. Although this snippet is not perfect, it illustrates somewhat what we mean:

Partner A: "Ok, the new system would give the- give the employees…"
Partner B: "More time to deal with the customers."

The two comments above, taken together, create the merged novel idea that a new banking system has the benefit of giving employees more time to deal with customers, consistent with definitions provided by Rafal [5] and Barron [1]. This interacting process seems different from the mutually-sequential elaborating process. For one, in the mutually-sequential process, the second partner simply elaborates on the idea contributed by the first partner, whereas in this case, Partner B's comment is not exactly an elaboration of Partner A's comment. Furthermore, the contributions by the two partners can be both independent and not novel, but when merged, they create a new single idea.

The merging process can be undertaken by one or both partners. That is, we postulate that when two independent ideas are presented and externalized in close sequence, one or both partners can examine them and "see" a novel idea by merging the two externalized contributions. Our example above is not perfect because in this particular case, both ideas are incomplete fragments, which together form a complete idea. The example above illustrates an "idea completion process," which can create a novel idea, but is actually more similar to a mutually-sequential process since the first comment of "give the employees…" could invite the second comment of proposing what can be given. To note, our conception of a merged novel idea does not require that each idea from each partner needs to be an incomplete fragment; instead, each contribution can be a complete but independent idea. Moreover, there is no way to tell how such a merged idea can be created and perceived by each participant.

In summary, we propose that there are at least three dialog patterns that can create innovative ideas. The first pattern attributes an innovation to an individual "lone genius," with serendipitous inputs from a partner that trigger some insight in the lone genius. The second pattern attributes an innovation to the mutually-sequential processes in which an idea is continually elaborated upon by both partners so that it transforms into a novel idea. The third dialog pattern attempts to show that two random ideas can be posed by two partners, and when externalized and combined, a novel idea can emerge that may be recognized and used by either partner, or can be further built upon and elaborated. Thus, an innovative idea can emerge from random collisions of individual ideas. Notice that in all three dialog patterns, even though we were able to postulate what the interacting processes are, understanding the processes does not guarantee that an innovation is produced. For example, even though the mutually-sequential spiraling process can be easily and successfully taught to dyads to carry out [3], since it is essentially an elaborating process much like ones individuals carry out on their own generations, there is no guarantee that an innovative idea will be produced even if it is more likely, given that the participants in dyads and groups have multiple perspectives and different sets of knowledge. Thus, understanding innovating dialogic processes does not imply understanding how innovative products can be produced.

2. Preliminary Evidence

Do we have evidence that innovating dialogs exist and if so, how often do they occur? In this section, we report preliminary findings from two studies.

2.1 Merging or Completing Ideas

In our first study, we collected dialogs from pairs of high school students working with an interactive computer simulation in which they had to make joint decisions about what to do as a new vice president of a small local bank. The vice president was required to solve problems arising at the bank that covered a variety of general business issues such as customer relations or facilities upgrades [2]. The third scenario presented above was taken from this study. In the dialogs, we coded the occurrence of jointly produced ideas that were novel, meaning that the ideas were created by two speakers and were not presented in the simulation, and found that 11% of the jointly produced ideas were novel.

2.2 Assessing that Innovating Ideas Are Novel and Useful

In the prior study, even though the jointly produced ideas were novel in the sense that they were not presented in the simulation, we were skeptical that these merged ideas were, in fact, locally innovative for each individual partner. That is, it is possible that each partner, given the first phrase of the idea, could have come up with or inferred the completed idea on his/her own. In other words, we only coded that a completed idea was generated, but we did not assess whether it was novel to the partners themselves, and more importantly, we could not guarantee that the completed idea, while novel, was also productive and useful.

To assure that the partners could not have generated the jointly produced ideas on their own, in a subsequent study [4], we assessed in a pre-test each partner's prior knowledge to determine whether the jointly produced ideas were, in fact, novel to them, and productive in the sense of allowing the partners to use them to solve problems. To be concrete, one simple mechanics problem, for example, required that solvers treat two blocks, one on top of another, as a single compound body. We assessed on a pre-test that students, individually, could not come up with this "insight" of treating the two bodies as a single compound body. If dyads could solve this compound problem together, then presumably they have created a necessary novel concept. To determine this, we coded a jointly produced idea as innovative if neither partner knew it on the pre-test. The finding was that only 20% of the dialog episodes could be coded as having joint constructions that led to correct solutions [4]. Thus, this method assured us that the jointly produced ideas, such as a compound body, were, in fact, novel ideas that neither partner knew initially and were used to solve problems.

2.3 Summary of Preliminary Evidence

From these two studies, we might conclude that we can capture jointly produced ideas that are innovative, in the sense that the ideas are both novel (to the partners) and useful for solving problems. However, from the perspective of finding important results from empirical data, the frequency of innovations seems low, between 10% to 20%. On the other hand, having innovative ideas occur 10% to 20% of the time is actually quite remarkable, given that they could occur naturally from collaborating, without any specific instruction to innovate. Thus, it appears that we have succeeded in capturing an important benefit of dialogic interactions in dyads, in that collaborative partners can come up with innovations either from building upon each other's ideas or perhaps randomly generating ideas.

3. Limitations

Our theoretical conception failed to capture two senses of collaborative (in dyads) or collective (in groups) innovation. First, a collective innovation suggests that the processes of creating it are not sequential, whereas dialogic interactions necessarily are sequential. Second, a collective innovation implies that the product is more than the sum of each partner's contribution. Sawyer [6] gives the following example to illustrate this simultaneous and non-additive notion. Suppose four jazz members play a song together. How they sound is far superior to each jazz member playing in a separate room and a recording studio overlay their four performances. What makes the four jazz members' simultaneous playing more enjoyable to listen to than a recording that overlays their individual playing? One explanation is that in simultaneous playing, the members interact with each other by trying to sync up with or adjust to each other. Thus, it is the simultaneous interactions that seem to produce a collective innovation, and yet dialogic interactions are necessarily sequential. A second limitation of our conception is that by our definition, an innovative idea arising from the merging of two ideas is necessarily additive whereas the notion of a collective innovation is that it is non-additive.

A third limitation of our theoretical conception is that it cannot shed light on why innovations may be difficult to produce, even if we have some understanding of how innovations can be created by dyads, as illustrated by the three dialog patterns. That is, undertaking such dialog processes may not guarantee that innovative ideas are produced.

Finally, our codings in the two preliminary studies, carried out several years ago, were also not as sensitive as our current definitions of innovative dialogic patterns. In other words, in the prior codings, we did not ascertain whether a jointly produced novel idea resulted from the mutually-sequential elaborating processes or from the random collision merging processes.

Despite the many limitations, we nevertheless hope that the conceptualization and dialogic patterns laid out in this paper can lead to new insights at understanding and coding of innovative dialogic interactions.

Acknowledgements

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