Social Offloading:
Just Working Together is Enough to Remove Semantic Interference

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Abstract

Cognitive interference is a classic cognitive phenomenon: processing one stimulus while ignoring another is more challenging when the two are related. Recently, and surprisingly, it has been shown that an individual's cognitive interference can be removed by the people around them. In the picture-word interference paradigm, participants respond to a target picture and ignore distractor words. If the words are semantically related to the target, interference slows responses. We found that this cognitive interference was removed, or socially offloaded, when participants believed that they were working together with another person. In contrast to previous studies we found it did not matter if the other person worked on the distractor words or on task irrelevant, coloured squares. Furthermore, the time course of this effect suggests that the social offloading of semantic interference is underpinned by late inhibitory mechanisms rather than early distractor filtering.

Keywords: cognitive offloading; distributed cognition; joint action; interference effects; social context

Introduction

Behaviour is embedded in a complex environment of objects and people. Studies of situated cognition have shown how cognition is grounded in our interactions with the world (e.g. Kirsh, 2008), and the people within it (Hutchins, 1995). One model of cognition that highlights the importance of context is cognitive offloading (Risko & Gilbert, 2016). Cognitive offloading reflects an extended and distributed view of cognition whereby the physical environment in which an individual finds themselves affords opportunities to offload cognitive processing and thereby reducing internal cognitive demands.

According to this theory there are two possible routes to offloading, onto the body or into the world. The former may, for example, involve the use of gestures to externalise thoughts (Chu & Kita, 2011), while the latter comprises of actions that either involve the use of physical tools in the environment such as notepads for writing (Risko & Dunn, 2015), or draw on other agents in the social world, something that has been described as "socially distributed cognition" (Hutchins, 1995).

One example of socially distributed cognition is the offloading of knowledge to others. In a transactive memory system, information (an individual's memory) is spread across one or more other individuals such that the system as a whole knows more than any one individual (Wegner, 1987). In such cases, the cognitive demand required to remember such information has been offloaded to someone else, or put differently, it can be said that memory information is being taken care of by another individual.

However, we propose a broader interpretation of offloading behaviours in socially distributed cognitive systems such as transactive memory. Rather than viewing offloading as solely the sharing of cognitive resources across agents to reduce individual internal demands, these behaviours could also be viewed as the use of agents to filter potentially distracting information. In such cases, responsibility for information that might otherwise cause conflict with an individual's ability to process other (possibly more relevant) information can be offloaded to another person. As such, offloading behaviours may not only function to reduce internal cognitive demands but also internal cognitive conflicts (interference) by encompassing mechanisms that attenuate the influence of distracting information and thereby facilitate performance.

Continuing to use transactive memory as an example, not only does the dividing of encoding responsibilities across individuals afford the opportunity for more items to be remembered by the group than by any one person (the reduction of cognitive demands) but it may also allow each person within the system to remember their own items better than they would have done alone (the reduction of cognitive interference). This dynamic and situated interplay between the individual and others, afforded by a social context (involving two or more people), and which crucially leads to facilitated individual performance when working together compared to working alone, we define as social offloading.

At its most basic, social offloading describes any shared task-based situation in which an individual is able to leverage agents in the social world (either implicitly or explicitly) to facilitate their own cognitive performance. Underlying mechanisms will therefore be socially sensitive and in appropriate social contexts trigger offloading behaviours. These may include the freeing up of cognitive resources through sharing cognitive demands with other agents or the increasing efficiency of ongoing processes through socially led modulation of cognitive interference. It is the latter that is the focus of this paper.

Classic cognitive interference paradigms lend themselves well to the systematic investigation of social offloading as described. These paradigms offer sensitive measures of cognitive interference that reflect the balance in processing between target and task-irrelevant distractor stimuli. Furthermore, they are often conducive to splitting between two individuals, providing opportunities to test the influence of minimal social contexts and their characteristics (e.g. task sharing with someone else). Comparing levels of interference between one condition in which a person acts alone, versus when performing the same task with a partner, reveals the degree to which working together influences the balance in target-distractor processing and as such reveal the social sensitivities of the mechanisms that underpin social offloading behaviour.

Studies using interference paradigms have shown that even the mere presence of another person is a sufficient social context to induce social offloading. For example, Huguet, Galvaing, Monteil and Dumas (1999) demonstrated that levels of Stroop task interference can be reduced and therefore task performance improved just by being in the presence of a passive, non-evaluative partner. In the language of social offloading, simple social presence has changed the way distractor information is internally processed such that its influence on behaviour is offloaded, permitting target processing to precede more efficiently and with less conflict.

But just how socially sensitive can social offloading be? To what extent and in what ways does the nature of different social contexts shape social offloading and make it more or less permissible? And what are the possible mechanisms that underpin this phenomenon?

A recent study by Sellaro, Treccani and Cubelli (2018) has taken steps to address some of these questions and offer a more nuanced view of this phenomenon. Using a picture-word interference (PWI) paradigm they show that distractor stimulus interference can be socially offloaded when performing a joint task with an active, non-evaluative partner. Furthermore, social offloading critically depends on the partner task involving the distractor stimulus.

In the individual task, participants are presented with a series of words written on top of pictures. Some of these picture-word combinations are related in their semantic category (e.g. dog-cat, table-lamp) or unrelated (e.g. dog-lamp, table-cat). Participants have to vocalise the name of picture while ignoring the word. Despite the words being task irrelevant results show longer naming latencies for semantically related combinations compared to unrelated combinations, a semantic interference effect. In the joint task version, participants continue to respond to the target picture, but are now told that they will work with a partner seated in another room. They are told their partner will see the same picture-word combination but will 'work on' the words by reading them aloud and as such they will 'take care of' the distractor words. This creates a joint task with a clear division of labour. I'll take care of the pictures, while you take of the words. Despite participants being unaware of semantic interference, in the joint condition, interference is significantly reduced (Experiment 2). The authors conclude that in joint tasks where there is a clear division of labour and task irrelevant distractor information is 'taken care of' by another person, target stimulus performance can be improved as distractor interference is socially offloaded and ceases to cause response conflict.

This result adds to an intriguing and growing body of research demonstrating the social offloading of interference effects (e.g. see Sharma, Booth, Brown & Huguet, 2010, using the Stroop task; see Heed, Habets, Sebanz & Knoblich, 2010, using a cross-modal Simon task). Most interestingly, Sellaro et al. (2018) also showed that when participants worked in the joint condition with a partner who, rather than taking care of the word, was now working on the same pictures as them (albeit a different task), semantic interference returns (Experiment 3). The authors claim that the offloading of semantic interference depends critically upon someone working on the distracting stimuli and suggest that simple co-presence or co-working which leaves the distractor words "uncared for" is not enough for social offloading to occur.

This paints a socially sensitive and nuanced view of social offloading, one that says offloading behaviours are shaped not only by social presence but also by what others are doing in relation to ourselves. However, there is an alternative account for this result. When both the participant and the partner are working on the same picture a scenario of shared object attention is created. Sharing attention with another person to an object and its properties is thought to increase cognitive resources allocated to that object and is likely associated with an increase in cognitive load (Shteynberg, 2015). Under conditions of increased cognitive load, the effects of interference have been shown to strengthen (e.g. Chen, 2003). Therefore, the return of interference may have been a result of increased interference from sharing attention to the pictures, masking underlying offloading effects. In this alternative account, social offloading mechanisms appear less nuanced. We would predict that in the absence of shared object attention engaging in a joint task with a clear division of labour should be sufficient for social offloading to occur irrespective of what a partner 'takes care of'.

In this study we aim to resolve these two alternate accounts by replicating the joint PWI task while further manipulating the partner's role. In one case, the participant is told that their joint task partner will takes care of the word, as per the original paradigm. We call this the Word-Master condition. In the second case, a task irrelevant, non-distractor object is added in addition to the picture and word (a highly faded coloured square placed behind both the picture and word stimuli) and the participant is told that their task partner will take care of the coloured square. We call this the Colour-Master condition.

We predict that if social offloading is contingent on the distractor word being taken care of then we would expect interference to be removed *only* in the Word-Master condition. In contrast, if this effect is not contingent on the distractor stimuli being taken care of but simply on participants believing they are jointly engaged in a shared division of labour task, then we predict the removal of interference in *both* the Word-Master and the Colour-Master condition.

We have also made a number of methodological refinements to the joint task PWI paradigm used by Sellaro et al. (2018). These included employing a fully counterbalanced within subject design, having a real person meet the participant and play the role of task partner, using only upper-case letters for the distractor words rather than the mixed upper- and lower-case letters, and using a manual response to avoid participant self-awareness of evaluation when vocalising their answers known to decrease interference (e.g. Harkins, 2006). Semantic interference produced by manual responses have been shown to be equivalent to vocal responses (Rahman & Aristei, 2010).

Methods

Participants

Seventy-eight participants from the University College London subject pool volunteered to participate in exchange for a £5 payment. Previous research using joint task interference paradigms suggested that at least forty-four participants were required in order to achieve 80% power for a medium effect size when employing a standard 0.05 criterion for statistical significance.

Twelve participants were excluded a priori from analyses, seven for performance at chance, and five for stating in the debrief that they guessed the other participant was a confederate. A total of sixty-six participants were analysed (mean age 24.5 years; 19 males, 47 females).

Informed consent was obtained from all participants prior to beginning. We used a confederate to play the partner role in each experiment, they were selected from one of four research assistants (2 male, 2 females) and randomly assigned across participants to ensure none of the observed effects would be due to the identity of the confederate.

Design

We employed a 2x2x2 mixed design: with two within subject factors, *Picture-Word* and *Social-Context,* and one between subject factor, *Confederate-Role*. The factor *Picture-Word* had two conditions (Semantically-Related & Semantically-Unrelated), *Social-Context* had two conditions (Alone & Joint), and *Confederate-Role* had two conditions (Word-Master & Colour-Master).

Apparatus and Stimuli

The participant and confederate were seated in chairs on opposite sides of an opaque divide. They both could hear instructions given by the experimenter but were unable to directly see each other. Participants sat 60cm in front of a 20” LCD computer screen, with headphones, keyboard and mouse. All apparatus was replicated for the confederate.

The experiment was hosted, and data collected using the Gorilla Experimental Builder (www.gorilla.sc) (Anwyl-Irvine, Massonnié, Flitton, Kirkham & Evershed, 2018). The main dependent variable was reaction times to categorising the last letter of picture names as vowels (keyboard press 1) or consonants (keyboard press 9).

Stimuli were picture target and word distractor combinations that were either semantically related (e.g. Drum-Flute) or unrelated (e.g. Tree-Dress). Related picture-word combinations were obtained from previous studies (Costa, Alario & Caramazza, 2005; Geng, Kirchgessner & Schnur, 2013; Vigliocco, Vinson, Lewis & Garrett, 2004), and were matched for length, frequency, age of acquisition, phonological overlap and familiarity (see Costa, Alario & Caramazza, 2005; Geng, Kirchgessner & Schnur, 2013; Vigliocco, Vinson, Lewis & Garrett, 2004, for further details). Unrelated picture-word combinations were created from this set of distractor words ensuring no categorical relationship.

Picture targets consisted of thirty-two black and white line drawings of everyday objects across a range of categories in line with previous studies (e.g. Rahman & Aristei, 2010). Twenty-eight items were selected from Snodgrass and Vanderwart (1980) and a further four items from the BOSS (Brodeur, Guérard & Bouras, 2014). Pictures were presented on a white background and scaled so that they fitted within a 300x300pixel area.

A single trial consisted of a single picture target with a single distractor word (either related or unrelated) in red, upper case courier new bold font presented on top of the picture in such a way as to achieve maximal central coverage without obscuring it.

For the Colour-Master condition an additional coloured square measuring a 600x600pixel area was centred behind each picture-word combination and presented across all conditions. There were four different colours of square (blue, green, red and yellow), faded to make colour discrimination noticeable but challenging. Presentation of each colour was counterbalanced across both *Picture-Word* and *Social-Context* conditions.

Half of the pictures ended in a vowel and half in consonant, half of the distractor words ended in vowel and half in a consonant, and combination selections were made to ensure counterbalancing of letter ending between picture and word. This meant there were an equal number of vowel-vowel, vowel-consonant, consonant-vowel, consonant-consonant picture-word combinations. Picture-word stimuli combinations were then pseudo-randomised to avoid the adoption of a response strategy.

Procedure

While participants completed a consent form, the confederate arrived, posing as a second participant. The paradigm was then explained in detail to the participant (and the confederate). Participants either started with the Alone or Joint block of trials, with the order of which was counterbalanced between participants.

To create the belief of social connection, participants were told that they would be playing a "picture-word game" twice, once individually (*Social-Context* - Alone condition) and once as part of a team with the confederate (*Social Context* - Joint condition). Pre-recorded videos were used to deceive participants into believing that the two computers used in the experiment would be connected with a shared screen. During the Joint condition, the participant and confederate would play the game as a team, seeing the same stimuli on their screens, despite sitting on either side of a partition and not being able to see each other. Participants were told that during the Alone task the connection would turned off and they would play individually. In reality, the two computers were never connected, and the participants always worked alone. Throughout the experiment participants were always in the same room as the confederate.

It was explained that they would take on one of two roles at random during the game. In fact, the participant was assigned the role of picture master and the confederate the role of word or colour master. They were instructed that the picture master's role is to take responsibility for the picture and to decide if the last letter of the picture name is a vowel or consonant. The word master's role is to decide if the word contains a single vowel or more than one vowel. The colour master's role is to decide if the coloured square is red or blue versus green or yellow.

Across the experiment, each participant completed a total of 128 test trials split into two 64 trials test blocks (one Alone, one Joint) and each block began with 10 practice trials (using combinations different from the test trials). Each trial started with a centrally positioned fixation cross displayed for 500ms, followed by a picture-word stimulus. After a response was registered a blank screen presented for 500ms, followed by the next trial. If no response is given after 2500ms the trial ends and the next trial begins. An ISI timing of 1000ms is thought to be long enough for the detection of inhibitory processes (Sharma et al., 2010).

Results

RT Analysis by Participant

We found that semantic interference effects were present in the alone condition, as expected. But regardless of what the confederate's task was the interference effects were removed in the Joint condition.

Mean RTs by participant were calculated for all correct trials (94.4% of the data). We excluded trials on which participants may have anticipated their response (RT<150ms) and trails with RTs more than 3SD above their mean response times by trial type (a further 1.0% of the data). We then conducted a three-factorial mixed-design 2x2x2 ANOVA with two within subject factors, *Picture-Word* and *Social-Context*, and one between subject factor, *Confederate-Role*. As predicted, we observed a significant main effect of *Picture-Word*, $F(1, 64) = 6.50$, $p = .01$, $\eta_p^2 = .09$, with mean reaction times for Related trials (M = 1050ms, SEM = 22ms) slower than Unrelated trials (M = 1034ms, SEM = 22ms) representing an overall semantic interference effect of 16ms.

Importantly, the two-way interaction between *Picture-Word* and *Social-Context* was significant, $F(1, 64) = 13.87$, $p < .001$, $\eta_p^2 = .18$. Post hoc comparisons showed that there was a significant semantic interference effect in the alone condition $t(128) = 4.43$, $p < .0001$), with related trials 37ms slower than unrelated. In contrast, the difference in the Joint condition was -7ms and non-significant, ($t(128) = -0.80$, $p = .43$). The main effect of *Social Context* was not significant overall, $F(1, 64) = 0.62$, $p = .43$, $\eta_p^2 = .01$.

Crucial to our hypothesis, the three-way interaction between *Picture-Word*, *Social-Context* and *Confederate-Role* was non-significant, $F(1, 64) = 1.18$, $p = .28$, $\eta_p^2 = .02$. Semantic interference effects were present in the Alone condition whether the confederate looked after the distractor word (28ms) or looked after the non-distractor coloured square (47ms), and these effects went away in the joint conditions (-4ms, and -10ms respectively – see figure 1)

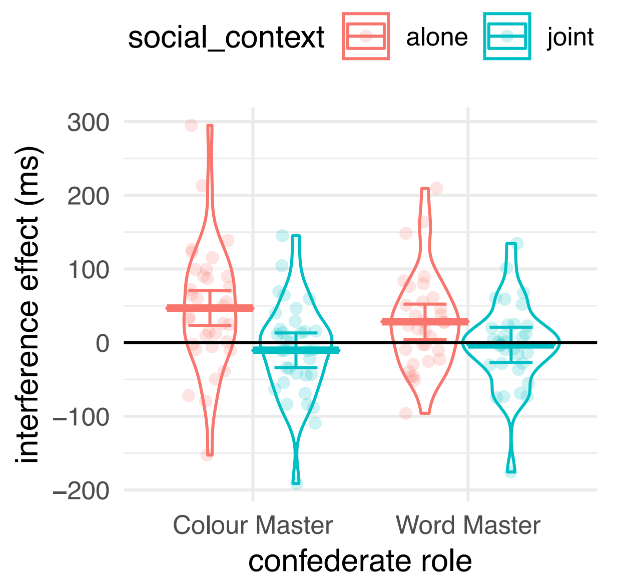

Figure 1: Mean interference times (ms) by *Social Context* & *Confederate-Role* conditions, error bars represent SEM

To determine if order or practice effects modulated this result, analyses were re-run using a four-factorial mixed-design 2x2x2x2 ANOVA keeping the two key factors of interest, *Picture-Word* and *Social-Context* but then including two further factors, *Block-Half* (within-subject) and *Order* (between-subject). The factor *Block-Half* had two levels, First-Half (trials 1-32) and Second-Half (trials 33-64) and was included to determine the influence of practice effects. The factor *Order* had two levels, Alone-First and Joint-First, reflecting which block was taken first.

There was no evidence for practice effects on the removal of semantic interference by social context as this result did not interact with *Block-Half*, $F(1, 64) = 0.09$, $p = .76$, $\eta_p^2 = .001$. However, the three-way interaction of *Order* with *Picture-Word* and *Social-Context* did approach significance, $F(1, 64) = 3.08$, $p = .08$, $\eta_p^2 = .05$, suggesting there may have been some carry over effect, with the removal of interference stronger for those participants completing the Alone condition first compared to the Joint condition. Importantly, the two-way interaction of *Picture-Word* and *Social-Context* remained significant $F(1, 64) = 14.08$, $p < .001$, $\eta_p^2 = .18$.

Participants got quicker over the course of the experiment. This is shown by the interaction of *Order* with *Social-Context*, $F(1, 64) = 347.62$, $p < .0001$, $\eta_p^2 = .84$, indicating that overall response times were faster on the whichever block came second. And by a main effect of *Block-Half*, $F(1, 64) = 85.59$, $p < .0001$, $\eta_p^2 = .57$, showing that participants were faster during the second half of trials compared to the first half. No other main effects or interactions reached significance (all *F*s < 2.50, ps > .1).

Error Analysis by Participant

We conducted the same analyses for participant performance measures (% correct) to ensure results cannot be explained by a speed-accuracy trade-off. No main effect or interactions reached significance (all *F*s < 0.90, ps > .35).

RT Analysis by Item

The picture-word paradigm consisted of 32 picture targets. As such semantic interference effects can be measured for each picture. As a baseline, interference was calculated for each picture for non-social blocks and ranked by magnitude. Of the 32 items, 22 generated semantic interference. These 22 items were then subjected to same analyses as participant RTs to confirm that the participant effects seen were not due to an increased facilitation for the 10 items not generating interference.

A 2x2 repeated measures ANOVA revealed a significant main effect of *Picture-Word*, $F(1, 21) = 14.48$, $p = .001$, $\eta_p^2 = .41$, and crucially, a significant interaction between *Picture-Word* and *Social-Context*, $F(1, 21) = 21.08$, $p < .001$, $\eta_p^2 = .50$. In the Alone condition these items generated an average interference effect of 69ms ($M_{related} = 1106$, $SEM_{related} = 18$ms; $M_{unrelated} = 1037$ms, $SEM_{unrelated} = 18$ms), while in the Joint condition this reduced to 2ms ($M_{related} = 1039$, $SEM_{related} = 18$ms; $M_{unrelated} = 1037$ms, $SEM_{unrelated} = 18$ms). Post hoc comparisons confirmed a significant interference effect in the Alone condition, $t(40) = 5.84$, $p < .0001$, then removed in the Joint condition, $t(40) = 0.09$, $p = .93$.

Time Course Analysis

RTs were analysed to produce time course plots of interference by condition (*delta* plots), as described by Ridderinkhof, Scheres, Oosterlaan and Sergeant (2005). This was to shed light on the nature of possible mechanisms underpinning social offloading behaviours. One possibility is for social offloading mechanisms to be driven by slow inhibitory processes that build over time and increasingly reduce distractor conflict with longer response times. Alternatively, social offloading mechanisms maybe occur very early and involve the immediate filtering of distractor information.

Mean RTs were divided by participant and trial type, ranked by speed, and then divided into four quartile ‘bins’ such that there were equal number of trials per bin, and with Q1 containing on average the fastest responses through to Q4 the slowest responses. For each bin, mean related trial responses were subtracted to their unrelated bin counterpart for social and non-social conditions to yield semantic interference magnitudes as a function of trial response speed. Mean RTs were then reanalysed in a three-factor 2x2x4 repeated measures ANOVA with *Picture-Word*, *Social-Context* and *Quartile* (four levels: Q1, Q2, Q3, Q4) as within subject factors. As expected this analysis continued to reveal a two-way interaction between *Picture-Word* and *Social-Context*, $F(1, 65) = 15.04$, $p < .001$, $\eta_p^2 = .19$. Most interestingly, there was a three-way interaction between *Picture-Word*, *Social-Context* and *Quartile*, $F(1, 108) = 7.87$, $p = .001$, $\eta_p^2 = .11$, indicating that the size of the semantic interference effect varies significantly by condition over time (see figure 2). Means reveal that the relative sizes of interference between the Alone and Joint conditions increasingly diverge with increasing response time, a shape consistent with slow, late inhibitory mechanisms.

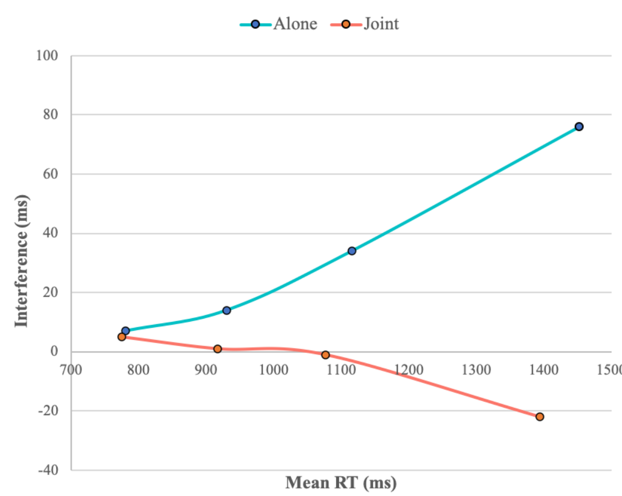

Figure 2: Delta plot of semantic interference by *Social-Context* condition as a function of response speed

Discussion

Cognitive interference is a well-established cognitive phenomenon that throws a spanner in the cognitive works, impairing performance. Yet we were able to remove semantic interference and improve cognitive performance by making simple changes to the social context. Responding to the target stimulus, while believing that someone else is taking care of the ignored distractor stimulus, appears to erase the conflict between the two and improve task performance. We propose this as an example of social offloading and argue that it adds to a growing number of examples of how cognitive interference can be offloaded by social context and result in facilitated performance (e.g. Heed at al., 2010).

Our main social offloading result replicates, as predicted, the findings in Experiment 2 by Sellaro et al. (2018) while also generalising to a within subject design, upper case words, a real person partner, and a manual response PWI task. Crucially, we extend these findings by demonstrating that when working with another person the offloading of semantic interference does not critically depend upon that person working on the distractor stimulus. Even when the task partner worked on a separate, non-distractor stimulus, leaving the distractor stimulus "uncared for", semantic interference was still removed in the joint condition.

This calls into question the claims made by Sellaro et al. (2018) that the removal of semantic interference depends upon a partner working on the distractor stimulus. We believe we have taken adequate measures to take explicit control of the partner role giving us confidence in concluding that in the absence of shared object attention engaging in a joint task with a clear division of labour is sufficient for social offloading to occur irrespective of what the partner 'takes care of'.

It also is important to draw attention to the fact that the only difference between our two *Social-Context* conditions was the mere belief of participant that they were working on a task alone or with another person – *shared task belief*. Our experimental set up meant that in both the alone and joint condition all perceptual information remained the same and the working partner was always present in the room with the participant. Given the occurrence of semantic interference in the alone condition and the removal of this interference in the joint condition, mere presence is not a sufficient explanation for the results. While it didn't matter what their partner was doing, for social offloading to occur participants had to believe they were at least engaged with the partner on a shared task at the same time. This belief alone was sufficient to remove interference.

What could be the mechanisms underpinning these cases of social offloading? One account is that working together with another person influences the level of motivation a person has to perform well. Increased motivation is known to narrow attention and may lead to decreased interference (Harkins, 2006). However, there is no evidence from the data to suggest that participants were any more motivated in the Joint vs Alone tasks as neither reaction times nor error rates were statistically different between conditions.

Another possible explanation is that the increased cognitive load from being in a social situation leads to the narrowing of attention and the increased ability to filter distractor stimuli. However, we argue this is also an unlikely account as cognitive load has been shown repeatedly to impede performance and increase interference, the opposite of the social offloading effect (see Lavie, 2005). Furthermore, time course delta plots reveal that the difference in interference between the Alone and Joint conditions builds up slowly over time, consistent with an inhibitory mechanism account rather than an early overload account.

The suggestion that social offloading processes are underpinned by late inhibitory mechanisms, aligns with work done on other interference tasks. Sharma et al. (2010) demonstrated that Stroop task interference can be reduced in the presence of a passive, non-evaluative partner. Importantly for the social offloading account, they argue against a purely motivational or load account for their pattern of results. They show that the effect of removing interference builds slowly over time, only conferring a benefit to performance if the inter-stimulus interval was long enough. They claim this is more consistent with a late rather than early selection account, which states that motivation or load collapses the attention window, increasing attentional focus, and decreasing the likelihood of the distractor being processed upfront. They conclude that the presence of someone else is more likely to activate late-selection mechanisms of selective attention whereby the distractor is initially processed normally but then strongly inhibited before a response is given.

Taken together such evidence points towards the offloading of cognitive interference being mediated by socially sensitive, top-down, and selective inhibitory processes. Put another way, once situated in the appropriate social context and following the initial and automatic processing of distractors, resultant cognitive interference effects are being "internally and implicitly offloaded" by socially led inhibitory control mechanisms, resulting in the facilitation of performance. A view consistent with our definition of social offloading and one in which offloading behaviours may be seen to be implicit and automatic as well as decided upon and selected.

Questions still remain around what makes the social context appropriate for social offloading to occur. Results from this current study do not suggest that such processes are sensitive enough to be shaped by the specifics of a partner's task. Though unlike Sharma et al. (2010) they do suggest that participants need to believe they are at least engaged in a shared task together. Social offloading may in fact be sensitive along other dimensions. For example, Gobel, Tufft & Richardson (2018) have shown that inhibitory attention mechanisms are modulated by social context such that the magnitude of inhibition of return (IOR) effects is increased when the attentional cue bears social relevance. In a series of experiments IOR magnitude is compared between an individual task condition, in which participants are told that visual attention cues are randomly generated by a computer, and a joint task condition, in which participants are told cues represent where a partner has just looked. Crucially, the increase in IOR magnitude seen in the social, joint task condition is modulated by the social status of the partner, and only when participants believe those partners are engaged in the same shared task. This offers a natural next step: using semantic interference to understand the sensitivity of social offloading to the characteristics of a partner rather than the partner's task.

Conclusion

Here we have explored the conditions under which participants will exploit the presence of others to reduce cognitive interference, and socially offload. In contrast to other researchers, we found that participants' practice of social offloading their cognition was not sensitive to exactly what task their partner was engaged in.

One possibility, of course, is that there are other aspects of a partner's task that we could have explored that would perturb social offloading. The other possibility is that we have been looking at the phenomena of social offloading backwards. We have been assuming that an individual will process information as a lone cognitive agent, unless a precise constellation of circumstances allows them to socially offload to another. But perhaps cognition is not individual by default, but social. Social offloading, and other forms of distributed cognition, might in fact be the default case and represent a fundamental and skilful attunement to the social world.

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