"It's Fun not to Know": The Role of Uncertainty in Text-Based Online Collaborative Storytelling

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Abstract. Computer-mediated communication platforms provide new ways for people to tell stories together, while at the same time introducing new challenges. In this paper we explore how people coordinate process, content, and direction during text-based online collaborative storytelling. In our study, six pairs of participants were asked to tell a story together using two variations of a chatroom-like system. Both conditions provided direct text-based interaction visible to the audience, whereas one condition also included a "backchannel" interface for private communication that was not visible to the audience. The system also provided basic workspace awareness in the form of persistent story text, coloured based on contributor, and a typing activity indicator. Even with just a partial understanding of the content and direction of the story, most participants felt they were able to successfully tell a story together. In fact, some participants preferred the uncertainty associated with limited communication, seeing this as encouraging creativity. This suggests guidelines for designing collaborative tools, which tend to emphasize shared understanding, may need to take into consideration the role of uncertainty in creative activities such as collaborative storytelling.

Keywords: Collaborative storytelling · Improvisation · Backchannel communication · Awareness · Coordination · Uncertainty · Creative collaboration

1 Introduction

Computer-mediated communication has long been used by people to tell stories together. Groups such as the Plaintext Players and the Hamnet Players have made use of MUDs (multi-user dungeons), IRC (Internet Relay Chat), and Second Life for improvisational storytelling [1–4]. Twitter and Facebook have also been used to create improvisational stories in the form of networked improvisations or "netprov" [5, 6]. There have been a number of platforms explicitly designed for online collaborative storytelling, such as *Sleep is Death* [7] and *Storium* [8]. People also tell stories online in less formal settings, such as on social media or using instant messaging systems [9].

A key component in the process of improvisational collaborative storytelling is coordinating the movement towards cognitive consensus, or the development of a shared mental model [10]. As Magerko argues, "Body language, domain-specific cues, and

M. Vosmeer and L. Holloway-Attaway (Eds.): ICIDS 2022, LNCS 13762, pp. 229–248, 2022.
https://doi.org/10.1007/978-3-031-22298-6_15

verbal commands all contribute to the collaborative process […] Any model of improvisation needs to address how communication to others in the group is used for coordination" [11]. Unlike face-to-face improvisational storytelling, online storytelling is potentially both constrained by the limitations of online media and allows for new forms of communication and coordination. This raises the question of how people use computer-mediated communication to negotiate and coordinate cognitive convergence during online storytelling, and how collaborative storytelling tools can support this.

To explore this question, we focused on an extremely constrained situation, text-only chat, and observed how people coordinate and communicate while telling a story together. Participants were asked to use a text-based communication system to tell a story together in front of a hypothetical online audience. In one condition they only had a public communication channel, and in the second condition they had an additional private backchannel. The system also supported simple workspace awareness: persistent story text, coloured based on contributor, and a typing activity indicator. The two conditions served as stimuli, creating differing contexts to enable us to investigate and probe the ways that people handle these contexts, with and without a backchannel. As such, it is important to note that the focus was not on directly comparing the two conditions, but instead on exploring how participants managed these contexts.

Even with limited channels of communication, and although they claimed to have only a partial understanding of the story content and direction, most participants still felt able to successfully tell a story. In fact, some felt the uncertainty involved was beneficial, with one participant claiming "it's fun not to know" where the story is going. This suggests traditional guidelines for designing shared workspaces, which emphasize workspace awareness and development of a shared mental model, may need to account for the role of uncertainty in real-time online creative collaboration such as collaborative storytelling.

2 Related Work

We begin by summarizing theories of collaboration and coordination in face-to-face improvisational storytelling, and work investigating support for online computer-mediated collaborative writing and collaborative storytelling.

2.1 Improvisation and Coordination

Sawyer [12, 13] characterizes improvisational group creativity as a situation in which "interaction between performers is immediate, durationally constrained to the moment of creation, and is mediated by musical or verbal signs", where "the group has no intention of generating something that will remain after their performance is done" [14]. Each performer proposes possible future content or structure, what he refers to as an "indexical entailment" after Silverstein [15]. Accepted proposals become part of the "emergent" - the cumulative set of indexical presuppositions that have resulted from the interactions up to that moment. Future proposals are constrained by the genre of the performance, other participants in the performance, and the set of previous entailments already accepted into the emergent. Tension exists between maintaining coherence with

the emergent and demonstrating some degree of innovation. We are interested in how this tension is impacted by, and impacts, the use of computer-mediated communication as the medium for storytelling.

Research into collaborative storytelling in improv theatre has explored how actors develop a shared mental model of their performance [11]. A mental model is "any underlying assumptions held by an improviser" [10], whereas a shared mental model is the set of mental models where improvisors "think about a phenomenon in a similar manner" [16, quoted in [10]]. Developing a shared mental model inevitably involves misunderstanding and miscommunication, what Fuller and Magerko [10] refer to as cognitive divergence, followed by cognitive convergence, eventually leading to cognitive consensus and a shared mental model of the developing story. Cognitive divergence takes many forms, including disagreements about content, the intended future direction of the story, and the process being used to tell the story. Interestingly, this suggests the process of divergence, convergence and consensus is an essential part of improvisation. Again, we are interested in how computer-mediation impacts and is impacted by this process, and how tools can better support this.

2.2 Computer-Mediated Collaborative Storytelling

Research into computer-mediated synchronous collaborative writing [17, 18] has focused on shared representations and tools for awareness and the use of a shared workspace to support the writing process, with some focus on collaborative storytelling [19, 20]. More recent work examines changes resulting from easily accessible collaborative writing tools such as Google Docs [18, 21]. A key concept is workspace awareness [22, 23], which allows individual collaborators to know what others are doing within a shared workspace, and how an individual's actions relate to their current and planned contributions. Important differences between these situations and what we are examining are the potential presence of an audience during collaboration, and the relative importance of the process, rather than the outcome, of the collaboration.

Another key concept is the provision of an informal, private "backchannel" that parallels a more public "main channel" of communication [24–27]. Work on backchannel communication generally explores private communication between group members in non-performative situations, or between audience members during a performance. Exploring the use of a backchannel by performers in the context of improvisation, *AntWriter* [28] contains a scrolling window where participants enter story fragments to indicate their intended actions, providing time for participants to coordinate before performing. Observations [29] suggest that while participants make use of the ability to share upcoming actions to coordinate their actions, there is a tension between the time needed to plan, and the immediate response needed during improvisation.

3 Research Problem

Previous work on designing and evaluating computer-mediated tools to support collaborative writing emphasizes the need to provide awareness, a shared workspace, and backchannel communication to enable coordination. However, work on face-to-face

collaborative storytelling suggests tensions not usually found in non-storytelling contexts: between coherence and innovation, divergence and consensus, and planning and immediate response. These tensions make it is unclear how traditional approaches to supporting collaborative work apply to computer-mediated collaborative storytelling.

This motivates our research question: how do people use communication channels provided by computer-mediated platforms to coordinate during online collaborative storytelling? We aim to understand the specific design requirements for supporting coordination in real-time computer-mediated creative collaboration such as storytelling.

4 Method

We investigated this question through an exploratory, qualitative observational study of people using two versions of a simple online collaborative storytelling tool: one without and one with backchannel communication. 12 participants (6 pairs) took part in the study. The study was structured using a "within-subjects" approach, with each pair using both versions of the system, counterbalanced to account for potential order effects. This approach was chosen so we could ask comparative questions, exploring how the participants felt about the use of the backchannel during storytelling.

4.1 Materials

The tool was implemented in JavaScript and node.js. Each participant interacted with the system through the Chrome browser on a MacBook Pro connected to a wireless network. Information was relayed between the participants through a central communications server, also implemented in node.js running under Ubuntu 14.04.

The tool provides two views of the ongoing story. In version 1 (see Fig. 1), the storyteller's view shows the ongoing story (A), and the audience's view (B) shows the story as seen by the audience. Participants can type new text to be shown to the audience (C). This text is simultaneously added to both views on both participants' screens when the "enter" key is pressed. The system also provides simple awareness features. Story text is colour-coded to show who wrote the text and is persistent and scrollable. When one participant is typing in the public text entry field, "X is typing…" (D), where X is the name of the participant, is shown just above the text entry field on the other participant's interface. Audience members have a simplified interface only showing the audience view (B). For our study, both the storyteller's and audience's views were shown side-by-side on each participant's screen (see Fig. 1). In version 2 (see Fig. 2), in addition to the above features, backchannel communication (E) was provided in the form of text typed by participants and then shown to other participants in a manner visually distinct from the story text (F), and not shown to the audience.

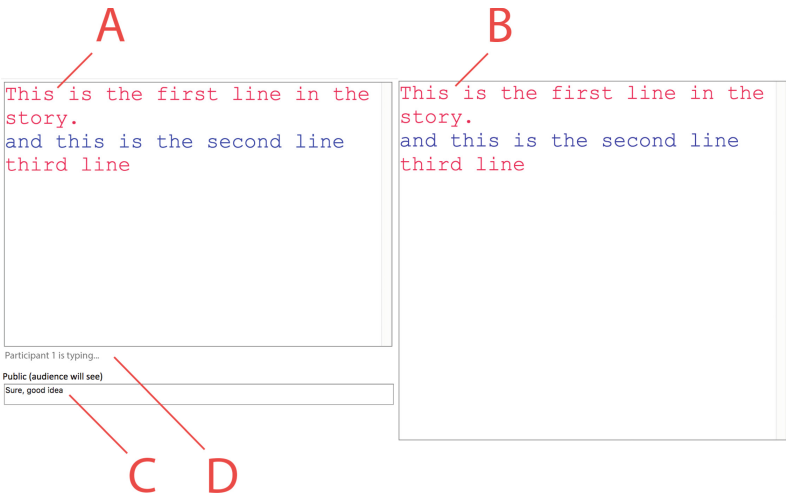

Fig. 1. Version 1 of the storytelling system, with only public communication.

The system was deliberately designed to provide minimal workspace awareness tools [22]. The coloured text provides awareness related to the past, in terms of what has been written and by whom. The “X is typing…” indicator provides awareness related to the present, specifically whether the other participant is currently preparing an entry to add to the story. These tools were provided in both versions, as we wanted to focus specifically on the impact of providing explicit backchannel communication in the form of the private text field.

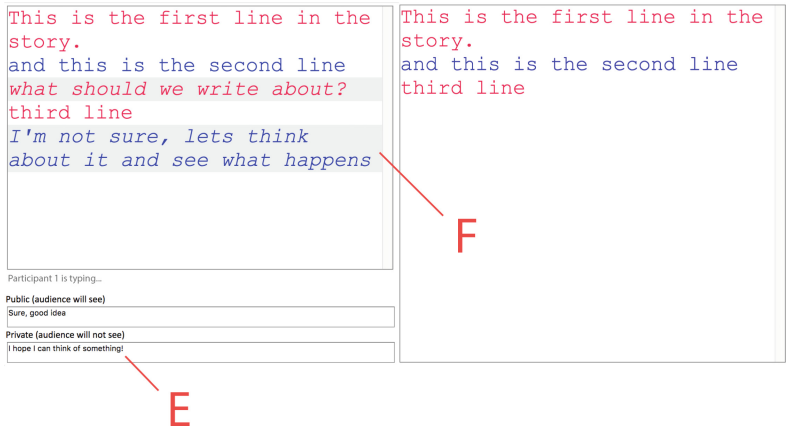

Fig. 2. Version 2 of the storytelling system, with backchannel communication. (Color figure online)

4.2 Protocol

Participants were selected using convenience sampling, with the requirement that they have experience with some form of collaborative storytelling, such as improv theatre or tabletop roleplaying games. Although some participants self-reported "no" to collaborative storytelling experience, all reported having roleplaying experience. Participants were briefed on the study and asked to fill out a demographic questionnaire (see Table 1 for details). They were then introduced to the storytelling system, and any questions about the interface were answered. This was done together to ensure participants received the same briefing.

Participants were then taken to separate rooms and asked to work with their partner to tell a story. They were told the story is for an online audience, represented by the "audience" view in the storytelling tool. Although there was no actual audience, the intention was the implied presence of the audience would emphasize the fact that utterances by the participants are immediately consumed and therefore cannot be edited or retracted, providing time pressure and a need to keep the storytelling process going. To be clear, there was no deception involved here: participants were explicitly asked to imagine there was an audience, to help constrain their use of the "public" text entry field to utterances that they wanted the "audience" to see.

Table 1. Background of participants.

ID	Gender	Age	Rel'ship	Self-reported storytelling experience		
				Individual	Collab	Roleplay
G1P1[1]	Female	28	Couple	None	Yes	Player
G1P2	Male	26		Amateur	Yes	Player/GM[2]
G2P1	Male	35	None	None	No	Player
G2P2	Male	28		Theatre	Yes	Player
G3P1	Female	30	Friends	Amateur	Yes	Player
G3P2	Female	30		Amateur	No	Player
G4P1	Male	32	Worked together	Poet, improv	Yes	Player
G4P2	Male	47		Writer	Yes	Player/GM
G5P1	Male	31	None	Amateur	No	Player/GM
G5P2	Female	33		Amateur	Yes	Player/GM
G6P1	Female	26	None	Amateur	No	Player
G6P2	Male	24		Filmmaker	Yes	Player/GM

[1] Participants will be referred to as "GXPY", where X is the group number (1–6), and Y is the participant number (1 or 2). Here, for example, G1P1 refers to group 1, participant 1.

[2] GM refers to the role of "game master", the person who moderates a tabletop role-playing game session.

To start the story, each participant was given a prompt. Participants were told they could optionally make use of this prompt to help them get started. The prompts were randomized separately and were generally not the same for the two participants, although this was not enforced. These prompts were designed to be generic, and to suggest possible story directions. Participants were not shown their partner's prompt.

Participants had 10 minutes to tell the story. They received a 5-minute and 2-minute warning and told to stop once the time was up. Each participant was then separately asked questions related to their understanding of the story, communication, awareness, and use of the tool.

Once both participants completed their interviews, the process was repeated for the second storytelling session, this time using the other version of the system. For groups 1, 3 and 5, participants used version 1 followed by version 2. For groups 2, 4 and 6, the order was reversed.

After both storytelling sessions and individual interviews, participants were brought together and asked questions about the overall storytelling process. Follow-up questions were asked regarding any issues that arose during the individual interviews.

4.3 Data Collection and Analysis

Video recordings were made of all on-screen actions for both participants. Audio was recorded during the storytelling sessions, the individual interviews, and the combined interview. Three researchers engaged in transcription and open and axial coding of the recordings of the storytelling sessions and interviews, then came together to group these codes thematically, resulting in the categories described below. While we generally took a grounded theory approach [30], we also looked for instances of cognitive divergence and convergence, and paid attention to how the participants worked to coordinate. This approach is in line with the position that the use of existing theories is not at odds with grounded theory, as long as researchers exercise reflexivity [31]. Given our focus, we deliberately chose to limit our analysis to process, rather than story quality or audience experience.

5 Results

We observed participants develop several ways of coordinating and negotiating the *process* they would follow during the storytelling session, and the *content* and *direction* of their story, both without and with the presence of the backchannel. We also found that, while most groups claimed not to completely understand the content and direction of the story, they did not see this as a problem, and in some cases felt this contributed to the storytelling process.

5.1 Implicit Coordination Without the Backchannel

Several groups made use of the story text itself to coordinate the content and future direction of their stories, and in some cases also the process for storytelling.

Negotiating Content and Direction Through the Story Text. In group 2, participants had access to the backchannel during the first session but didn't use it. Despite this, they managed to move the story forward by negotiating both the content and direction of the story through the story text. Both participants received abstract prompts that, while different, were not necessarily incompatible. G2P1 received: "something has dropped from your pocket", whereas G2P2 received: "you have been looking into a reflective surface". While these prompts did not immediately suggest any connection, the participants, without ever explicitly sharing these prompts, were able to gradually incorporate both concepts.

G2P1 began by writing short fragments that mentioned his prompt (see Fig. 3, blue text), whereas G2P2 initially went along with G2P1's contributions, and later brought in his own prompt. Immediately after entering this, G2P2 scrolled up to look at the earlier text and his prompt. G2P2 did this several times, clearly attempting to determine how to combine the various fragments into a more coherent story.

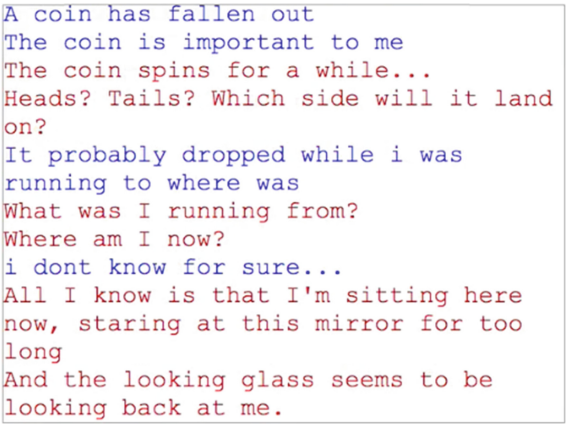

Fig. 3. Negotiating to incorporate 2 unrelated prompts. (Color figure online)

Following this, G2P1 picked up the "mirror" theme, responding with a question. The next few lines related to the mirror, until G2P2 combined the two prompts, asking "I wonder which side the coin landed on […] perhaps that's the side of the mirror I'm now waiting in" (see Fig. 4). This tied together both the coin that G2P1 had introduced as the result of the "something dropped" prompt, and the mirror introduced by G2P2.

Both participants continued to make connections, taking turns to introduce short sentences that referred to both concepts (see Fig. 5). Again, G2P2 tended to scroll back up, reintroducing the "running" concept from earlier and using this to bring the story to a climax, ending with "There's something behind me", which was supported by G2P1's brief but effective "Look."

The gradual convergence of the participants' contributions suggests an implicit negotiation was taking place, not through the backchannel but through the story text, both in terms of the ongoing contributions and the persistent record of contributions.

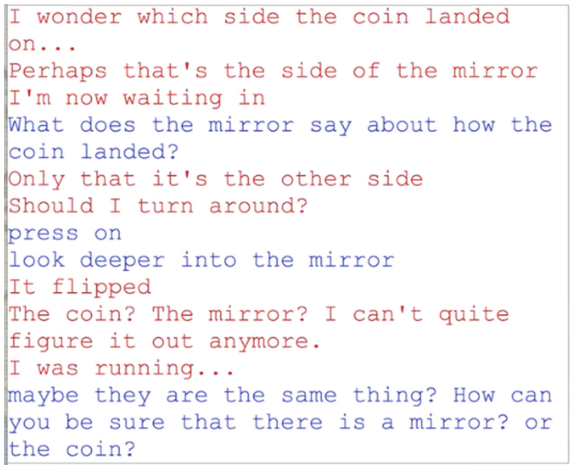

Fig. 4. G2P2 (red text) connecting the two threads of the story. (Color figure online)

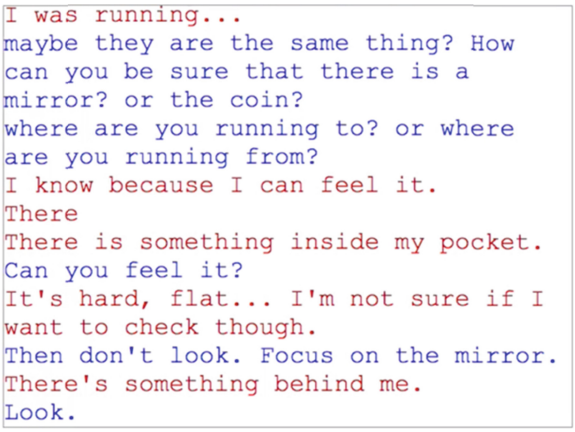

Fig. 5. Making connections and bringing the story to a close.

Negotiating Content, Direction and Process Through the Story Text. Group 5 was also able to develop a turn-taking protocol, despite not having a backchannel during the first session. The prompts in the first session were the same, something the participants were unaware of as they are not shown each other's prompts. Initially, both participants riffed directly off the prompt. Here they were typing simultaneously. After a few lines, both participants began paying attention to each other's contributions and shifted to a turn-taking protocol. As with group 2, negotiation of content and direction was happening within the story text. This suggests that the story text itself supports coordination.

G5P1's initial contribution responded to the prompt (see Fig. 6, blue text). G5P2 also responded to this, introducing a "bizarre world" theme in response to the second half of the prompt: "What has staggered you so?". G5P1 picked up on this, providing examples

of how the world was "breaking apart". Here, there was no direct connection between the contributions, as both partners were making parallel contributions along the "bizarre world" theme. G5P1 wrote "Escalators breaking down…"; simultaneously, G5P2 was typing "All he wanted was to pick up that $10 bill on the ground, and suddenly it had".

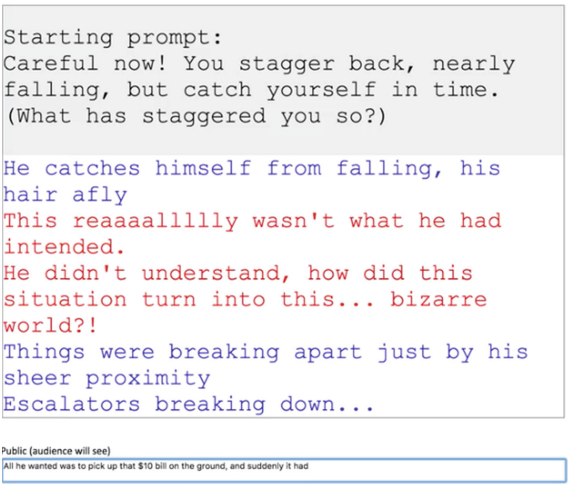

Fig. 6. Group 5 starting to converge (G5P1 in blue, G5P2 in red). (Color figure online)

However, rather than sending this text, G5P2 deleted this line, and instead typed "Pigeons attacking…", a line structurally similar to G5P1's contribution, further building on the theme. This was sent simultaneously with G5P1's "Wedding decorations catching fire…", which appeared first in the text (see Fig. 7).

From here onwards, contributions quickly converged on the concept of a pigeon wedding, with each building on this idea. As G5P2 explained:

> For me I guess that's what I was trying to do, […] is there some way that he can pick up from that, and then we bounce off again, or if he didn't react to that then ok so what did he come up with like open ended sort of stuff that I can pick up on so I guess that was the main sort of communication processes, to make it like back and forth. (I1, 00:07:10)[3]

This "back-and-forth" led to an implicit understanding of where the story was going and how the story was being told, without any explicit communication, much like verbal improv storytelling. A similar process was seen for group 2 during their second story, and for group 4 during both stories.

[3] I1 and I2 denotes individual interview 1 and 2 respectively for a given participant, and F denotes final interview involving both participants.

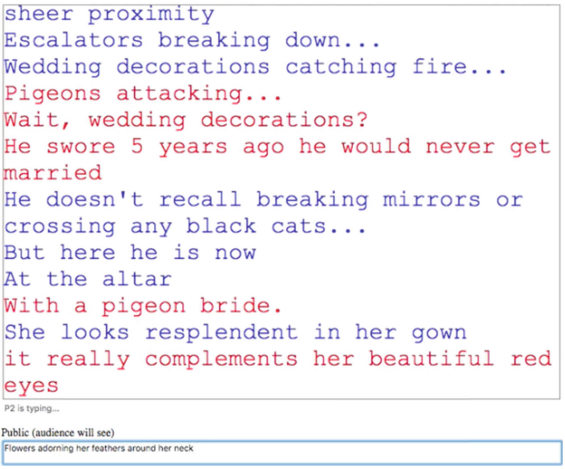

Fig. 7. Converging on a common platform without explicit coordination.

5.2 Use of the Backchannel for Coordination

These observations suggest that without using the backchannel, groups coordinated process, content and direction using the implicit communication provided by the story text. However, when breakdown was too great to overcome through implicit coordination, and the backchannel was available, groups made use of the backchannel to overcome breakdown.

Breakdown and Backchannel for Coordination and Support. In group 3's first session, the backchannel was unavailable. Unlike other groups, these participants failed to coordinate using the story text, with G3P1 dominating and G3P2 only making two contributions. There was no visible connection between their contributions, suggesting a failure to reach any cognitive consensus. It is worth considering why this happened.

From the start, G3P2 struggled to keep up with G3P1's contributions. Clearly the two participants were working independently. As G3P2 explained:

> I wasn't really paying attention to hers. Cause, I'll get distracted, […] And I'm like trying to think about how to make it connect but I was like, but I won't be typing anything because she types faster than me! (I1, 0:00:15)

G3P2 was overwhelmed by the rate at which G3P1 was contributing to the story, making it difficult for her to focus on her own contributions.

When asked, G3P1 admitted she hadn't realized G3P2's contributions were not showing up, assuming G3P2 was adding to the story although she couldn't see her text:

> I saw her, that she was typing, but because it wasn't coming up on the screen, […] by that point I had already written so much so I just said I will finish my piece and it's just a one piece that's separate from hers. (I1, 00:08:33)

Here G3P1 gave up on collaborating and focused on her own story. Similarly, there was a point where G3P2 decided to ignore her partner and write her own, separate story. At the 5-min point, G3P2 was still editing her first contribution (see Fig. 8). As she said, "I haven't even typed anything, I haven't even entered anything! I'm think I'm going to completely ignore what she's writing" (I1, 00:06:01). The lack of backchannel led to a complete breakdown in coordination, with no means available for negotiation or repair.

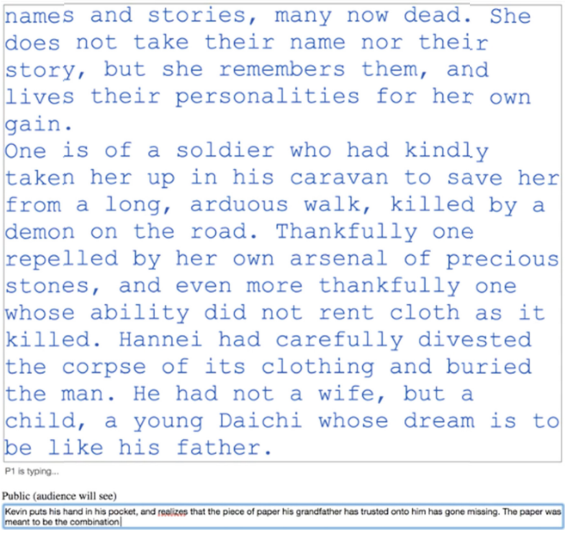

Fig. 8. G3P1 dominates (blue text), while G3P2 spends a lot of time editing (text entry field). (Color figure online)

In contrast, in the second session the participants immediately made use of the backchannel to establish a turn-taking protocol. They each provided many support responses as they went. The style of contributions also changed, with G3P1 slowing down and both participants thinking about how their contributions will build off each other's text. In the first 2 min of the session, the participants only typed in the backchannel (see Fig. 9). They shared their prompts and decided to use turn-taking. The backchannel allowed them to negotiate the process, content, and direction of their story.

Use of the backchannel continued as they began writing the story. They continuously provided support responses and encouragement (see Fig. 10) and suggested where to take the story. Unlike the first story, the participants connected their prompts and worked together on a coherent story. Although G3P2 continued to spend a lot of time editing, she could do this without the pressure she felt during the first session, as she knew G3P1 would wait for her. They were also able to signal their intent using the backchannel and provide encouragement when they felt their partner needed support.

For group 3, the backchannel was essential for the success of their collaboration. Without any means of direct communication, they were unable to coordinate, whereas when the backchannel was provided, they used it to coordinate both the content and the process of their collaboration. Interestingly, in this group the participants were close

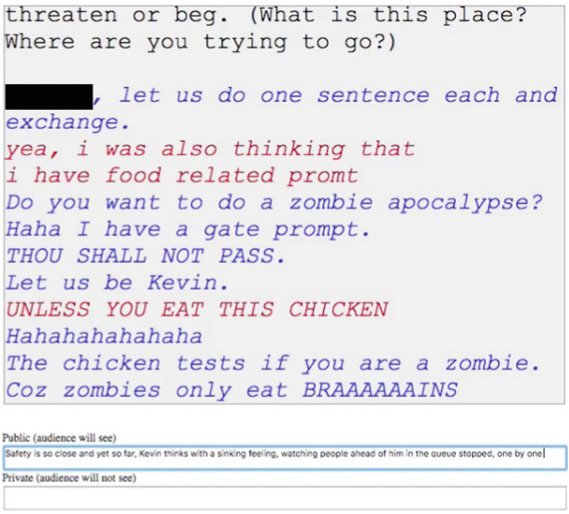

Fig. 9. Negotiating for both content and process.

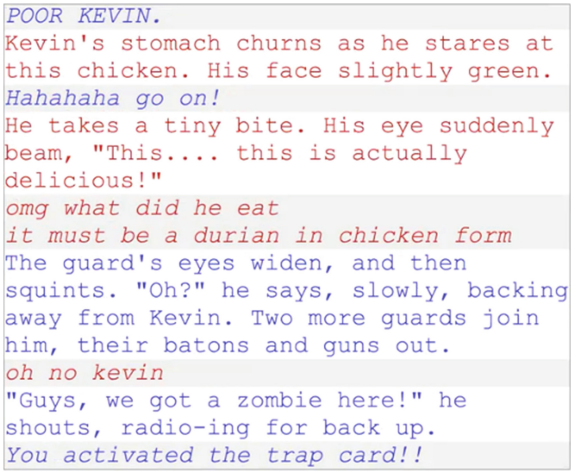

Fig. 10. Backchannel support responses and encouragement.

friends, and had taken part in tabletop role-playing game sessions together. Despite this, they still struggled to tell a story together in the absence of the direct communication provided by the backchannel.

Using the Backchannel for Support and Repair. Other groups used the backchannel for support and repair, although not to the extent of group 3. In the second session, group 5 used the backchannel to set the tone of the story ("full on horror"), to determine the turn-taking protocol, and to decide the story would be a continuation of their first

story (see Fig. 11). For the next 5 minutes, they worked without using the backchannel, following a loose turn-taking protocol.

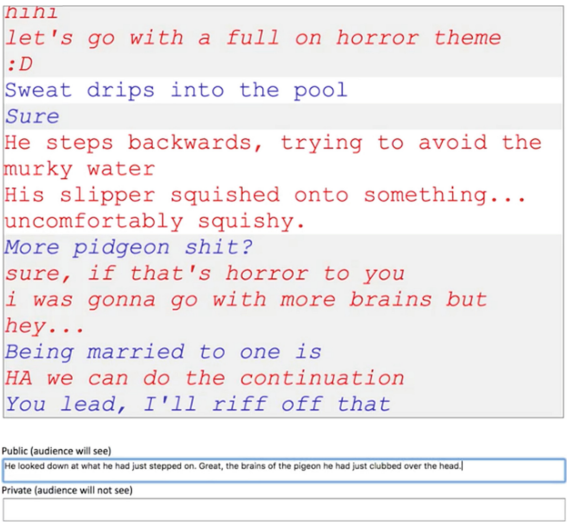

Fig. 11. Determining the tone, protocol, and continuation of previous story.

Although the "pigeon" theme from the first story had re-emerged, the story was veering into comic rather than horror territory. At this point, G5P2 used the backchannel to ask: "what happened to the horror" (see Fig. 12). In response, G5P1 added a line stating the main character's trousers are torn, which G5P2 followed up on in the backchannel, suggesting "maybe he can turn into a pigeon too". G5P1 responded both in the story ("He falls by a tree clutching his leg, pain searing"), and in the backchannel ("Exactomondo"). G5P2 supported this, suggesting "or maybe pigeons start developing a taste for blood", followed by a support response ("great!!") to encourage the direction G5P1 was taking.

As G5P2 explained, here the backchannel enabled them to quickly get back on track:

> We started off with horror, then it kind of went a little bit off and that's why I said, "hey we're going to do horror right?" then he brought it back he did bring it back so that worked out. (I2, 00:11:12)

Here, the backchannel is being used to correct what one participant saw as a straying from the direction they had set, and the other participant responded. As with group 3, the backchannel was being used for support and confirmation.

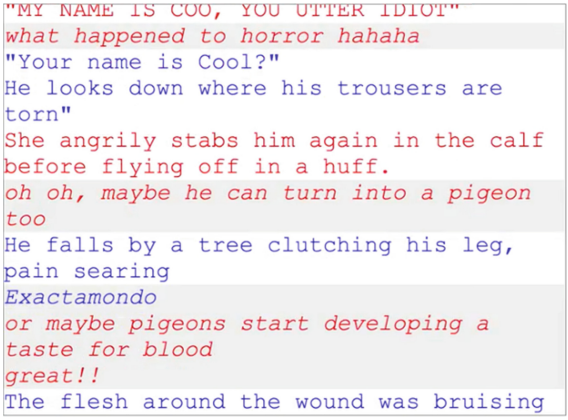

Fig. 12. Using the private backchannel to bring the story back in line.

5.3 Varying Degrees of Cognitive Consensus

One issue arising from these observations is the varying degrees to which the participants could be said to have developed a shared mental model of the story. Despite this, apart from the first session for group 3, the participants were able to move the story forward and maintain some coherence, often without the backchannel. This suggests that an approximation of cognitive consensus is enough for collaborative storytelling.

Importance of a Common Starting Point: Group 3 experienced difficulty during the first session, with one participant completely dominating. Interestingly, in the second session they built on ideas from the first story to ground the second story. During their initial backchannel communication, they decided on their roles. As G3P1 said, "we can try and prompt each other, like I'll be the guard, you be Kevin" (F: 00:02:37). Building on G3P2's character from the first session gave them a common starting point and enabling the collaboration to proceed.

However, as G3P1 explained, this still allowed for uncertainty: "Because she was Kevin, but I didn't know what her prompt was except it was related to food and I didn't really tell her what my prompt was because I didn't really think it was necessary" (I2: 00:03:46). Similarly, G3P2 did not have a complete understanding of the story or its direction: "Not quite, because we would change it, because I wrote something and then she added a twist, and I'd be like ok it went this direction, how would I continue from there" (I2: 00:47:23). Despite this, the group appeared to have enough cognitive consensus to move the story forward, without the breakdown seen in session 1.

Understanding "The Broad Frame" of the Story. For group 2, although both sessions went smoothly, participants admitted they were not clear about story content or direction. When asked if he knew where the second story was going, G2P1 said: "Not really, actually the stronger player in this part is basically the other player, because I'm just reacting, I'm trying to push to the end, to push towards a resolution" (I2, 00:05:00). Similarly, G2P2 initially had trouble determining what was happening in the first story, and struggled to link G2P1's contributions with his own:

> I knew there was a coin and there was a mirror. And I assume that his prompt has something to do with a coin, so in a broad way in my mind, [I] kind of wanted to link them together about the sides and falling, so that's the broad frame that I was working with. (I1, 00:09:44)

G2P2 struggled to reach some form of cognitive consensus from which to build the story. Despite this, there was eventually some clarity as to how to move the story forward, what G2P2 referred to as "the broad frame" of the story. This seems to have been enough to allow collaboration to proceed.

For group 6 there was a similar sense of having just enough cognitive consensus for the process to flow, while still not quite "getting it". For G6P1, the direction in the second session was initially unclear. When asked whether this was a problem, she said: "no, it's fun to not know, there's a bit of anxiety also that you don't know, and then you realize that it's not so bad that you don't know" (I2: 00:20:13). This tension between knowing and not knowing is something G6P2 also mentioned:

> I found myself being more comfortable in that space of […] knowing and not knowing at the same time. I knew what I wanted to do but at the same time I had to confirm based on what the other person was going to do, and from there come to a sort of compromise. (I2: 00:04:56)

There was a transition from the need to develop at least some degree of cognitive consensus to the idea that uncertainty and reduced communication can be productive.

Deliberately Retaining Some Uncertainty. This interest in maintaining uncertainty was clearest with group 4. In both sessions the participants could collaborate, despite repeatedly admitting that neither had any idea where the story was going.[4] For the second session they never came to a consensus as to what the story was about or where it was going, but they nevertheless were able to proceed. In fact, G4P1 felt this lack of understanding contributed to the success of the session:

> [The] fact that there is some distance between me and [G4P2], in terms of we don't see what the other person's expression is, allows me to have my own take on the story while having [G4P2] input stuff. (I2: 00:16:47)

Similarly, comparing the first session (without backchannel) with the second session (with), G1P2 felt the backchannel might lead to one person dominating:

> If we were given the chance to do a private chat, I feel that one person would dominate the other with their [ideas] and just have their story and other would just follow […] we will follow one storyline, whereas in the first [session] we were both just shooting guns everywhere and having our own storyline (F, 00:14:54)

This suggests G1P2 was concerned too much awareness of where the other person was taking the story might inhibit free exploration of ideas. Likewise, G1P1 felt there

[4] It is worth noting that this pair knew each other professionally and were both practicing storytellers: G4P1 works in improv theatre and spoken word poetry, and G4P2 is a published author. This likely contributed to the ease with which they coordinated their storytelling.

should be some preliminary communication to set up an initial shared mental model, but this should stop once basic parameters were established:

> If we want to have a coherent storyline that the audience can enjoy, probably the first minute or two we don't talk to the audience we just set up our own parameters of the storyline, and then in order to have a refreshing, impromptu story, take away the [backchannel] and then we do our own shenanigan things within the set parameters so at least we do not veer too far away and the audience will be able to appreciate it. (F, 00:31:30)

There is an interesting desire here to maintain uncertainty, which some of participants felt would contribute to the quality of both the experience and the resulting story. It was only in group 3, where the uncertainty interfered with the process of telling the story, that the backchannel was seen as necessary and uncertainty as an obstacle.

6 Discussion

Even with limited or no backchannel communication, participants generally felt able to successfully work together to tell a story. For some groups, minimizing direct communication and leaving gaps in their shared understanding seemed to be an important part of the creative process. This suggests that, even in the absence of a clear shared mental model, if participants had a rough idea of the story direction and what their partner thought the story was about, collaboration could proceed. Only with a large amount of divergence, as with group 3, did the process break down.

We can connect our observations to Saywer's [13] notion of the "emergent", the cumulative set of constraints put in place by the contributions made by the participants. In our context, the "emergent" is explicitly represented by the concrete trace of participants' contributions (the text in the scrollable chat window). This captures what has been "said" in the story but does not include the intentions behind those utterances. For most of the groups, the combination of the "emergent" and each participant's individual understanding of what this suggested regarding the future direction of the story seemed to be sufficient for them to form new contributions, even if they didn't ever completely understand what the other participant had in mind. For group 3, however, it was only when they could set some initial parameters in the second session that they were able to move the story forward. They still didn't come to a complete cognitive consensus, but it was enough for them to proceed with the storytelling task.

For some groups this lack of complete cognitive consensus, coupled with limited communication, seemed to be an important part of creative collaboration. This aligns with Sawyer's [13] description of improvisational performances as experiencing a tension between maintaining coherence with the emergent and demonstrating some degree of innovation. It was only when the balance shifted too far towards innovation, with very little coherence, that the lack of cognitive consensus became irreconcilable. This also mirror Magerko et al.'s [11] description of the process of cognitive divergence and cognitive convergence. By deliberately limiting their communication and avoiding sharing too much about their prompts, participants made it more likely they would repeatedly

experience the cognitive divergence/cognitive convergence cycle, perhaps using this to manage the tension between coherence with the emergent and innovation.

This need to balance coherence and innovation suggests that online collaborative storytelling tools should provide flexibility for how much, and when, information is shared between participants, rather than providing as much shared information as possible, all the time. When it is possible to move forward with limited information and implicit coordination, it may be better to minimize the information being shared. When participants feel that there is a breakdown, as we saw with group 3, it should be possible to switch to more explicit modes of communication to repair the breakdown and move the storytelling process forward. How this movement between a richer and a deliberately more impoverished mode of communication is initiated, and who controls this (the participants, the system, or some combination of the two), is not clear. This suggests interesting areas for further research.

7 Conclusion

The results of our study suggest that minimal workspace awareness features, a shared representation of the story so far, and a simple backchannel may provide enough awareness and communication to enable some degree of coordination of process, content, and direction. Most participants felt they could tell their story even without achieving a clear shared mental model, suggesting that with some degree of cognitive consensus, participants could continue to contribute. Most important was having either implicit or explicit agreement about the process. In fact, some participants found lack of a clear shared mental model and limited communication channels were productive for creativity. This suggests designers of collaborative storytelling tools should acknowledge the importance of the ongoing process of cognitive divergence and convergence, rather than focusing on support for reaching and maintaining cognitive consensus.

Although we explored text-based collaborative storytelling, there are other, similar contexts, such as storytelling in group chat and social media, where our observations may also be relevant. Future work could extend our observations to wider contexts, to help inform the design of tools for supporting a range of forms of creative collaboration. It would also be worth exploring the impact of the backchannel not just on coordination, but also on story quality and the audience experience.

Acknowledgements. This research was funded under the National University of Singapore Humanities and Social Sciences Seed Fund grant "Communication Strategies in Real-time Computer-Mediated Creative Collaboration".

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