Environmental learning and individual spatial factors: the role of self-efficacy

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INTRODUCTION

Spatial self-efficacy can be defined as beliefs referring to the ability to accomplish spatial environmental tasks and predict performance in shortcut finding (Pazzaglia et al., 2017). So far, spatial self-efficacy was measured using a questionnaire that allows to acquire a global measure of spatial self-efficacy, resulting from self-efficacy estimation referred to a number of everyday spatial situations and tasks, however, self-efficacy can be more or less specific to a given cognitive-demanding situation and task (Herzog & Dixon, 1994; Beaudoin & Desrichard, 2011). Therefore, it is important to investigate spatial self-efficacy considering both global beliefs in navigation and task-specific beliefs.

AIMS

To examine the relationship between ***spatial self-efficacy (both global and task-specific)*** and performance in ***spatial learning*** and subsequent recall in young adults

To examine the relationship between ***individual spatial factors*** (self-reported measures and visuospatial abilities) and performance in ***spatial learning*** and subsequent recall in young adults

METHOD

Self-reported measures

Wayfinding self-efficacy questionnaire (Pazzaglia et al., 2017). The questionnaire assesses how confident individuals feel about their ability to perform environmental spatial tasks (e.g., “Finding the right path in an unfamiliar environment

Task-Specific spatial self-efficacy. Before each environment task, participants were asked for a single item to indicate how much they feel able to accomplish the environmental tasks in a virtual environment (i.e., "Now that the task has been explained to you, how well do you feel you can do the task you are about to tackle?")

Sense of Direction and Spatial Representation questionnaire (SDSR; De Beni & Pazzaglia, 2001). The questionnaire assesses self-reported sense of direction, a preference for a map-based or route- or landmark-based preference mode, and knowledge and usage of cardinal points (e.g., “Do you think you have a good sense of direction?”).

Spatial Anxiety scale (SA; De Beni et al., 2014; Adapted from Lawton, 1994). The questionnaire assesses the degree of space-related anxiety experienced in an environment. (e.g., “Going to an appointment in an unfamiliar part of the city).

Visuospatial cognitive abilities

Route task
(Nori & Giusberti, 2006; Giusberti & Nori, 1999).

Map memory
(Ekstrom, Dermen and Harman, 1976).

Virtual environment: encoding and testing phase

Encoding phase

A video of a route within the environment was created and shown to participants twice. The path was around 1 km long and encountered all landmarks of the environment.

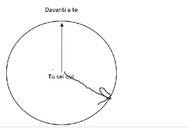
Testing phase

1

Route retracing task

Participants indicate the direction to proceed for retracing the route by inserting an arrow inside the screenshot.

2



Pointing task

Participants indicate the direction of landmarks of the environment that were not visible to participants.

3

Map-completion task

The task consisted in placing each landmark in the sketch map. Each landmark is located in one of the grey portion of the map.

Procedure

1. **SELF-REPORTED SPATIAL ABILITIES**
   - **Spatial self-efficacy** *(Wayfinding self-efficacy questionnaire; Pazzaglia et al., 2017)*
   - **Spatial anxiety** *(SA; De Beni et al., 2014)*
   - **Sense of direction** *(SDSR; De Beni & Pazzaglia, 2001).*
2. **VISUO-SPATIAL TASKS**
   - **Route task** *(Nori & Giusberti 2006)*
   - **Map memory** *(Ekstrom et al., 1976)*
3. **VIRTUAL ENVIRONMENT** — Learning phase
4. **VIRTUAL ENVIRONMENT** — Testing phase
   - *Task specific self-efficacy* ➡ Route retracing
   - *Task specific self-efficacy* ➡ Pointing
   - *Task specific self-efficacy* ➡ Locating landmarks

RESULTS

Sample: 114 (57%/ F) italian healthy young adults between 18 to 40 years old, participated to the study (see Table 1)

Whole sample (n = 114)	M	SD
Age (years)	23.93	4.48
Female (%)	50%	-
SAS	21.49	6.17
SDSR	16.36	4.13
Global spatial self-efficacy	30.31	16.36
Task-specific self-efficacy (route retracing)	55.95	21.51
Task-specific self-efficacy (pointing)	46.83	22.11
Task-specific self-efficacy (locating landmarks)	47.97	22.90
Route task	12.50	4.82
Map memory	22.26	1.79
Route retracing	6.70	1.26
Pointing	62.51	24.58
Locating landmarks	5.56	4.41

In this study, another group received a feedback after the visuospatial tasks (experimental manipulation) but it was not investigated here.

Table 2. Multiple regression models on Route retracing (Model 1).

	Route retracing (accuracy)			
	Δ R^2	Estimates	95%CI	β
Step 1: Route task		.17	-.01 - .08	.14
Map memory	22%	**.56**	**.20 - .043**	**.45*****
Step 2: Spatial anxiety	3%	.10	-.002 - .05	.08
Sense of direction		.07	-.04 - .08	.06
Global Self-efficacy		.05	-.03 - .05	.04
Task-specific self-efficacy		**.35**	**.09 - .62**	**.24** **
Total R^2	25%			

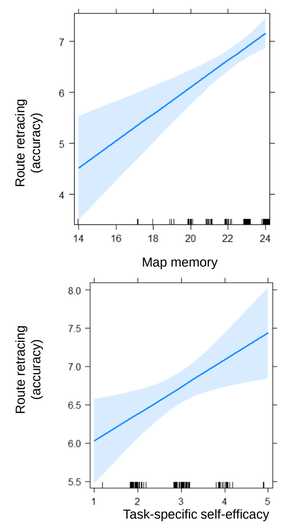


Table 3. Multiple regression model on Pointing (Model 2).

	Pointing (error)			
	Δ R^2	Estimates	95%CI	β
Step 1: **Route task**		**-4.60**	**-8.83 - -.37**	**-.19** *
Map memory	16%	**-8.66**	**-12.89 - -4.43**	**-.35*****
Step 2: Spatial anxiety	4%	-.19	-5.12 – 4.74	-.01
Sense of direction		**-6.23**	**-11.47 - .99**	**-.25** *
Global Self-efficacy		1.06	-4.02 – 6.13	.04
Task-specific self-efficacy		-1.48	-6.97 – 4.01	-.05
Total R^2	20%			

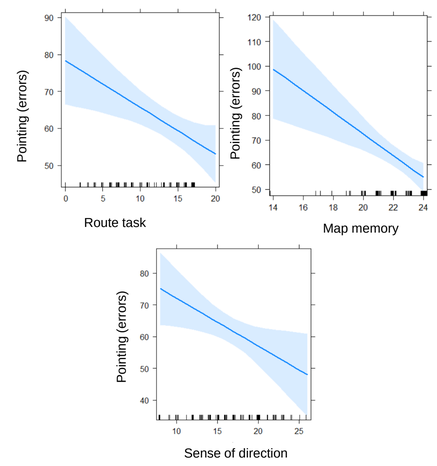
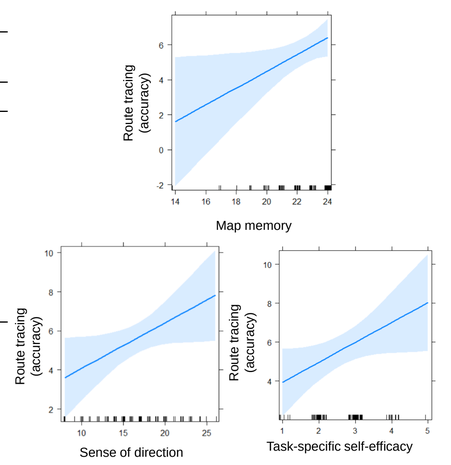


Table 4. Multiple regression model on Locating landmarks (Model 3).

	Locating landmarks (accuracy)			
	Δ R^2	Estimates	95%CI	β
Step 1: Route task		.05	-.75 - .85	.01
Map memory	6%	**1.24**	**.44 – 2.04**	**.28** **
Step 2: Spatial anxiety	11%	-.67	-1.54 - .20	-.15
Sense of direction		**.96**	**.03 – 1.90**	**.22** *
Global Self-efficacy		-.37	-1.29 - .55	-.08
Task-specific self-efficacy		**1.02**	**.05 – 2.00**	**.19** *
Total R^2	17%			



CONCLUSION

Overall, the results highlight that individual spatial factors relate to environment learning in healthy young adults. In particular:

- Higher levels of self-efficacy assessed before the tasks (task-specific self-efficacy) and higher visuospatial abilities are related to better performance in route retracing and locating landmarks
- Higher levels of sense of direction and visuospatial abilities are related to better performance in the pointing task and locating landmarks task

In conclusion, along with visuospatial abilities, task specific self-efficacy became prevalent in predicting performance in retracing routes and locating landmarks indicating that task-specific self-efficacy may have a role in explaining environmental learning performance.

References

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