KEY WORDS: Collaborative cognition, cognitive aging, interpersonal cueing

With a Little Help from my Spouse:

Does Spousal Collaboration Compensate for the Effects of Cognitive Aging?

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Abstract

Background: Collaborating with another person may help people compensate for aging-related losses in memory performance. However, collaborating in itself is effortful and draws upon individual cognitive resources. One factor that can facilitate collaboration, and decrease its resource requirements, is familiarity between interaction partners. Such facilitation should be particularly important when cognitive-mechanic resources are low. **Objective:** The current study was conducted to empirically test this theoretical notion. We hypothesized that cognitive aging should amplify the advantage of collaborating with a familiar partner over collaborating with an unfamiliar person. **Methods:** We developed an interpersonal-cueing task based on the game Taboo©. The task modelled an everyday-life situation in which one person cues another person to retrieve a piece of information from memory. Seventy-six younger adults (20–33 years) and 80 older adults (63–79 years) worked on this task once with their spouse, and once with an unfamiliar cross-sex partner from the same age group. Collaborative performance was operationalized as the number of cue words needed until the partner guessed the target, as determined by independent trained coders. Performance in the Digit–Symbol Substitution Test was used as an indicator of cognitive aging. **Results:** Multilevel-modelling analyses revealed that collaborating spouses outperformed collaborators who had not known each other before. This effect was comparable for both age groups, but larger in persons with lower Digit–Symbol scores. While participants with lower Digit–Symbol scores generally performed worse in the collaborative task, they partly made up for this difference when working with the spouse. **Conclusion:** We conclude that spousal collaboration may offer a compensatory strategy to cope with individual aging-related losses.

Keywords: cognitive aging, collaboration, collaborative cognition, familiarity effect

With a little help from my spouse: Does Spousal Collaboration Compensate for the Effects of Cognitive Aging?

People often remind each other of appointments they should not miss, of things they should buy, or of names they forgot. Many cognitive tasks in everyday life are thus not accomplished alone, but in collaboration with others. We will argue that such memory collaboration is beneficial and cognitively demanding at the same time, and that *facilitating* collaboration should hence become increasingly important across adulthood. In the present study, we investigated this idea at the example of one factor that can facilitate collaboration, namely, the interaction partners' familiarity.

Memory collaboration has received considerable attention in the aging literature, and it has been suggested to help individuals compensate for aging-related losses in memory performance (Dixon, Rust, Feltmate, & Kwong See, 2007; Zacks, Hasher, & Li, 2000; Martin & Wight, 2008). Empirical evidence indeed suggests that collaborating dyads' performance is superior to that of individuals in memory tasks (e.g., Gagnon & Dixon, 2008; Johansson, Anderson, & Rönnberg, 2005; Ross, Spencer, Blatz, & Restorick, 2008).

While collaborating dyads outperform individuals, they however usually do not reach the pooled (i.e., added, non-redundant) performance of two single persons who carry out the same task independently (Andersson & Rönnberg, 1997; Finley, Hitch, & Meudell, 2000). Some of the dyad's theoretical potential thus seems to be lost in the interactive process, which has been ascribed to the cognitive demands of the interaction (e.g., to monitor the partner, process incoming information, generate an appropriate response, and keep it in mind until it is one's turn to respond; Weldon, Blair, & Huebsch, 2000). These demands require the investment of cognitive-mechanic resources (i.e., basic information-processing capacities such as processing speed, working-memory capacity, reasoning, and cognitive control). If interactive demands are complex, individual cognitive-mechanic capacities may thus delimit the usefulness of collaboration – a constraint worth emphasizing when approaching collaborative phenomena from a developmental perspective.

Cognitive-mechanic capacities decrease throughout adulthood (Li et al., 2004; Salthouse, 2004). A developmental perspective on memory collaboration therefore raises the question of how interactions can be facilitated to preserve the potential benefits of collaboration throughout the adult lifespan – even in the face of aging-related losses in cognitive-mechanic capacity. One such factor that can facilitate an interaction is being familiar with the interaction partner.

Interactions among familiar partners are informed by past experiences, which can facilitate the interpretation of the partner's behavior (Dixon, 1999). For example, familiar partners have access to a pool of shared memories and also tend to converge in their retrieval strategies for these memories (Wegner, Raymond, & Erber, 1991). When cueing each other, they can hence tailor their cues to their partner's knowledge (Krauss & Fussell, 1991; Rauers, Riediger, Schmiedek, & Lindenberger, 2009). Across various cognitive tasks, research has shown that familiar partners indeed outperform unfamiliar interaction partners (e.g., Andersson & Rönnberg, 1997; Johansson et al., 2005).

Considering the aging-related decline in cognitive-mechanic resources across adulthood, it has been proposed that older adults may profit more from this *familiarity effect* than younger adults do (cf. Dixon, 1999; Johansson et al., 2005). Empirical evidence on this suggested age-differential benefit from the interaction partners' familiarity is hardly available, with one study supporting (Dixon & Gould, 1998), and another study not supporting this notion (Gould, Osborn, Krein, & Mortenson, 2002). We propose that considerable inter-individual variability in trajectories of cognitive aging (Hertzog, Dixon, Hultsch, & MacDonald, 2003; Schaie, 2005) may be among the reasons for this ambiguous pattern of findings. Although chronological age is negatively correlated with cognitive-mechanic capacity, it is only a proxy variable for a person's cognitive functioning (Li & Schmiedek, 2002; MacDonald, Dixon, Cohen, & Hazlitt, 2004). We therefore hypothesized that the benefit from collaborating with a familiar, rather than an unfamiliar interaction partner, would be moderated by the individual's cognitive-mechanic capacity, but not necessarily by his or her chronological age.

Method

Sample

The sample consisted of N = 78 heterosexual couples (N = 156 persons) from two age groups: Younger participants (n = 76 persons, 38 couples; mean age = 26.64 years; SD = 2.77), and older participants (n = 80 persons, 40 couples; mean age = 71.59 years; SD = 3.56). All couples cohabitated and had been together for at least six months (younger couples: 0.68–10.87 years, M = 4.35 years, SD = 2.49; older couples: 7.30–58.52 years, M = 41.60, SD = 14.35). For simplicity, we will refer to real-life partners as "spouses" regardless of their marriage status (84% of the older, and 11% of the younger participants were married). Ninety percent of the younger adults and forty-eight percent of the older adults held a high school diploma or a higher degree. Only people who played the commercial game Taboo© (the basis of our experimental task, see below) less than four times a year were included in the sample in order to exclude persons with repeated practice in the task. Couples were paid 100 Euro for their participation. The ethics committee of the Max Planck Institute for Human Development had approved of the study.

Interpersonal-Cueing Paradigm and Procedure

Based on the game Taboo©, we developed a novel interpersonal-cueing paradigm simulating a collaborative everyday-life situation in which one person cues another person to help him or her retrieve a piece of information from memory. Participants were asked to explain target words to an interaction partner, using as few cue words as possible while avoiding a list of "taboo cues." The partner's task was to guess the target word. The number of words needed by the explaining partner to successfully cue the partner served as collaborative-performance outcome.

Participants took part in two experimental sessions (mean time interval: 1.89 days, *SD* = 1.51). In one session, they carried out the Taboo task with their spouse, and in the other, with an unfamiliar partner. Unrestricted time was given for task completion. Prior to the task, participants completed ten practice trials each (which were not included in the analyses), during which we provided performance feedback to assure that the task had been understood.

Across both sessions, participants completed 48 trials of the task. Target words were balanced regarding everyday-life reference, frequency in the media, morphology, and word length, as determined by lexical information and a prior, independent word-rating study with *N* = 65 adults. The order of experimental conditions was nearly counterbalanced (unfamiliar first in 54% and 50% of the younger and older couples, respectively) and was controlled for in the analyses reported here. Socio-demographic variables and cognitive-mechanic capacities were assessed in a separate questionnaire session.

Collaborative Performance

Collaborative performance was operationalized as the number of cue words needed by the explaining person until the partner guessed the target. All trials were transcribed and coded by one of four trained coders. Ten percent of the trials were coded by two coders to calculate intra-class correlations (ICC) as an indicator of inter-rater reliability. Coders determined the number of cue words needed (ICC = .99; younger spouses: *M* = 6.78; between-person *SD* = 2.75; younger unfamiliar partners: *M* = 7.89, *SD* = 3.55; older spouses: *M* = 12.42; *SD* = 5.03; older unfamiliar partners: *M* = 14.77; *SD* = 7.43). Performance was similar for men (*M* = 10.64; *SD* = 5.39) and women (*M* = 10.41; *SD* = 4.96). Coders also coded the use of taboo cues (*M* = .21, between-person *SD* = .19; ICC = .90), for which we controlled in the analyses.

Cognitive-Mechanic Capacity

Cognitive-mechanic capacity was measured using the Digit–Symbol Substitution Test (paper-and-pencil version; Wechsler, 1955). This test assessing perceptual and motor speed is widely used as a reliable marker of aging-related decline in cognitive-mechanic capacities (Hoyer, Stawski, Wasylyshyn, & Verhaeghen, 2004), and is regard here as an indicator of the resources available to the individual for coping with the costs caused by collaboration. The task requires participants to fill in symbols corresponding to a given row of digits as fast as possible. Both younger and older adults' scores were similar to those found in other studies (Hoyer et al., 2004; younger adults: $M = 60.17$, $SD = 9.32$, older adults: $M = 41.31$, $SD = 8.61$). The variable was normally distributed across the total sample and was grand-mean centered before being used in the analyses.

Analyses

Analyses were based on data from all trials in which the target word had been correctly guessed by the partner ($N = 3{,}496$). Trials where this was not the case were the exception for both younger (1.5%) and older adults (2.4%). We used crossed-random effects multilevel modeling (cf. Baayen, Davidson, & Bates, 2008; Locker, Hoffman, & Bovaird, 2007) to predict collaborative performance at a given trial, and included a trial-level variance component at level one, and three additional variance components at level two (Snijders & Kenny, 1999) pertaining to (a) the person who explained a target, (b) the person who guessed the target, and (c) the natural partnership of the explaining person. The variance components thus modeled interdependencies in the dependent variable due to between-person and between-couples differences in the ability to explain and guess targets. Of interest with respect to our hypothesis are parameter estimates of the fixed effects of model predictors (i.e., age group, familiarity condition, and Digit–Symbol score). Analyses were implemented in SAS 9.1 for Windows, using the mixed procedure (SAS PROC MIXED, REML). We used the log-transformed distribution of the dependent variable (number of cue words used) to correct for the positive skewness of the untransformed variable. Following log-transformation ($\log_{10}(x)$, Tabachnick & Fidell, 2001), the assumptions of normality and linearity were met. Degrees of freedom were adjusted according to the Kenward-Roger (KR) correction procedure to reduce the potential for Type I error (Littell, Milliken, Stroup, Wolfinger, & Schabenberger, 2006).

Results

We tested age group and Digit–Symbol performance as moderators of the familiarity effect by predicting collaborative performance (i.e., the number of cue words needed to explain a target) using familiarity condition (i.e., collaborating with spouse versus unfamiliar partner), age group, the explaining partners' Digit–Symbol Score, the interaction of age group and familiarity condition, and the interaction of the explaining partner's Digit–Symbol Score and familiarity condition as predictor variables. We controlled for the guessing partners' Digit–Symbol scores, as each participant collaborated with two different partners, for the order of conditions, and for the use of taboo cues. As can be seen in Table 1, participants performed better (i.e., they needed fewer cue words) when working with their spouse, than when working with an unfamiliar partner. The interaction effect of age group and familiarity condition was not significant, suggesting that the familiarity effect was comparable for younger and older adults.

However, there was a significant interaction effect of familiarity condition with the explaining partners' Digit–Symbol score. To follow up on this interaction, we plotted simple slopes for working with one's spouse versus an unfamiliar partner as estimated for individuals with mean, lower (M – 1 SD), and higher (M + 1 SD) Digit–Symbol performance. As can be seen in Figure 1, participants with lower Digit–Symbol scores performed worse in the collaborative task, but partly made up for this difference when cueing their spouses. That is, the lower the explaining partner's Digit–Symbol score, the greater was the familiarity effect. This association was not different for younger and older adults (i.e., there was no three-way interaction of age group, Digit–Symbol performance, and familiarity condition; estimate = .004, SE = .003, $p = .17$). Additionally controlling for relationship duration and partnership satisfaction (Relationship Assessment Scale, Hendrick, 1988) did not change the results.

Discussion

The present study investigated inter-individual differences in the familiarity effect, which denotes the often replicated finding that familiar interaction partners outperform unfamiliar partners in collaborative tasks (e.g., Andersson & Rönnberg, 1997; Johansson et al., 2005). Older adults, with less cognitive-mechanic capacities than younger adults, have been suggested to profit especially from this facilitative effect (Dixon, 1999; Johansson et al., 2005). However, empirical evidence on this notion has been rarely available and inconsistent to date. We assumed that the familiarity effect was not moderated by chronological age per se, but by cognitive-mechanic capacities, which decline with age. Our results support the notion of changes in the size of the familiarity effect across adulthood. More precisely, our results suggest that the benefit from knowing the partner for collaborative performance depends on the cognitive-mechanic resources available to the aging individual.

We replicated the familiarity effect in a sample of younger and older adults who collaborated on an interpersonal-cueing task, working once with their spouses, and once with an unfamiliar partner. Participants performed better working with their spouse than with an unfamiliar partner. This familiarity effect was comparable for both age groups, but associated with performance in the Digit–Symbol Substitution Test, a widely used marker for cognitive aging (Hoyer et al., 2004). The lower participants' Digit–Symbol score, the greater was the familiarity effect. Given the within-person manipulation of partners' familiarity, word-finding difficulties in old age may explain the main effect of age, but not between-person differences in the familiarity effect. Our results are in line with the theoretical notion that the familiarity effect should especially support individuals who operate at the limits of their cognitive capacities – a resource situation that becomes increasingly likely as people age (Dixon, 1999).

The present work thus complements yet inconsistent research on the partners' chronological age as a moderator of the familiarity effect. Our data suggest that not chronological age in itself, but the availability of cognitive-mechanic resources, which decline with age, delimit the potential of collaborating. Our results further suggest that this disadvantage can be partly buffered when people collaborate with a familiar partner. Older adults' motivational focus on few meaningful relationships (Lang & Carstensen, 2002) may therefore not only be emotionally adaptive, but also offer cognitive benefits.

The specificity of the investigated task and sample impose limitations in the generalizability of the findings. Future research will be needed to replicate the reported result pattern using alternative collaborative tasks, as well as additional age groups and dyad compositions (e.g., friends, working colleagues, or senior adults collaborating with their adult son or daughter). Despite these limitations, the present data illustrate that collaborating with a familiar partner, such as a spouse, may help to compensate for aging-related losses.

Exclusive reliance on spousal collaboration may, however, also have its costs. It could, for example, foster mutual interdependency and thus compromise the important developmental challenge of preserving one's autonomy in old age (Baltes & Horgas, 1997). It could also lead to uncritically accepting the partner's influence when this is in fact unwarranted (Peker & Tekcan, 2009), or result in impaired individual memory performance when interpersonal support is not, or as in the case of widowhood, no longer, available (cf. Schaefer & Laing, 2000).

Despite these potential caveats, collaborating with the spouse may help the aging individual to cope with everyday challenges. Spousal collaboration is readily available in many everyday-life situations. Moreover, spouses can rely on their refined expertise in interacting with each other. This may imply less cognitive-mechanic demands than collaborating with alternative social partners. Spousal collaboration may thus pose a simple and effective everyday-life strategy to compensate for the effects of cognitive aging.

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Tables

Table 1

Explaining Partner's Digit–Symbol Score Is Less Predictive of Collaborative Performance When Interacting with Spouse Than with Unfamiliar Partner: Results from Crossed-Random Effects Multilevel Regression Models (N = 3,496 trials).

Parameter	Estimate	SE
Fixed effects		
Intercept	1.018 *	.028
Familiarity (0 – spouse, 1 – unfamiliar)	.041 *	.018
Age group (0 – younger, 1 – older)	.199 *	.044
Explaining partner's Digit–Symbol score	-.003 *	.001
Familiarity x age group	.035	.031
Familiarity x explaining partner's Digit–Symbol score	-.003 *	.001
Order of conditions	.020	.026
Use of taboo cues	-.410 *	.073
Guessing partner's Digit–Symbol score	-.001	.001
Variance components		
Trial	.082 *	.002
Explaining partner	.006 *	.002
Guessing partner	.005 *	.001
Explaining partner's natural partnership	.006 *	.002

Notes. Multilevel model predicting the number of words needed (log-transformed distribution). High values in the dependent variable represent low performance. The variance components were included to account for overall between-person and between-couple differences in the dependent variable (number of cue words needed), thus obtaining more accurate estimates of the fixed effects when predicting the dependent variable. Estimates for variance components are shown for the sake of completeness but are not informative for hypothesis testing, which relied exclusively on estimates for the fixed effects. For an estimation of effect size, the interaction effect is illustrated in Figure 1 using the original metric of the dependent variable (i.e., number of cue words needed).

* $p < .05$.

Figures

Figure 1

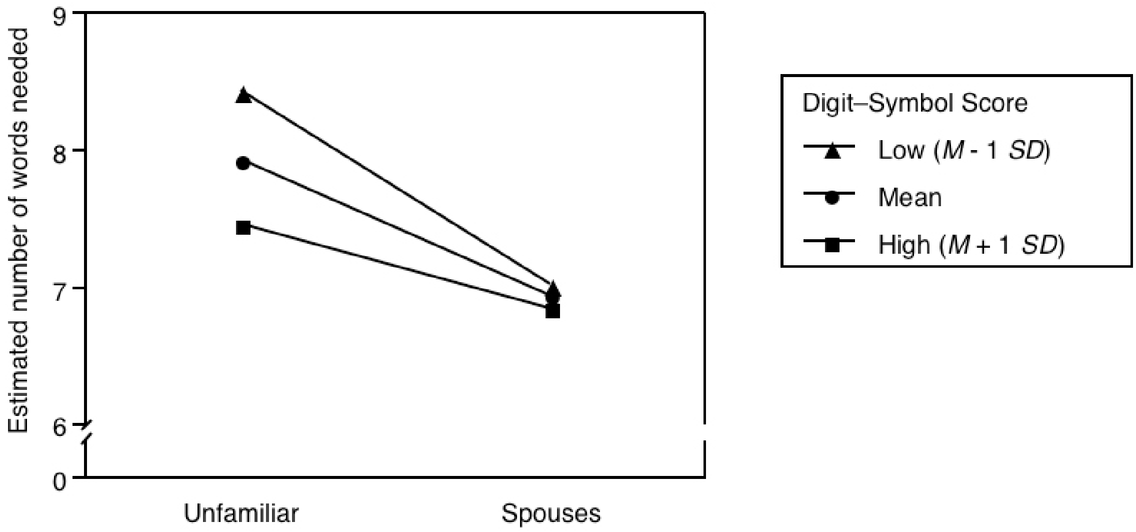

Figure 1. Simple slopes for the familiarity effect in the case of low, mean, and high Digit–Symbol performance. Estimates from multilevel regression were re-transformed and are shown in the original metric of the dependent variable (number of words needed). Estimates pertain to mean values in additional continuous predictors and were obtained from a model without the dichotomous variable of age group.