When non-salient information becomes salient in conversational memory: Collaboration shapes the effects of emotion and self-production.

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Abstract

People's memory of what was said and who said what during dialogue plays a central role in mutual comprehension and subsequent adaptation. This paper outlines that well-established effects in conversational memory such as the self-production and the emotional effects actually depend on the nature of the interaction. We specifically focus on the impact of the collaborative nature of the interaction, comparing participants' conversational memory in non-collaborative and collaborative interactive settings involving interactions between two people (i.e., dialogue). The findings reveal that the amplitude of these conversational memory effects depends on the collaborative vs. non-collaborative nature of the interaction. The effects are attenuated when people have the opportunity to collaborate because information that remained non-salient in the non-collaborative condition (neutral and partner-produced words) became salient in the collaborative condition to a level similar to otherwise salient information (emotional and self-produced words). We highlight the importance of these findings in the study of dialogue and conversational memory.

Key words: Dialogue, collaboration, conversational memory, emotions

Introduction

The ability of speakers to remember the information exchanged in a conversation depends both on what was said and who said it. Indeed, prior research has shown that memory in conversation depends (inter alia) on whether the information was produced or simply heard, as speakers tend to remember self-produced information better (e.g., Knutsen & Le Bigot, 2014). Recently, a few studies have also explored the influence of emotion on conversational memory (e.g., Le Bigot et al., 2018), based on the idea that examining emotions contributes to a better understanding of communication, as emotion is inherent to information processing. All these contextual factors (e.g., cognitive, emotional) are of central importance, as they highlight how different kinds of factors may affect both dialogue partners' ability to subsequently adjust to each other's conversational needs (Horton & Gerrig, 2005, 2016). However, although such a context-dependent approach has provided many important insights, exactly how emotion and production might contribute to memory processing in communication remains unclear: indeed, the dialogic production and emotion effects are more or less likely to be observed depending on the experimental setting used. We propose that this lack of consistency could be due to the collaborative nature of dialogue per se. Indeed, one possibility is that because dialogue involves active collaboration and engagement in the interaction, dialogue partners tend to pay more attention overall to what is said than in any other, non-dialogic situation. If verified, this would imply that memory biases (such as remembering partner-produced information less well than self-produced information, or neutral information less well than valenced information) would be smaller or would even disappear in dialogic settings. The originality of the current research was thus to understand *why* it is so difficult to find cognitive and emotional effects in dialogue research by comparing conversational memory in collaborative vs. non-collaborative settings. We assumed that the collaborative nature of dialogue might conceal the effects observed elsewhere (i.e., in non-dialogic situations) because of a global memory boost affecting all the information mentioned.

To say that collaborating with others is essential in a conversation setting sounds like an evidence, as dialogue is usually defined as a collaborative activity (Clark, 1985, 1996; Clark & Wilkes-Gibbs, 1986). Nevertheless, the concept of “collaboration” appears to be used by researchers as an umbrella term to account for various and heterogenous phenomena. Within the context of the collaborative approach to dialogue, collaboration is defined as the fact that each dialogue partner puts individual efforts into reaching mutual comprehension (e.g., Clark, 1996). Common ground, which may be defined as the knowledge that two people share and are aware of sharing (Clark, 1996; Clark & Marshall, 1981; Rubin et al., 2011) plays a central role in this context. According to Clark and Marshall (1978, 1981), dialogue partners rely on three *copresence* heuristics to determine whether a piece of information belongs to their common ground or not. According to these heuristics, a piece of information belongs to the partners’ common ground if they have already encountered this information together either physically (physical copresence) or linguistically (linguistic copresence); information which is usually shared amongst members of communities both partners belong to are also deemed part of their common ground. Common ground plays a central role in collaboration, as it enables people to determine what their partners know (or do not know) in order to produce utterances that can be understood easily, a process referred to as audience design (e.g., Bangerter & Clark, 2003; Brennan & Clark, 1996; Brown-Schmidt, 2009; Clark & Wilkes-Gibbs, 1986; Knutsen & Le Bigot, 2012, 2014, 2020; Metzing & Brennan, 2003). Regardless of whether audience design is considered as effortful (e.g., Horton & Keysar, 1996; Rossnagel, 2000) or automatic (e.g., Fay et al., 2018; Micklos et al., 2020; Pickering & Garrod, 2004 – see also Barr & Keysar, 2005 and Keysar & Barr, 2002), the copresence heuristic framework highlights that any dialogue involves the co-construction of meaning and that dialogue partners may rely on “collaborative remembering” of past interactions to facilitate ongoing conversations (Bavelas et al., 2000; Norrick, 2019).

Memory for past conversations, or conversational memory, thus plays a central role in dialogue and communication success (e.g., Horton & Gerrig, 2005, 2016). Indeed, interacting with others requires being capable of remembering what information was mentioned (the content of the information – “What was said”), and also who provided the information (the source of the information, or *reality-monitoring* – “Who said what”). However, memory is not a stable function but rather varies in a complex way depending on various individual- and/or context-specific factors (e.g., Ahn & Brown-Schmidt, 2020; Brown-Schmidt et al., 2015).

In this vein, there is strong evidence that producing information out loud leads to better memorisation than reading information silently – or hearing it being produced by someone else – an effect referred to as the (*self-*)*production effect* (MacLeod, 2011; MacLeod & Bodner, 2017). In a situated dialogue, this effect involves that self-produced information is remembered better than partner-produced information. Although this effect has been observed - indirectly - in studies focusing on word accessibility during the interaction via the reuse of information (e.g., Knutsen & Le Bigot, 2014), relatively few studies found it after the end of the interaction in experimentally controlled settings (Fischer et al., 2015; McKinley et al., 2017; Yoon et al., 2016). In contrast, the opposite pattern is found in studies involving ecological conversations followed by a free recall task: participants find it easier to recall their partners' contributions. This result, might be due to a familiarity effect: because my own verbal productions seem less important to me, I feel less pressured to report them (Stafford & Daly, 1984; Stafford et al., 1987).

In any event, self-production also affects reality monitoring – the ability to distinguish between internal and external features of the memory trace (Johnson et al., 1993; Johnson & Raye, 1981), which may refer in dialogue to the distinction between oneself and one's partner as the source of the information mentioned. However, the evidence regarding this point is also mixed. When a piece of information is self-produced (and thus well memorized), some studies suggest that its source is less well identified (e.g., Fischer et al., 2015; Jurica & Shimamura, 1999) whereas others show no such effect (e.g., McKinley et al., 2017 – see also Pereira et al. (2019) for a review and some contradictory results). Note here that two different factors may help explain why the evidence is mixed. Firstly, the conversational partner is rarely an actual person in most reality monitoring studies; secondly, in studies on reality monitoring in language research the "source" of the information is operationalized in very different ways depending on the studies conducted (e.g., in some studies, the colour of the ink of the word read or spatial location may be considered as the source, e.g., D'Argembeau & Van der Linden, 2004). In the present work, we focused on reality-monitoring in interpersonal verbal interactions, and thus on the question of who said what (i.e., "did I say it myself, or did my partner say it?").

In the area of emotion research, it is well established that emotionally charged events are remembered better than neutral ones, regardless of the nature of the stimuli to be remembered (e.g., events, pictures, words) and particularly for negative valence (Bowen et al., 2018; Leclerc & Kensinger, 2008; Mather & Sutherland, 2011; for reviews, see Baumeister et al., 2001; Levine & Edelstein, 2009) – although there is a debate about the nature of the underlying mechanisms (i.e., arousal or valence *per se*). The impact of emotions on reality-monitoring is more contrasted. Some studies show an emotion-related degradation of the memory trace, others a benefit or even no significant effect (Pereira et al., 2019). More broadly speaking, it is surprising to note that relatively little research has been conducted on the emotional dimension of dialogue; even though princeps studies have highlighted the interest of this dimension in the study of conversational memory (i.e., sarcasm and other affective properties of recalled sentences) (e.g., Keenan et al., 1977; Stafford et al., 1988). Indeed, oral interpersonal interactions are often charged affectively, as when - to mention only extreme cases - individuals are under pressure or producing a testimony. In sum, routine verbal interactions require accurate conversational memory either in order to adapt moment-by-moment to one's conversational partner, or to a subsequent task, coping with the affective dimension of the target event and its potential biases. One study explicitly focused on the role of emotion in dialogue, showing that both emotion and self-production boost participants' memory for what was said, but that emotion impairs memory for who said what (Le Bigot et al., 2018). These results are fully consistent with the idea that emotional stimuli are more salient than neutral ones in cognitive processing. Content is remembered better while sources tend to be forgotten because the processing of the emotional valence of an event is cognitively demanding, limiting the amount of attention available to process the contextual features of the information (e.g., information source). This is consistent with an attention-based hypothesis and with the weapon focus effect (WFE) framework (for a review, see Fawcett et al., 2013). In other words, insofar as human attention is limited, the attractiveness of emotional information undermines the attention devoted concomitantly to other peripheral elements.

An important issue in several of the studies listed above is that they did not necessarily involve a collaborative experimental setting. For instance, in the study reported by Le Bigot et al. (2018), participants were asked to produce unrelated sentences and were thus not required to collaborate in order to reach mutual understanding. This raises a paradox: Although the question of conversational memory is inherently linked to the notion of collaboration, conversational memory is not systematically studied in collaborative experimental settings. It is thus difficult to determine whether or not findings related to conversational memory can be generalised to genuine dialogue situations (in fact, opposite patterns of results may be found in experimental versus genuine dialogue settings, as illustrated by the self-production vs. partner-production effects reported in the literature; Knutsen & Le Bigot, 2014; Stafford & Daly, 1984). This could also help explain why results on the influence of cognitive and emotional determinants on conversational memory sometimes appear to be inconsistent. In an attempt to overcome this paradox, in the present work, we explicitly manipulated collaboration in order to examine its impact on memory effects in dialogue. In both conditions, two dialogue partners took turns producing utterances based on words presented on a screen. Crucially, in one condition (collaborative condition), the participants needed to coordinate their utterances to form a coherent story together, thus requiring a certain level of collaboration between partners. In the other condition participants also had to perform the task together (i.e., they took turns speaking), but they were not required to form a story together; thus only involving a minimal form of coordination (non-collaborative condition).

Therefore, the present study sheds light not only on the interplay between emotional and dialogic mechanisms, but also on how collaboration may affect individual memory mechanisms. If collaboration boosts memory, we expected participants to remember information better in the collaborative condition than in the non-collaborative condition. We also expected to observe the (self-)production and emotion effects in the non-collaborative condition, but not in the collaborative condition, as the memory boost in the collaborative condition should cause all information (regardless of who produced it and of its emotional valence) to be remembered well in this condition. As for source memory, we expected to replicate Le Bigot et al.'s (2018) finding that emotion impairs reality monitoring in the non-collaborative condition; but we did not expect to find this effect in the collaborative condition, where we expected negative and neutral content to be equally likely to be remembered.

Method

Participants

104 undergraduate students – all female, as gender can be a cause of distinctiveness within a dyad (see Fisher et al., 2015 for a discussion) – from a French University were recruited in exchange for payment. All participants provided written informed consent and the study was conducted in accordance with the 1964 Helsinki declaration. All participants were randomly assigned to one of the two conditions described above (54 participants, *Mean age* = 19.95, *SD* = 1.32 in the collaborative condition and 50 participants, *Mean age* = 20.10, *SD* = 1.17 in the non-collaborative condition). Participants took part in the experiment in pairs (participants within each pair had no particular relationship prior to the experiment (no couples, etc.)).

Material and procedure

108 French words were taken from norms established by Monnier and Syssau (2014). Twelve neutral nouns were used as examples and 96 nouns were selected for the test phase (see Appendix 1 for the complete list of the 96 words used): 48 neutral (*Mvalence* = 4.92, *SD* = 1.52; *Marousal* = 3.46, *SD* = 2.27) and 48 negative nouns (*Mvalence* = 2.25, *SD* = 1.58; *Marousal* = 5.21, *SD* = 2.77) significantly differing on their emotional value (i.e., valence and arousal on a 9-points scale). These two categories of nouns did not differ (all $Fs<1$, ANOVAs) in length (i.e., same number of 1, 2 or 3 syllable-words for each category), in their degree of imageability (*Mneutral* = 4.62, *SD* = 1.07; *Mnegative* = 4.67, *SD* = 1.40) or in book (*Mneutral* = 53.26, *SD* = 93.52; *Mnegative* = 57.15, *SD* = 81.46) and in film (*Mneutral* = 41.33, *SD* = 68.04; *Mnegative* = 55.6, *SD* = 95.44) frequencies. Two microphones and a dual voice recorder were used to record verbal productions.

The experiment took place in a quiet experimental room. Each participant sat in front of a computer screen and was identified as Partner 1 or Partner 2. A partition prevented both participants from seeing each other. In both conditions, participants performed the five steps of the experimental session: the production phase (Phase 1), a first interfering task (Phase 2), the memory assessment phase (Phase 3), a second interfering task (Phase 4), and a finalised interactive task

(Phase 5). The only difference between the two conditions was the content of the instructions of Phase 1.

During the production phase, the participants had to use nouns which appeared simultaneously on both computer screens (they saw the same word at the same time, as the screens were connected to the same computer program) to produce a meaningful utterance out loud; both partners took turns speaking (i.e., while one participant spoke, the other one listened). The program was developed in E-prime 2.1, and the stimuli were presented in a pseudo-random sequence so that each partner spoke the same number of times and with the same number of negative and neutral words.

The participants first performed two blocks of six familiarisation trials (neutral words only). They then embarked on eight blocks of 12 trials. In each trial, a fixation cross appeared in the center of the screens for 1000ms, followed by the presentation of a noun for 1500ms. Two additional pieces of information were provided to the participants on the bottom of the screen: who would speak next (i.e., Partner 1 or 2) and the partners' progress in the story (items 1 to 12 within each block of trials). Therefore, each participant produced 48 utterances out loud (24 based on a negative noun and 24 based on neutral nouns).

In the collaborative condition, participants were told that within each block, the utterances produced should be coherent, i.e., that they should develop a story together, based on the words shown on their screens. No such instructions were given in the non-collaborative condition, where the participants were simply instructed to produce meaningful utterances.

In Phase 3, each participant completed an individual memory content assessment – what was said (i.e., they had to write down as many words which had been presented on the screen in Phase 1 as possible) and a reality-monitoring assessment – who said what (i.e., they were given the list of all the nouns actually shown in Phase 1, and they were asked to write, for each noun, who (self or other) had produced the corresponding utterance).

Phases 2 and 4 were interfering phases, which consisted in the completion of the Symbol and Coding subtests of the Wechsler Adult Intelligence Scale (WAIS-IV; Wechsler, 2008), each of these during two minutes. Finally, Phase 5 consisted in a joint task in which 1/ in the non-collaborative condition, participants had to create a story with the information they remembered from Phase 1; 2/ in the collaborative condition, they had to give a title to each of the eight stories they had come up with in Phase 1. The data from Phases 2, 4 and 5 were not of prime interest to this study and were therefore not analysed.

Results

The analyses were performed in two steps. The first step (hereafter referred to as the preliminary analyses) sought to verify that the participants had followed the instructions provided, that is, that the utterances produced in the collaborative condition formed coherent stories. We did this by comparing the production of a number of discourse markers (see below) in the collaborative condition and the non-collaborative condition. The length of the utterances produced by the participants was also examined in the preliminary analyses. The analyses of interest (hereafter referred to as the main analyses), which focused on content and source memory during Phase 3, were then conducted during the second step. Note that insofar as emotion was one of our initial factors of interest, it was systematically taken into account in all steps of the analyses.

Preliminary analyses

Corpus transcription and data coding

The utterances produced by the participants were transcribed, and the transcripts were then coded for four discourse markers, that is, expressions which relate discourse segments with each other (e.g., Fraser, 1999). In this study, we particularly focused on markers of coherence, referring to words and expressions mentioned earlier in the current story (in the collaborative condition) or in the ongoing block of utterances (in the non-collaborative condition). The markers coded were verbatim repetition (i.e., a content word mentioned in an utterance was repeated later in the story; e.g., the noun “lady” or the verb “to eat” were mentioned once, and then at least once again later in the same block), anaphoric repetition (i.e., a pronoun was used to refer to a referent which had been mentioned earlier in the same block; e.g., the pronoun “he” was used to refer to a character which had been previously been referred to as “a guy”), possessive determiners (i.e., a possessive determiner used by one of the participants referred to a character mentioned earlier in the same block; e.g., the determiner “her shoes” referred to a female character mentioned previously) and relative clauses (i.e., the utterance produced by a participant was attached to the previous sentence by a relative pronoun such as *who*, *which* or *that*, or a phrase such as *in the meantime*; e.g., one of the participants would say “Charline has a stomach ache after eating an artichoke” and the other participant would say: “because her brother hadn’t cooked it well”).

The coding procedure for these four markers was as follows. First, the coder read each utterance and coded it 1 if it was coherent with the rest of the story (that is, that it included at least one coherence marker), and 0 if it was not. This generic level of coding was used to simplify the rest of the coders’ work and was not included in any of the analyses conducted in this study. If the utterance had been coded as coherent, the coder then coded it for verbatim repetition (1: present; 0: absent), anaphoric repetition (1: present; 0: absent), the presence of a possessive determiner (1: present; 0: absent) and for the presence of a relative clause (1: present; 0: absent). Importantly, all four variables were binary: the number of coherence markers was not taken into account. For instance, if an utterance included three verbatim repetitions, it was still coded 1 for verbatim repetition.

The data from 12 dyads (representing approximately 23% of the entire corpus) were triple coded for coherence. Fleiss’ kappa was then calculated to assess the reliability of agreement across the three coders. The values obtained were 0.90 (verbatim repetition), 0.93 (anaphoric repetition), 0.88 (presence of a possessive determiner) and 0.82 (presence of a relative clause), indicating very good agreement across coders. All disagreements were solved through discussion. Each coder then individually coded one third of the remainder of the corpus.

Analysis of the corpus

The corpus included 4992 utterances produced: 96 utterances per dyad (12 items x 8 stories) x 54 dyads. Except for word count, the first production of each block of trials was not taken into account in the analysis, as it represented the starting point of each story or each block (and thus could not be preceded by another utterance; the level of coherence of this first utterance could thus not be coded). Without these initiating utterances (11 items x 8 stories = 88 utterances for a dyad), the final corpus included 4576 utterances, with 2200 (88 x 25 dyads) produced in the non-collaborative condition (including 1100 utterances for each valence) and 2376 (88 x 27 dyads) produced in the collaborative condition (including 1188 utterances for each valence).

Linear (word count) and logistic (verbatim and anaphoric repetitions, possessive determiner) mixed models were used (see Baayen et al., 2008) in SAS 9.4 (GLIMMIX procedure). The maximal random structure justified by the experimental design (i.e., all random intercepts and all random slopes corresponding to within-unit independent variables (IV)) was initially implemented, in line with Barr et al. (2013). When random effects caused G-matrix convergence issues, they were identified and removed from the model, which has no effect on the outcome of the analysis (Kiernan et al., 2012). Because the number of observations in each cell of the design varied across cells (as the number of participants was not the same in both conditions), a Satterthwaite correction was applied to correct the degrees of freedom.

Table 1 shows the characteristics of this final corpus in each Condition (Non-collaborative vs. Collaborative) and as a function of Valence. The final random structures of the model (A), the test of fixed effects (B) and the model parameters (C) for each model are reported in Table 2. Note that the analyses on the presence of a relative clause could not be conducted, as they were never used in the non-collaborative condition (thus, the variance was null in this condition).

Word count. Participants produced longer utterances in the collaborative condition than in the non-collaborative condition. In order to account for this, this variable was included as a (centered) covariate in all subsequent analyses.

Verbatim repetitions. Participants were more likely to use verbatim repetitions in the collaborative condition than in the non-collaborative condition, *OR(Ref=non-collaborative condition)* = 3.38, $CI_{.95}$ = 2.17, 5.26. They were also more likely to use verbatim repetitions in utterances which included a negative word than in utterances which included a neutral word, *OR(Ref=neutral)* = 1.37, $CI_{.95}$ = 1.12, 1.69.

Anaphoric repetitions. Anaphoric repetitions were more likely in the collaborative condition than in the non-collaborative condition, *OR(Ref=non-collaborative condition)* = 13.81, $CI_{.95}$ = 6.68, 28.55. There was also a significant Condition x Emotion interaction. In the collaborative condition the neutral/negative ratio was slightly reversed compared to this same ratio in the non-collaborative condition: in the former participants were more likely to use anaphoric repetitions in utterances including neutral than negative words, whereas in the latter they were more likely to use them in utterances which included negative than neutral words.

Possessive determiners. Possessive determiners were more likely to be produced in the collaborative condition than in the non-collaborative condition, *OR(Ref=non-collaborative condition)* = 3.86, $CI_{.95}$ = 2.12, 7.03.

In sum, these preliminary analyses confirm that within each block of items, participants produced utterances which were more coherent with each other in the collaborative condition than in the non-collaborative condition. Moreover, an additional finding was that the use of verbatim repetition (and anaphoric repetition to a certain extent) was influenced by the valence of the words shown on the participants' screens. We will return to this unexpected finding in the Discussion section.

-----Insert Table 1 here----

-----Insert Table 2A, 2B and 2C here----

Main analyses: Content and Source memory

Data coding and analysis

The first dependent variable (DV), content memory, corresponded to the probability of correctly recalling a word (each word was coded 1 if it was recalled correctly and 0 if it was not recalled). The second DV, reality-monitoring, corresponded to the probability of correctly recognising the origin of a word (self vs. partner; each word was coded 1 when its origin was recognised correctly and 0 when it was not).

As in the preliminary analyses, logistic mixed models (GLIMMIX procedure) were initially used in SAS 9.4 for each DV. The maximal random structure justified by the experimental design was initially used. The Satterthwaite correction was applied to correct the degrees of freedom Because the participants' success rate on the reality-monitoring task was very high, the complementary log-log model link was applied to account for success probability (Agresti, 2002, p.249) for this DV. In such cases, SAS calculates means instead of odd ratios.

The IVs were Condition (between-subjects: collaborative vs. non-collaborative), Emotion (within-subjects: negative or neutral) and Production (within-subjects: self vs. partner-produced). Word count was added as continuous predictor. Multiple comparison tests were carried out with a Bonferroni adjustment to examine the differences between modalities when significant effects were found.

Data analysis

Content memory. The random effects structure, the test of fixed effects and the model parameters are reported in Table 3.

The analysis revealed that nouns were more likely to be recalled in the collaborative condition than in the non-collaborative condition, *OR(Ref= non-collaborative condition)* = 1.43, $CI_{.95}$ = 1.14, 1.80; and that self-produced nouns were more likely to be recalled than partner-produced ones, *OR(Ref=partner-produced)* = 1.66, $CI_{.95}$ = 1.50, 1.83. The effect of Emotion was not significant, *OR*(*Ref=neutral*) = 1.12, $CI_{.95}$ = 0.88, 1.42.

Importantly, significant interactions provided further insights into the results (see Figure 1). Firstly, the analysis revealed a significant Emotion by Condition interaction: Whereas neutral nouns were recalled better in the collaborative condition than in the non-collaborative condition, $t(120.4) = 4.21$, $p = .0003$, $OR = 1.79$, there was no significant difference between conditions for negative nouns, $t(113.9) = .97$, $p = 1$, $OR = 1.14$. Second, a significant Production by Condition interaction reflected the fact that although partner-produced words were recalled better in the collaborative condition than in the non-collaborative one, $t(139.7) = 4.70$, $p < .0001$, $OR = 1.83$, there was no significant difference between the manipulated conditions for self-produced words, $t(113.5) = .91$, $p = 1$, $OR = 1.12$. All other interactions were non-significant (all $Fs < 1$).

-----*Insert Figure 1 here*----

-----*Insert Table 3 here*----

Reality-monitoring. The random effects structure, the test of fixed-effects and the model parameters are reported in Table 4. As illustrated in Figure 2, all three main effects were significant. Performance on the reality-monitoring task was higher for neutral (*Estimated Mean = 1.046, SE = 0.061)* than negative items (*Estimated Mean = 0.710, SE = 0.060)*; for partner-produced items (*Estimated Mean = 1.017, SE = 0.051)* than for self-produced items (*Estimated Mean = 0.739, SE = 0.050)*; and for the non-collaborative condition (*Estimated Mean = 1.020, SE = 0.061)* than for the collaborative condition (*Estimated Mean = 0.735, SE = 0.058)*. All interactions were non-significant (all *Fs* < 3).

-----Insert Figure 2 here----

-----Insert Table 4 here----

Discussion

Any dialogue requires people to collaborate which each other, at least to a certain extent. The first goal of this work was thus precisely to comprehend the impact of the collaborative nature of the interaction on the mechanisms at play in conversational memory. To do this, two verbal interaction settings were directly compared; in one, the partners were instructed to coordinate their productions in order to create a coherent story, whereas in the other no coordination instructions were provided. The results clearly revealed that the partners' content memory was improved in the collaborative condition, in comparison to the non-collaborative condition. Moreover, the discourse marker analysis confirms that the features of the utterances produced differed across conditions. In the collaborative situation, participants produced utterances which were connected with what had been said previously, as reflected by the greater use of verbatim and anaphoric repetitions as well as possessives. One possible explanation is that our collaborative situation required a greater cognitive effort, due to the use of coherence markers and the production of longer sentences. Such additional processing might have led to a more efficient memorization of the information shared during the interaction. In any event, these findings corroborate the idea that collaboration impacts memory (e.g., Barber, et al., 2010), and more precisely work showing that shared encoding tasks benefit to memory by promoting stronger cross-item elaboration (e.g., Harris et al., 2012). For instance, it is well documented that efficient social interaction enhances communication success as it contributes to the creation of common representation shared by all partners (e.g., Fay et al., 2018; Micklos et al., 2020).

In contrast, source memory was impaired in the collaborative condition, in comparison to the non-collaborative condition. This suggests that the participants' improved memory for content might in turn negatively affect the processing of features considered as peripheral (e.g., source information), making remembering who said what more difficult, consistently with previous studies on this topic (e.g., Fischer et al., 2015; Jurica & Shimamura, 1999; Le Bigot et al., 2018). The processing of both the information and its source might cause a competition for necessarily limited attentional resources (Baddeley, 1992; Kahneman, 1973). In summary, we suggest that the collaborative situation involves a more elaborated processing of the utterances *per se*; but that although this focus on content involves better memorization of the information, its cognitive cost also decreases the amount of attention available for reality-monitoring. Of course, it is important to note that the features of the collaboration task used in the current study (i.e., developing a shared story) may not have encouraged the participants to pay attention to who said what, in comparison to other conversational settings (even though the probability of recognizing the source was very high). In other words, the question of whether our results may be generalized to other verbal interaction settings remains to be answered.

Previous studies (Fischer et al., 2015; Le Bigot et al., 2018; McKinley et al., 2017; Yoon et al., 2016) have argued that conversational memory is shaped by ordinary memory effects such as the self-production effect (MacLeod et al., 2010) and the emotion-based effect (e.g., Holland & Kensinger, 2013; Kensinger, 2009). Importantly, consistent with our hypothesis, the analyses revealed that information that remained non-salient in the non-collaborative condition (neutral and partner-produced words) became salient in the collaborative condition to a level similar to otherwise salient information (emotional and self-produced words). In other words, the information which is usually found to be non-salient becomes salient when people collaborate. One important aspect of these findings is that they highlight that dialogue is all the more a situated activity in which individual and contextual-based factors are crucial; what is more, these findings offer a better understanding of why researchers sometimes find it difficult to generalise findings obtained in more or less collaborative experimental settings. These two considerations may have direct implications for dialogue research.

For instance, a very clear production effect was found in this experiment (i.e., self-produced content was remembered better than partner-produced content) whereas the opposite pattern was found for reality monitoring. Thus, the current findings add to the literature by highlighting the robustness of the self-production effect in conversational memory (Fischer et al., 2015; McKinley et al., 2017; Yoon et al., 2016). Interestingly, although the self-production effect was attenuated in the collaborative condition, we nonetheless failed to find a partner-production effect such as that reported by Stafford and Daly (1984). Thus, the partner-production effect does not necessarily occur in all collaborative conversational settings. As highlighted in the introduction, it is possibly due to the fact that the participants were more familiar with their own productions in the Stafford and Daly study (in contrast, the participants did not chose the topics under discussion in the current study). As for the emotional effect, the literature states that cognitive processes such as attention (e.g., Vuilleumier, 2005) or learning and memory (e.g., Phelps, 2004) are affected by emotional events. In the present work, the results are consistent with the idea of a cognitive cost of processing emotional events which directly impairs the processing of features considered as peripheral. This is consistent with the attentional resources hypotheses described in the WFE in the emotion research literature (e.g., Earles et al., 2016; for a review see Fawcett et al., 2013). Indeed, in the current study, trials which involved processing a negative word led to poorer source recognition than trials based on neutral words. The corpus analyses conducted can shed further light on this discussion. Some of the discourse markers were more likely to be used in the emotional condition than in the neutral condition (e.g., verbatim repetitions). Therefore, when dialogue partners had to produce an utterance involving emotional content, their productions were likely to be connected with pieces of information which had previously been produced or heard. We suggest that this unexpected influence of emotion on the production of utterances *per se* may also be linked to the attentional resource hypothesis: The greater use of pieces of information which had already been produced or heard in the emotional condition could reflect an attempt to reduce the speaker's cognitive costs, as these pieces of information would be readily available to him or her through automatic priming processes.

To conclude, we have demonstrated that the nature of the dialogue setting can modulate the influence of common effects on conversational memory. In addition, the current results reveal an effect of collaboration both on memory and on the features of the utterances produced. Although the latter was not initially expected, both kinds of results can be linked to the attention-based hypothesis. Future work may examine the determinants of this collaboration-driven memory boost, including the nature of the partners' relationship and/or of the utterances produced during the interaction, and also the potential emotional contagion mechanism which is likely to affect people in dialogue settings.

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