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Cultural Diversity in Couples and Collective Performance: Using a Culture-Based Memory

Game to Measure Transactive Memory

Abstract

Transactive memory refers to the way people in close relationships use each other's memories as extensions of their own to improve their collaborative performance. Although pioneer research has been conducted among close couples, no studies have examined the effects of the cultural composition of couples on transactive memory. The goal of the present study was to extend research about the positive impact of cultural diversity on team performance to mixed- (French-Moroccan) and same-culture couples (French-French, Moroccan-Moroccan). Thirty heterosexual couples aged from 22 to 55 ($M = 42.25$ years and $SD = 8.15$) performed a culture-based memory game with cards depicting French and Moroccan culture. The order in which the pairs of cards were found is thought to reflect the efficiency of transactive memory. Results revealed that collective performance was better in mixed French-Moroccan couples than in same-culture couples, but only for the French culture cards. These findings suggest that cultural diversity in couples has an impact on transactive memory and should be taken into consideration.

Keywords: cultural diversity, transactive memory, couples, cognition, collaboration

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"*Remembering is traditionally a social enterprise*" claimed Wegner and Ward (2013),

suggesting that humans have always relied on one another to recall things and to improve

collaboration in everyday life.

As people in close relationships are aware of what each other remembers, they are able

to access the information that the other person knows, thus improving their collective memory

performance without much cognitive effort. This type of memory functioning is referred to as

transactive memory, a term coined by the social psychologist Daniel Wegner to describe the

way people in close relationships use each other's memories as an extension of their own

memory (Wegner, 1986; Wegner, 1995; Wegner, Giuliano, & Hertel, 1985). Theoretically,

transactive memory has been defined as a socially "*shared system for encoding, storing, and

retrieving information*" (Wegner, Erber, & Raymond, 1991, p. 923). Because couples in close

relationships are likely to have built up a robust shared system over time through

communication (or transaction), the first studies on transactive memory focused on how

memory functions in these couples (*e.g.,* Wegner, 1986; Wegner et al., 1985; Wegner et al.,

1991). In a couple, the partners have shared beliefs about 'who knows what', helping them to

solve a wide variety of problems collaboratively in everyday life. For example, a husband

may depend on his wife to remember when to pay the electricity bill, and conversely the wife

will know that her husband will be able to remind her of the dates of the children's upcoming

sporting events. In this way, if each partner in a couple knows the other's area of expertise,

they can use each other to remember information that they could not remember on their own.

It has been demonstrated that people in close relationships benefit from a transactive memory

system, and thus have better memory performance when working together than 'artificial

dyads' composed of strangers working on a similar task (Hollingshead, 1998a, 1998b;

Wegner et al., 1991). In their pioneer research, Wegner et al. (1991) found that close couples

outperformed 'artificial dyads' in remembering information previously learned in different

areas of expertise (*e.g.,* spelling, television, food), but only when the area of expertise was not

imposed on the partners, in other words, when the transactive memory system was used

spontaneously without any instruction given about how to memorize the information. Using a

similar paradigm, Hollingshead (1998a, 1998b) found that when face-to-face communications

were allowed, dating couples outperformed 'artificial dyads' on memory tasks such as

remembering word lists and general knowledge. In other words, these findings suggest that

partners who have cohabitated for a certain length of time develop a robust transactive

memory system and can use it when they have to work together.

Although the first studies on transactive memory involved couples, paradoxically, very

few studies in this field have since been conducted with couples in close relationships (*e.g.,*

Hollingshead, 1998a, 1998b; Wegner et al., 1985; Wegner et al., 1991). In their review of

studies conducted between 1985 and 2010, Ren and Argote (2011) estimated that 62% of the

publications on transactive memory were devoted to teams, groups and organizations, and

only 10% dealt with the functioning of couples and 'artificial dyads' (see also Barnier, Klein,

& Harris, 2018; Hollingshead, Gupta, Yoon, & Brandon, 2011; Peltokorpi, 2008). Since

2010, research on transactive memory in close relationships has not advanced much, apart

from two studies validating Lewis's (2003) transactive memory scale among couples (Hewitt

& Roberts, 2015) and adapting it to the study of friendships (Iannone, McCarty, & Kelly,

2016). While very few studies have examined transactive memory in close couples, even

fewer have examined the role of cultural factors on transactive memory in dyads and couples.

To our knowledge, only one study has experimentally examined 'artificial' same-sex dyads

(and not couples) composed of white Europeans or Eurasians collaborating in a memorization

task on stereotypical materials (Yoon & Hollingshead, 2010). They found that culturally

diverse dyads had better collective performance than culturally similar dyads, making fewer

coordination errors and recalling more information. These results may be explained by

transactive memory, as each person in dyads composed of individuals from different cultures

has expertise in their own cultural stereotypes and a good understanding of the other's

expertise. Therefore, they can rely on their partner's knowledge of his/her own culture, thus

creating an effective transactive memory system pertaining to cultural stereotypes to improve

their collective performance. To our knowledge, there have been no studies examining the

influence of the cultural composition of close couples on transactive memory, or more

specifically the potential benefits of cultural diversity in mixed-culture couples on

performance of a memory task using cultural (but non-stereotypical) materials.

This lack of research is in stark contrast with studies that have examined the impact of

cultural diversity on team performance (e.g., Bell, Villado, Lukasik, Belau, & Briggs, 2011;

Ely & Thomas, 2001; Jackson, 1992; Qiu, Zhang, & Liu, 2011). Cultural diversity refers to

the extent to which team members differ in nationality, subculture, ethnicity, native language,

geographic location, or home region (e.g., Connaughton & Shuffler 2007; Larkey, 1996;

Paulus, Van der Zee, & Kenworthy, 2016). One of the cultural differences widely examined

in the literature involves individualist and collectivist orientation (Hofstede, 1980). This

distinction is based on the idea that people from different cultural backgrounds have different

attitudes, values, and norms that reflect their cultural heritage. For example, individuals

belonging to collectivist cultures place greater emphasis on cooperation with their group

members (Triandis, 1995), leading them to adopt more cooperative behaviors compared to

people in individualist cultures, whose behaviors are based more on independence or

autonomy (Cox, Lobel, & McLeod, 1991; McLeod, Lobel, & Cox, 1996).

A number of studies have revealed that cultural diversity in well-established groups,

in other words, groups where members have built strong relationships, has a positive impact

on group performance of complex tasks (van Dijk, van Engen, & van Knippenberg, 2012; Watson, Kumar, & Michaelsen, 1993). These benefits can be explained by the importance of shared team experiences (e.g., Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000; Moreland, 1999; Salas, Rosen, Burke, & Goodwin, 2009), whereby team members in well-established groups will know "who knows what" about different topics or areas of expertise. Thus, they can more effectively tap each other's unique experience and knowledge to improve their performance on collaborative tasks. It has been demonstrated that transactive memory can be developed not only by training group members to work together (Liang, Moreland & Argote, 1995), but also spontaneously through numerous interactions with people in close relationships (e.g., married couples, friends). As team members (or partners) become familiar with each other, they develop a transactive memory system helping them to improve their collective performance. In a *meta*-analysis, Bachrach, Lewis, Kim, Patel, Campion, and Thatcher (in press) pointed out that very few studies have examined the effects of cultural diversity on transactive memory, except a case study comparing cross-cultural teams of U.S. and Romanian engineers (Jarvenpaa & Keating, 2011). Their results revealed that cultural differences in values, practices, and institutions had an impact on transactive memory. For example, team members rarely correct each other for culturally inappropriate behavior, and they do not adjust their cultural practices to render them understandable. More important for our purpose, Bachrach and collaborators (in press) showed that the benefits of transactive memory on team performance were stronger in cultural contexts characterized by higher levels of collectivism, i.e. countries that valued group interests and collective accomplishments. As team members must work collectively to sustain and utilize a transactive memory system, it is likely a more robust phenomenon in cultural contexts where collectivism is high. These findings pave the way for research about the effects of cultural diversity in couples, groups or teams on transactive memory.

The aim of the present study was to extend research on the impact of cultural diversity on team performance and transactive memory in close couples, examining transactive memory among mixed- or same-culture couples performing a culture-based memory task. We chose this task for several reasons. A great majority of tasks used to examine transactive memory in couples and dyads are memory recall tasks (Peltokorpi, 2008), consisting of memorizing and recalling a list of words or items pertaining to different categories. This type of task was not appropriate for the participants belonging to different cultures because of strong differences in their ability to manipulate and use verbal materials based on language. Consequently, visual materials are preferable for examining the collective performance in couples composed of partners from different cultures, and thus measuring the efficiency of transactive memory. For this purpose, a 'memory game' composed of a series of pairs of cards with cultural images was specifically created for the needs of the study in order to palliate the language constraints. It consisted of remembering cards depicting elements pertaining to French and Moroccan culture.

Concerning the choice of couples, three categories of couples were compared: French-French, Moroccan-Moroccan, and French-Moroccan. The choice of these cultures was based on a set of criteria. First, a population census conducted in France showed that 36.1% of mixed heterosexual couples in France included a Moroccan partner (Collet, 2012), and there are statistically more French women/Moroccan men than French men/Moroccan women (63% and 37% respectively, INSEE, 2011). Secondly, extensive studies on different cultures by Hofstede, Hofstede, and Minkov (2010) revealed that individualism scores in Morocco are lower than in France (46 and 71 respectively) on a scale ranging from 0 to 100 (Hofstede Centre©, 2012). Finally, Morocco was for a long time a French protectorate in which people were immersed in French culture, internalizing French traditions and ways of life. Consequently, all Moroccans learned the French language and culture during their childhood,

leading them to internalize two cultural frameworks (Benet-Martínez, 2012; Benet-Martínez, Lee, & Leu, 2006). This biculturality is likely to be maintained and reinforced among people living with a partner with a different cultural background, helping them to develop a more complex understanding of the two cultures. In the present study, the Moroccan men in mixed-culture couples theoretically had a greater degree of biculturality than French and Moroccan men in same-culture couples, as a Moroccan man living for a long time with a French woman in France may have been acculturated through on-going interactions with his partner. Similarly, through contact with her bicultural partner, the French woman may have developed a better understanding of Moroccan culture. Together, they should remember relevant information about French and Moroccan cultures better than same-culture couples who have not developed shared cultural knowledge, thus improving their collective performance on a collaborative and culturally marked memory task. In other words, by tapping each other's knowledge of 'who knows what' in their respective cultural frameworks, the collective performance of mixed-culture couples should reveal a more efficient transactive memory system.

Method

Participants

Sixty participants, 30 heterosexual couples, aged from 22 to 55 ($M = 42.25$ years and $SD = 8.15$), and living together for at least one year, were recruited for a study aiming to test a new collaborative memory game. As in other psychological studies where the cultural composition of dyads (or couples) was manipulated as the independent variable (e.g., Shi, Frederiksen, & Muis, 2013), the sample size is rather small because of the difficulty of recruiting close couples, and more particularly mixed-culture couples living together for at least one year and who agreed to be filmed. Consequently, ten of the couples consisted of a French woman and a French man (French-French), ten couples consisted of a Moroccan

woman and a Moroccan man (Moroccan-Moroccan), and ten of a French woman and a Moroccan man. As there are more French women/Moroccan men than French men/Moroccan women, we did not include couples composed of French men and Moroccan women in our sample because it would have increased the difficulty of identifying and recruiting them. The time the couples had lived together ranged from 2 to 30 years ($M = 16.07$ and $SD = 8.63$), and the number of offspring ranged from 0 to 4 ($M = 1.87$ and $SD = 1.13$). All the participants had lived in France for a long time, and all the Moroccan participants were born in Morocco and had come to France in adulthood. At this step, it is important to point out that the small sample size used in the present study should lead to a cautious interpretation our findings. The present research has to be considered as a first attempt at exploring transactive memory in culturally mixed couples, and its effect on collective performance on a memory task.

Procedure

Participants were mainly recruited through advertisements on social networks, and Moroccan participants were also recruited by a research assistant (the first author of the paper) through direct contact in Franco-Moroccan friendship societies. The advertisement explained that couples were being recruited to test a new game aiming to discover different cultures through playing with a close friend, such as a co-habiting partner. Because of the difficulty in recruiting couples, and more specifically partners in mixed-culture couples living together, a prepaid gift credit card worth 15€ was offered to each person for their participation. This information was also mentioned on advertisements on social networks, on posters on the walls of Franco-Moroccan friendship societies, and orally reminded by the research assistant when soliciting couples through direct contact. The criterion for couples to participate in the study was that they had been living together for at least one year, and they arrived in France at adulthood.

Each experimental session involved one couple, and each partner was asked to sign a consent form giving their permission to be filmed during the task upon their arrival in the experiment room. The research assistant gave the task instructions orally, explaining that the couple would be testing a new game currently being developed, similar to a 'Memory' game. She explained that there would be no winners or losers and that the aim of the game was to make people aware of cultural differences through images representing different cultural attributes. Finally, she explained that the goal was to work together to find 24 pairs of cards in the fewest number of rounds possible.

Before starting the task, a board presenting the 48 images (24 identical pairs) was shown briefly to each couple because preliminary tests revealed that participants spent part of their time looking at the images before actually looking for matching pairs, which increased playing time. Before starting, participants were asked to turn off their mobile phones to avoid any distraction.

 For the purposes of the study, only the hands of the participants on the table were filmed to track the way they completed the task, and more specifically the order in which they turned the cards over and identified them. To perform the task, the partners were seated side-by-side in front of a green mat on which the 48 cards were placed upside down on a 6 x 8 grid (see Appendix B). The position of the cards was randomly determined at the beginning of the experiment and kept in the same position for all the couples. There was no time limit, to avoid temporal pressure on the participants, and to make the game similar to a real 'Memory' game. The main rule of the game was to find the pairs of matching cards, playing in turns to avoid one partner systematically controlling gameplay. The woman in the couple always began by turning over two cards, and her partner then turned over two cards, until all the pairs had been found. After a couple had found a pair of matching cards,

the cards were placed face up. The partners were allowed to communicate and help each

other during the task. The game ended when they had found all the pairs.

At the end of the experiment, each participant independently completed a short

questionnaire containing socio-demographic variables, Individualism-Collectivism and

transactive memory scales. Before leaving, the participants were debriefed, thanked for their

participation, and each received a prepaid gift credit card worth 15 € for their participation.

Measures

Controlled variable: Individualism-Collectivism scale (INDCOL)

As individualism and collectivism are the most predominantly studied characteristics

of culture (Green, Deschamps, & Páez, 2005), we chose to measure the participants' cultural

orientation to see whether it varied in the different cultural composition conditions. As the

cultural composition of couples was an independent variable in this study, it was important

to check whether partners in couples were culturally oriented. Theoretically, the level of

collectivism should be higher in Moroccan-Moroccan couples than in the other couples, and

it should also be higher for Moroccan men than for their French women partners in mixed-

culture couples. By contrast, the level of individualism should be higher in French-French

couples than in other couples, and it should also be higher for French women than for their

Moroccan partner in mixed-culture couples.

Each participant completed a questionnaire containing a French version

(Rakotomalala, 2010) of the 16-item Individualism-Collectivism scale (Triandis & Gelfand,

1998). They answered on a five-point Likert scale (from 1 = *strongly disagree* to 5= *strongly

agree*), organized around two orthogonal dimensions (individualism/collectivism and

horizontal/vertical relationships) with eight items on each dimension. The INDCOL

subscales showed acceptable reliability for the collectivism dimension (α = .84) on

horizontal (α = .69) and vertical (α = .71) subscales. As defined by Triandis and Gelfand

(1998), *horizontal collectivism* is seeing the self as part of a collective where everyone is equal (sample item: *To me, pleasure is spending time with others*) and *vertical collectivism* is seeing the self as a part of a collective containing hierarchy and inequality (sample item: *It is my duty to take care of my family, even when I have to sacrifice what I want*). The low reliability observed for individualism ($\alpha = .52$) prevented us from performing statistical analyses on the vertical and horizontal individualism sub-scales.

Transactive memory based on ranking identification of pairs of French and Moroccan culture cards

The order in which the pairs of cards were found is thought to reflect the efficiency of transactive memory, the sooner the pairs were discovered, the higher is the efficiency of transactive memory in close couples. The order was identified by analyzing the videos: the first pair of cards found was given a score of 1, the second pair a score of 2, and so forth up to the 24th pair. Lower scores are supposed to provide a behavioral measure of the efficiency of the transactive memory system in couples based on collective performance at the culture-based memory game.

Transactive memory based on self-report measures

The transactive memory scale administered at the end of the experiment was adapted for couples from the 15-item scale used by Lewis (2003), and validated in French (Michinov, 2007; see also Michinov & Michinov, 2009), to assess the transactive memory system (the word 'team' was replaced by 'couple', and the word 'project' by 'task'). The items were strictly identical to those of the transactive memory scale for couples recently validated by Hewitt and Roberts (2015). For example: '*My partner and I are responsible for expertise in different domains*', '*I am confident relying on information that my partner provides*', '*My partner and I work together in a well-coordinated fashion*'. Each item was scored on a 5-point Likert-type scale ranging from 1 (disagree strongly) to 5 (agree

strongly). The reliability was satisfactory (Cronbach's $\alpha = .71$). Before aggregating individual scores of the transactive memory scale to the group level, the homogeneity of scores within couples was evaluated using the Rwg index (James, Demaree, & Wolf, 1993). As a value of 0.70 or above is considered to represent satisfactory agreement, the mean Rwg of 0.93 in the present study suggests that the members' transactive memory scores could be aggregated to the group level for statistical analyses. Higher scores indicate stronger development of transactive memory systems in couples.

Results

Pretest

The culture-based memory task built to provide indicators of the efficiency of transactive memory systems in couples was composed of 48 cards, each containing an image referring to either Moroccan or French culture (24 pairs of images, 12 of French culture and 12 of Moroccan culture; see Appendix A). The goal of the task was to work collaboratively with a partner to find all the matching pairs of cards. Using illustrated cards containing images meant that verbal communication between partners was not necessary to perform the task.

Initially, a pool of images depicting Moroccan and French culture was collected, selected on the basis of both subjective and objective elements of the two cultures (Hofstede, 1983; Schwartz, 2009; Triandis, 1972; 1995). Some of the images were taken from a book explaining Moroccan culture to children (Oussiali & Oussiali, 2010) and the others were collected from different websites (see Delamarre Allaoui, 2016, for more details). After discussion with a focus group composed of ten people from each culture, some cards and concepts were eliminated because they were consensually judged as being (a) not specific to Moroccan or French culture (e.g., marriage, alms), (b) too difficult to recognize (e.g., the seven deadly sins), (c) universally known (e.g., cheese, couscous), (d) difficult to represent

graphically (e.g. social norms), or (e) related to nationalism (e.g., national flags, the royal coat of arms of Morocco). Finally, 24 distinctive images were retained, 12 referring to French culture and 12 to Moroccan culture. The images were organized in three categories by two coders (Cohen's Kappa= .72): rites and religious symbols (e.g., ceremonies, religious festivals), heritage and traditions (e.g., architecture, musical instruments), cultural values of individualism/collectivism (e.g., cooperation, competition, individual autonomy). For example, among the rites and religious symbols, we retained the "Sacrifice Feast" ("Eid El Kebir"), an important religious ceremony in Morocco, and the Christmas tree with a star at the top representing the Star of Bethlehem and the Nativity of Jesus, a Christian symbol in France.

These 24 images were then assessed by 30 Moroccan and 30 French people (50% men and 50% women), who were not part of the experimental sample. They were recruited by a research assistant from Franco-Moroccan friendship societies. Once they had agreed to complete an anonymous questionnaire, they were asked to identify the cultural orientation of each image by indicating whether it was: (a) essentially French, (b) essentially Moroccan, (c) neither French nor Moroccan, or (d) both French and Moroccan. The number of cards correctly identified by each participant was summed and ranged from 0 to 12 for French and Moroccan cards.

A 2 X 2 mixed ANOVA was conducted, with cultural origin of the participants as the between-subjects factor (French vs. Moroccan), and cultural orientation of the images (French vs. Moroccan) as the within-subjects factor in order to examine the number of correctly identified images. Results only revealed a significant effect of the cultural origin of the participants, with the Moroccans correctly identifying more cards than the French, $F(1, 58) = 30.61$, $p < .001$, $\eta^2 = .34$ ($M = 10.75$ and $SD = 1.20$; $M = 8.63$ and $SD = 2.10$; respectively). The interaction effect was not significant, $F < 1.0$. It can be observed that the Moroccan

participants identified a similar number of Moroccan and French cultural cards ($M = 11.00$

and $SD = 1.36$; $M = 10.50$ and $SD = 1.04$, respectively), and the French participants also

identified a similar number of French and Moroccan cards ($M = 8.50$ and $SD = 2.53$; $M = 8.77$

and $SD = 1.67$, respectively). These results suggest a higher degree of biculturalism among

Moroccan than French people, the former being able to recognize a larger number of both

Moroccan and French cards.

Individualism-Collectivism (controlled variable)

A preliminary data analysis using a box plot (Tukey, 1977) revealed an extreme outlier

on both vertical and horizontal collectivism, leading to the removal of one participant from

the statistical analyses (participant #30, a Moroccan female in the Moroccan-Moroccan

condition; see Appendix C).

A separate 2 X 3 Analysis of Covariance (ANCOVA) was conducted on each of the

collectivism sub-scales (vertical and horizontal), with Gender of the partners (Men vs.

Women) and cultural composition of couples (French-Moroccan vs. French-French vs.

Moroccan-Moroccan) entered as predictors; length of time living together was treated as a

covariate[1]. A significant interaction between the two predicting variables on vertical

collectivism was found, $F(2, 58) = 3.704$, $p = .031$, $R^2 = .125$ (see Table 1 and Figure 1)[2].

The interaction showed that vertical collectivism was higher for Moroccan men than for

French women in the mixed-culture couples, $t(18) = -3.78$, $p < .001$. This difference did not

appear in the same-culture couples, Moroccan-Moroccan, $t(18) = 0.13$, $p = .90$, and French-

French, $t(18) = 1.26$, $p = .22$. Although the difference was only marginally significant,

vertical collectivism tended to be higher in Moroccan-Moroccan couples than in the French-

French and French-Moroccan couples, $F(2, 58) = 2.95$, $p = .061$, $R^2 = .10$. No significant

main or interaction effects were found on horizontal collectivism.

*****Insert Table 1 and Figure 1 about here*****

Transactive memory based on ranking identification of pairs of French and Moroccan

culture cards

The collaborative nature of the task prevented multi-level analyses or dyadic data analysis because it was impossible to dissociate performance at the individual and couple levels, as each partner was dependent on the other to find the pairs of cards in the memory game. Moreover, as the rank order of finding the two categories of cultural cards was negatively correlated ($r = -.79$, $p < .001$) and therefore not independent, separate analyses were conducted on the French and Moroccan cards separately. Similarly, as the members of each couple completed the task together, data for the couples was not independent, and the statistical analyses were only conducted at the group level. Preliminary analyses on the time that couples spent to perform the collaborative task revealed that task duration was roughly 10 minutes ($M = 10.92$ min and $SD = 2.57$ min), with no significant difference between the conditions of the cultural composition of couples, $F (2, 29) = 2.07$, *ns*.

An Analysis of Covariance (ANCOVA) was performed using the length of time that couples had lived together as a covariate, and the cultural composition of couples as independent variable (French-Moroccan vs. French-French vs. Moroccan-Moroccan) on finding pairs of cards depicting either French or Moroccan culture.

For the French culture cards, the analysis did not reveal any effect of the covariate, $F < 1.0$. Only a significant effect of the cultural composition of the couples was observed on the order of finding pairs of French culture cards, $F (2, 29) = 3.30$, $p < .05$, $\eta^2 = .20$. As predicted, this revealed that the French culture cards were found more rapidly by the French-Moroccan couples ($M = 13.63$ and $SD = 1.20$) than the other couples, French-French ($M = 15.20$ and $SD = 2.39$) and Moroccan-Moroccan ($M = 16.07$ and $SD = 2.36$). As predicted, the difference between the French-Moroccan and the Moroccan-Moroccan couples was

statistically significant, t (18) = -2.88, $p < .01$, and the difference between the French-

Moroccan and the French-French couples was marginally significant, t (18) = -1.87, $p = .07$.

The difference between French-French and Moroccan-Moroccan couples was not

significant, t (18) = -.81, *ns.*

By contrast, the analysis of the effect of cultural composition of couples on the order

in which pairs of Moroccan culture cards were identified revealed no significant differences

between French-Moroccan (*M* = 15.40 and *SD* =2.10), French-French (*M* = 14.33 and *SD* =

2.35), and Moroccan-Moroccan couples (*M* = 13.93 and *SD* = 2.39), F (2, 29) = 1.51, $p =$

.24, $\eta^2 = .10$.

Transactive memory based on self-report measures

Contrary to our predictions, the composition of couples had no effect on the self-

report measure of transactive memory, F (2, 29) = 1.187, $p = 0.321$, $\eta^2 = .084$. However, a

significant and positive correlation was observed between this measure and the order of

finding French cards at group level, r (30) = .36, $p = .05$. By contrast, no significant

correlation was found between the self-report measure of transactive memory and the order

of finding Moroccan cards, r (30) = -.22, $p = .27$. Despite the lack of effect of the

composition of couples on the transactive memory scale, the correlations suggest that our

behavioral measure based on collective performance in a culture-based memory game

provides empirical support for its ability to assess the efficiency of transactive memory

systems in couples.

Discussion

The aim of the present study was to extend research on the positive impact of cultural

diversity in groups on collective performance to mixed- (French-Moroccan) and same-culture

couples (French-French, Moroccan-Moroccan). The collective performance of these couples

on a culture-based memory game was used to provide a measure of the transactive memory

of couples with different or similar cultural frameworks. It was expected that the collective

performance of French-Moroccan couples would be better than that of the other couples, due

to a more robust transactive memory system developed over time by partners from two

different cultural backgrounds.

Before testing this hypothesis, it was necessary to verify the cultural orientation of

the partners with regard to their degree of individualism and collectivism because the

cultural composition of couples was treated as an independent variable in this study. Results

on individualism-collectivism orientation confirmed that values differed according to the

cultural composition of the couples, but only on vertical collectivism, in other words,

cultural orientation consisting of perceiving the self as a part of a collective containing

hierarchy and inequality. First, in the French-Moroccan couples, vertical collectivism was

higher for Moroccan men than for French women, while no difference was observed in the

same-culture couples. This result suggests greater adhesion to vertical collectivism values

among Moroccan men than French women in mixed-culture couples. Second, vertical

collectivism tended to be higher in Moroccan-Moroccan couples than in other couples. This

suggests that Moroccan-Moroccan couples tend to express a greater adhesion to vertical

collectivism than other couples, and more broadly, that vertical collectivism values were

endorsed more by Moroccan than French participants. These findings are also consistent

with those of a survey conducted among 3,651 Moroccans (Ben Ahmed, 2015),

demonstrating the predominance of vertical collectivism values (55.3%), and to a lesser

extent of horizontal collectivism (25.4%). These findings on individualism-collectivism

considered as a controlled variable may be explained by the fact that Moroccan culture is

more vertically collectivistic than French culture, with people complying with authorities

and emphasizing hierarchy in social relations. Similarly, in mixed-culture couples,

Moroccan men expressed greater adhesion to vertical collectivism values than their French

wives. Although no significant results were found on other dimensions of individualism-collectivism, these findings suggest that the composition of couples depends on internalized cultural values.

After controlling the cultural orientation of couples involved in the present study, the test of hypothesis suggested, as predicted, that cultural diversity in couples has is associated with better transactive memory, but only on the behavioral measure collected during the task itself, not on the self-report measure of transactive memory administered after the task. It appeared that collective performance was better in mixed-culture couples (French-Moroccan) than in same-culture couples (French-French and Moroccan-Moroccan). More specifically, pairs of French culture images were found more rapidly by French-Moroccan than same-culture couples (French-French and Moroccan-Moroccan). No difference was observed between couples for the Moroccan culture cards. Although no direct effect of the composition of couples on self-report measures of transactive memory was observed, correlational analyses suggest a positive relationship between the behavioral measure based on performance on the culture-based memory game and the transactive memory scale. However, this relationship was only observed for finding French cards, and not Moroccan cards.

Interestingly, the present findings echoed the study of Yoon and Hollingshead (2010) where culturally diverse same-sex dyads (white Europeans or Eurasians) had better collective performance than culturally similar dyads in a memorization task of stereotypical materials, i.e. they made fewer coordination errors and recalled more information. The present study extends these initial findings to 'natural' couples, demonstrating the benefits of cultural diversity in mixed-culture couples on performance on a memory task using visual materials, i.e. 'memory game' with cards of culturally relevant symbols, instead of verbal materials, i.e. traditional memory recall tasks (see Peltokorpi, 2008). It is also interesting to point out that although Moroccan-Moroccan couples tend to express a greater adhesion to vertical

collectivism than other couples, they do not have better collective performance. This result is not consistent with results found by Bachrach and collaborators (in press). In their *meta-analysis*, they showed that the benefits of transactive memory on team performance were stronger in cultural contexts characterized by higher levels of collectivism. In the present study conducted among couples, it appears that the Moroccan-Moroccan couples do not have better collective performance than other couples. This result suggests that it is the interactions between group members of different cultures that affect transactive memory functioning rather than the degree of collectivism in groups *per se*.

Taken together, these findings suggest that transactive memory systems seem to function differently depending on the cultural composition of couples. It seems that mixed-culture couples develop a more efficient system over time, which has a positive impact on collective performance, at least in a collaborative memory game requiring memorization of culturally relevant visual materials. Unexpectedly, the efficiency of transactive memory only appeared on French culture cards, and not on Moroccan culture cards. Although empirical data are lacking in the present research to explain these unexpected results, one possible explanation is that there is a greater degree of biculturality in mixed-culture couples, helping them to discover French culture cards. This could explain why the relationships between the two measures of transactive memory, direct (memorization during the tasks) and indirect (self-report measures), were only related to finding French culture cards. In contrast to the other couples, partners in mixed-culture couples may have built up a shared knowledge of French culture, which they could use to perform the task efficiently. Thus, it was easier for them to remember relevant information about French culture than for couples who did not have this shared cultural knowledge. Although speculative, these findings are consistent with those of another experiment examining the influence of the cultural composition of dyads on individually/socially oriented self-regulatory strategies during a collaborative task (Shi et al.,

2013). In that study, 30 Canadian and 30 Chinese university students were randomly paired in ten 'artificial dyads' where cultural diversity varied (Canadian-Chinese, Canadian-Canadian, or Chinese-Chinese). Results demonstrated that the proportion of individually oriented actions relative to socially oriented actions produced by mixed-culture dyads composed of Canadian-Chinese students was similar to that produced by the Canadian dyads, suggesting that an acculturation process may be at work, encouraging Chinese students to adopt the dominant Canadian cultural values of individualism. Although a similar process may underlie the present findings, further investigations are required to test this interpretation. As in other studies, there are a number of limitations in the present study. Firstly, the sample size is rather small (at least at the group level), and consequently, we must be cautious about the generalization of the present findings. However, it is important to keep in mind that the recruitment of mixed-culture couples is a very difficult task in itself. Intimate couples, and more specifically mixed-culture couples living together for at least one year, are a population that is difficult to recruit for psychological studies. Moreover, small samples sizes have also been used in other studies where the cultural composition of dyads varied (Shi et al., 2013). Secondly, the collaborative nature of the task prevented us from performing multi-level analyses because it was impossible to disassociate individual performance from couple level performance as each partner was dependent on the other to find the pairs of cards. Finally, as with many experiments in this field, the present study is limited to a lab-based task (here a culture-based memory game) with a single solution. This kind of task does not consider the underlying processes at work when intimate couple use their shared memory system to negotiate decisions in their everyday lives (see Hewitt & Roberts, 2015). It will be important in future studies to replace the culturally marked images on cards by utensils, objects and materials of everyday life to conduct studies on transactive memory couples, including same-culture couples. Indeed, only a very small proportion of research on transactive memory has

been devoted to the functioning of couples (see Barnier et al., 2018; Hollingshead et al., 2011; Peltokorpi, 2008; Ren & Argote, 2011), and the present study provides a theoretical and methodological contribution to the literature going beyond couples composed of partners of the same culture.

Conclusion

Despite the limitations of the present study, and particularly the small sample size, it provides two main contributions to the very sparse literature on transactive memory in couples which was initiated by Daniel Wegner and continued by Andrea Hollingshead in the 1980s. The first contribution is theoretical in going beyond most contemporary research in transactive memory focusing on the study of intra-individual (cognitive) and inter-individual (social) processes. Indeed, transactive memory research is generally rooted in intra- and inter-individual explanations of the cognitive and social processes at work in collaborative tasks performed by couples (Hollingshead, 1998a, 1988b; 2001; Wegner et al., 1985). By contrast, and as is the case for many other social and psychological phenomena, positional and ideological explanations of transactive memory functioning are generally overlooked by researchers (Doise, 1986). In their review about the role of transactive memory in teams and organizations, Brandon and Hollingshead (2004) pointed that "group culture may modify who is assigned to know what beyond what the task requires, and other social meanings associated with tasks may modify how a group goes about its work." (p. 636). The present findings provided some arguments to their proposals, suggesting that cultural diversity in couples may affect transactive memory functioning, and it depends on the social and cultural meanings associated with the task, here the cultural meanings of cards of a memory game. The second contribution is methodological.

Indeed, the present study suggests a new method to measure transactive memory in couples (or groups) based on a memory game composed of cards depicting culturally relevant

symbols instead of memory tasks based on the recall of verbal materials such as words (Hollingshead, 1998a, 1998b; Johansson, Andersson, & Rönnberg, 2000; Wegner et al., 1991), or procedures for assembling a radio, a telephone, a robot, and so forth (Lewis et al., 2005; Liang et al., 1995; Michinov & Blanchet, 2015). The culture-based memory game used in this study offered new opportunities to infer transactive memory functioning from the quality of collective performance depending on the cultural meanings associated with the task. Although limited in scope, we hope that the present study will incite researchers to investigate more thoroughly the effect of cultural diversity in 'natural' couples on transactive memory using visual and verbal memory tasks, and taking in consideration social and cultural meanings associated with these tasks. In closing, and to paraphrase Wegner and Ward (2013), the present findings suggest that remembering is not only a "social enterprise", but also a "cultural enterprise".

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Footnotes

[1] The length of time couples had lived together was controlled because it may have an influence on the development and robustness of the transactive memory system. Indeed, the longer partners live together, the more opportunities they have to learn what they each know in a given domain. This is supported by studies demonstrating that the longer teams work together, the higher the transactive memory among the members (Lewis, 2004; Lewis, Lange, & Gillis, 2005), and that friendship length is positively associated with transactive memory (Iannone et al., 2016).

[2] A 2 (Gender of the partners, Men vs. Women) X 3 (Cultural composition of couples, French-Moroccan vs. French-French vs. Moroccan-Moroccan) ANOVA was conducted without the covariate on vertical collectivism, and revealed a similar significant interaction, $F(2, 58) = 3.598$, $p = .034$, $R^2 = .120$. No significant effect was found on horizontal collectivism, $F(2, 58) = 1.722$, $p = .189$, $R^2 = .061$.

Compliance with ethical standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

All procedures were in accordance with the ethical standards of institutional and/or national research committees for studies involving human participants, and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Appendices

Appendix A. *Images referring to Moroccan and French culture in the culture-based memory*

game.

Appendix B. *Overview of the grid composed of 6 x 8 cards of the culture-based memory*

game.

Appendix C. *Box plot with outlier on vertical and horizontal collectivism.*

Figure Caption

Figure 1. *Mean scores of vertical collectivism as a function of the gender of the partners*

(Women vs. Men) and the cultural composition of couples (French-Moroccan vs.

Moroccan-Moroccan vs. French-French).