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Map learning in young and older adults: The influence of perceived stereotype threat

Chiara Meneghetti [a,*], Veronica Muffato [a], Caterina Suitner [b], Rossana De Beni [a], Erika Borella [a,*]

[a] Department of General Psychology, University of Padova, Italy
[b] Department of Developmental Psychology and Socialisation, University of Padova, Italy

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ABSTRACT

This study aimed to analyze whether social factors such as perceived stereotype threat can influence spatial recall in aging. Thirty-four young, 34 young-old and 34 old-old adults studied a map and then performed spatial recall tasks (pointing, a verification task and map drawing) and completed a questionnaire measuring their perceived stereotype threat concerning spatial skills declining with age. Results showed a worse spatial recall performance in both the older groups (young-old and old-old) than in the young adult group. In the map-drawing task, the age effect was also mediated by the perceived stereotype threat. Overall, these findings indicate that perceived stereotype threat mediates the relationship between age and map learning, depending on the type of spatial recall task used.

1. Introduction

Being able to reach a destination is essential to daily functioning and independent living. To acquire environment knowledge people form mental maps (as conceptualized by Tolman, 1948), which are assumed to mentally represent the environment (e.g., Wolbers & Hegarty, 2010). Using maps that depict a given area, showing landmarks and how they are located in relation to one another, facilitates the construction of a spatial mental representation with configurational features (e.g., Richardson, Montello, & Hegarty, 1999; Thorndyke & Hayes-Roth, 1982).

Older adults may need to use maps as a source of information (for instance, they may consult a map to see how to reach their doctor's new office) in order to remain self-sufficient in their interaction with their environment (e.g., Burns, 1999). Cognitive researchers have studied how map learning skills change with aging, finding a worse map learning performance in older than in younger adults (Borella, Meneghetti, Muffato, & De Beni, 2014; Klencklen, Després, & Dufour, 2012; Wilkniss, Jones, Korol, Gold, & Manning, 1997). This is generally attributed to an age-related decline in cognitive abilities (Craik & Salthouse, 2008), such as spatial skills (Meneghetti, Fiore, Borella, & De Beni, 2011). Importantly, results emerging within this frame of reference suggest that older adults' declining map recall performance may relate to the type of task involved. Three recall tasks frequently used to assess age-related differences in map learning involve: (i) graphically reproducing a map of an environment (map-drawing tasks, e.g., Coluccia, Bosco, & Brandimonte, 2007; Wilkniss et al., 1997); (ii) imagining standing in a given place (or landmark) on a map while facing another and pointing towards a third (pointing tasks, Richardson et al., 1999; or judgments of relative direction, Shelton & McNamara, 2001); and (iii) answering questions that entail judging spatial relations between landmarks (verification tests, e.g., Meneghetti, Borella, Grasso, & De Beni, 2011; Taylor & Tversky, 1992). Studies on age-related differences have consistently shown that older adults perform less well than younger adults in pointing tasks (Borella et al., 2014; Meneghetti, Borella, Gyselinck, & De Beni, 2012), and verification tasks (Meneghetti et al., 2012). When map-drawing tasks were used, however, while some studies found a worse performance in older adults (Borella et al., 2014; Meneghetti, Fiore, et al., 2011), others showed a similar performance between older and young adults (Meneghetti et al., 2012; Meneghetti, Borella, et al., 2011; Yamamoto & DeGirolamo, 2012). These discrepancies can be attributed to several differences in the procedures used. For instance, providing a list of landmarks (Yamamoto & DeGirolamo, 2012) or asking people to reproduce a regular environment (Meneghetti, Borella, et al., 2011) reduces age-related differences by comparison with when no list of landmarks is provided (Borella et al., 2014), or the environment is irregular (Meneghetti, Fiore, et al., 2011). The lack of age-related differences could also be attributed to the combination of the type of request involved in the recall task and the type of input to be learnt. Indeed, studying a map and then drawing it from memory is a task that preserves the same (visuo-spatial) format and perspective (bird's eye view), whereas other tasks require a change of format (i.e., from a visuo-spatial to a verbal format in verification tests) or perspective (i.e., from an aerial to the observer's view in pointing tasks). Taken together, these studies thus suggest that the age-related decline seen in environment learning skills depends on the type of task used

* Corresponding authors at: Department of General Psychology, University of Padova, Via Venezia, 8, 35131 Padova, Italy.
E-mail addresses: chiara.meneghetti@unipd.it (C. Meneghetti), erika.borella@unipd.it (E. Borella).

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to measure recall; indeed, the age-related differences appear more evident in some tasks (e.g., pointing and verification tests) than in tasks that more closely resemble the learning modality (e.g., map drawing). The reason for this difference is still unclear, given that all these tasks are sustained by the same cognitive abilities. In fact, research has demonstrated, in both young and older adults, that spatial recall tasks (pointing and map drawing) after learning a map require the use of fluid abilities (Meneghetti, Borella, et al., 2011), working memory (Borella et al., 2014) and spatial abilities (e.g., Meneghetti, Borella, et al., 2011).

The social-cognitive domain offers a different theoretical approach to the question of older people's environment learning. Age-related differences in environment learning may be modulated not only by cognitive factors, but also by social factors such as stereotypes. The literature on aging clearly shows that older adults have more negative beliefs about aging and memory than younger people, and that these convictions negatively impact their memory performance and allocation of processing resources (Chasteen, 2000; Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Hertzog & Hultsch, 2000; Horton, Baker, Pearce, & Deakin, 2008). Studies on stereotype threat have shown that individuals' cognitive performance can be undermined by the activation of negative stereotypes concerning the group to which they belong, especially if their group is important to them (Steele, 1997; Steele & Aronson, 1995). For instance, older adults may feel threatened by any mention of the stereotype that memory declines with aging, and this makes them perform less well in memory tasks than other older adults who are not reminded about this stereotype (e.g., Hess, Auman, Colcombe, & Rahhal, 2003).

The effect of the aging stereotype on performance was evident not only when stereotypes were activated by manipulating the threat but also when the threat was perceived by participants due to their own beliefs about aging stereotypes (Chasteen et al., 2005; Kang & Chasteen, 2009). In this latter case, the source of the threat is the self (Shapiro & Neuberg, 2007). In Chasteen et al. (2005), for instance, young and older participants were given information about a target person and set a task presented as a test either of their memory or of how they formed their impressions; perceived stereotype threat of participants was also assessed. The results showed that older adults reported a stronger perception of stereotype threat and had a worse recall performance than young adults, and that the effect of age on recall performance was mediated not by the type of instruction, but by the perceived stereotype threat. This goes to show that older adults' memory performance is influenced by their social context, confirming the important influence of perceived stereotype threat on their recall performance.

The effect of stereotype also seems to vary depending on the type of task used to test memory (recall) performance. Kang and Chasteen (2009), examined the impact of perceived stereotype threat in conditions with a stereotype threat (activated by manipulating instructions and setting) and without a stereotype threat, on older adults' performance in prose recall tasks. Concerning perceived stereotype threat, their results showed that: i) the state (situational) perceived stereotype threat affected memory for the prose passage tested by cued recall (when participants answered open-ended questions); and ii) the trait (dispositional) perceived stereotype threat affected free recall (when participants were asked to report everything they could remember). In contrast, the perceived (state or trait) stereotype threat did not impair performance when a recognition task was used (that involved choosing from a list of options the name of the speaker of quotations drawn from the passage). Only performance in the cued recall task interacted with perceived (state and trait) stereotype threat and the manipulation threat's effect, however; in fact, when stereotype was activated by manipulating the threat, the decrease in cued recall performance was associated with an high perceived stereotype threat. The authors concluded that the perceived stereotype threat only moderated the stereotype threat's effect on memory performance in some tasks (such as recalling information in response to a cue); on the other hand, perceived stereotype threat did not influence the manipulation threat's effect on recognition or free recall tasks that the authors considered "easy" and "difficult", respectively. These results suggest that different task features and requests contribute to modulating the influence of perceived stereotype threat on final recall task performance and indicate that perceived stereotype threat can be considered a core factor capable of mediating the relationship between age and memory performance.

So far, however, the literature on aging and stereotype has mainly explored this effect on memory tasks involving verbal features, such as prose passages (e.g., Kang & Chasteen, 2009), or word lists (e.g., Hess et al., 2003), while no evidence comes from memory tasks involving spatial features, as in the case of map learning. Such social aspects of memory as perceived stereotype threat may prompt an inadequate allocation of cognitive and spatial processing resources by influencing motivation and effort, and this would contribute to older adults' poor performance in the spatial domain too.

The aim of the present study was thus to examine to what extent age-related differences between young and older adults performing spatial memory tasks (focusing on map learning) are influenced by negative stereotypes about aging and spatial skills. We thus mainly examined: (a) whether aging stereotypes mediate the relationship between age and spatial memory tasks referred to map learning; and (b) whether this relationship can change as a function of the type of task used to measure map recall (as suggested by Kang & Chasteen, 2009).

To elucidate these issues, a sample of young, young-old and old-old participants was asked to study a map; their recall was tested using pointing, verification and map-drawing tasks; their perceived stereotype threat concerning age and spatial skills (i.e. their general perception) was also assessed. For this latter purpose, the Perceived Stereotype Threat scale was administered as the last step to avoid activating any stereotype that might negatively affect the participants' recall performance (this is normal procedure in perceived stereotype threat studies, e.g., Chasteen et al., 2005).

Older adults were divided into young-old and old-old to see whether their spatial learning decline became more accentuated with time, as suggested in the aging literature (e.g. Baltes, 1987). Few studies have compared the age-related decline in the young-old and old-old in the spatial cognition domain (Meneghetti, Borella, Muffato, Pazzaglia, & De Beni, 2014).

First, we examined age-related differences in the performance of spatial recall tasks. We expected young-old adults to perform worse than young adults in pointing and verification tasks (e.g., Meneghetti et al., 2012; Wilkniss et al., 1997); we also explored whether the young-old adults' map-drawing performance was worse (Borella et al., 2014), or comparable (Yamamoto & DeGirolamo, 2012) with that of the younger group. As for the older groups, we expected the old-old to show a more accentuated decline than the young-old (as suggested by Baltes, 1987) especially for tasks that are demanding in terms of cognitive resources, such as the pointing task, which involves managing spatial information (e.g., Borella et al., 2014).

Second, regarding the perceived stereotype threat, we examined whether the two groups of older adults differed in their susceptibility to perceived stereotype threat (as suggested by Hess, Hinson, & Hodges, 2009). On the relationship between perceived stereotype threat, age and spatial recall tasks (the main aim), we hypothesized that perceived stereotype threat can mediate the relationship between age and spatial recall performance as an extension of the negative impact of aging stereotype in older adults' recall in verbal tasks (Chasteen et al., 2005). Given that the impact of a perceived stereotype threat can also depend on the difficulty of the task (as suggested by Kang & Chasteen, 2009), we can expect the negative influence of stereotype threat on spatial memory tasks to vary as a function of the type of task performed (map drawing, verification test or pointing task), because of their different cognitive demand. Considering map learning in