Mini-maps aid spatial cognition within virtual worlds

(reflected on the linguistic output of German speakers)

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Introduction

- Mini-maps have long been used as aid for navigation in virtual spaces: Defender (1980), Legend of Zelda (1986), Super Metroid (1994)
- But their usefullness has come into question, with some major games eliminating them in later releases: The Elder Scrolls V: Skyrim (2011) Assassin's Creed Origins (2017), Call of Duty: Modern Warfare (2019)
- Landmark based instructions have been proposed as an alternative to mini-map in games [2]

Research questions

- Can the benefit of mini-maps be measured in linguistic output?
- Does the map contribute to formulating better route directions?
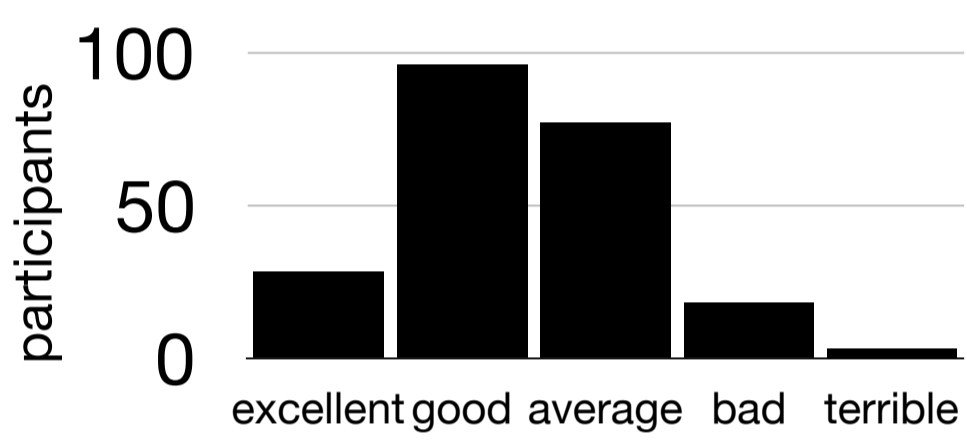- Does the map influence the linguistic placement of landmarks?

Participants

native speakers of German

N = 222

50% ♀ 50% ♂
age $\bar{x}$: 30 (18 - 73 y.o.)

self-reported spatial orientation

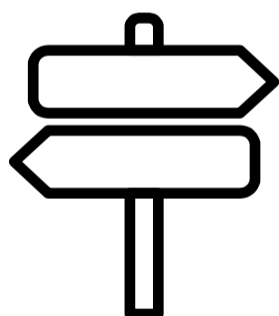|	excellent	good	average	bad	terrible
Spatial orientation	28	96	77	18	3

Table 1

- Route directions written on paper from memory

Landmarks

- Salient objects used as fixed points in the environment in order to locate other entities or describe movements in relation to them [3]
- Landmarks play an important role in wayfinding. Route directions without landmarks can not be followed since they are not anchored to the environment

[1] Gehen Sie geradeaus	[1] Go straight ahead
[2] dann links,	[2] then left,
[3] dann rechts,	[3] then right,
[5] wieder links,	[5] left again,
[9] nochmal links	[9] left yet again
[11] und zum Schluss rechts.	[11] and finally right.

- All 222 texts annotated manually: Coded as fatal errors were unmarked/wrong changes of direction and crossing wrong doors
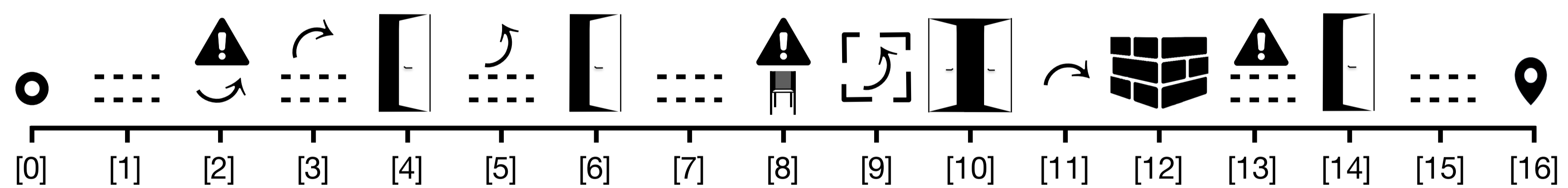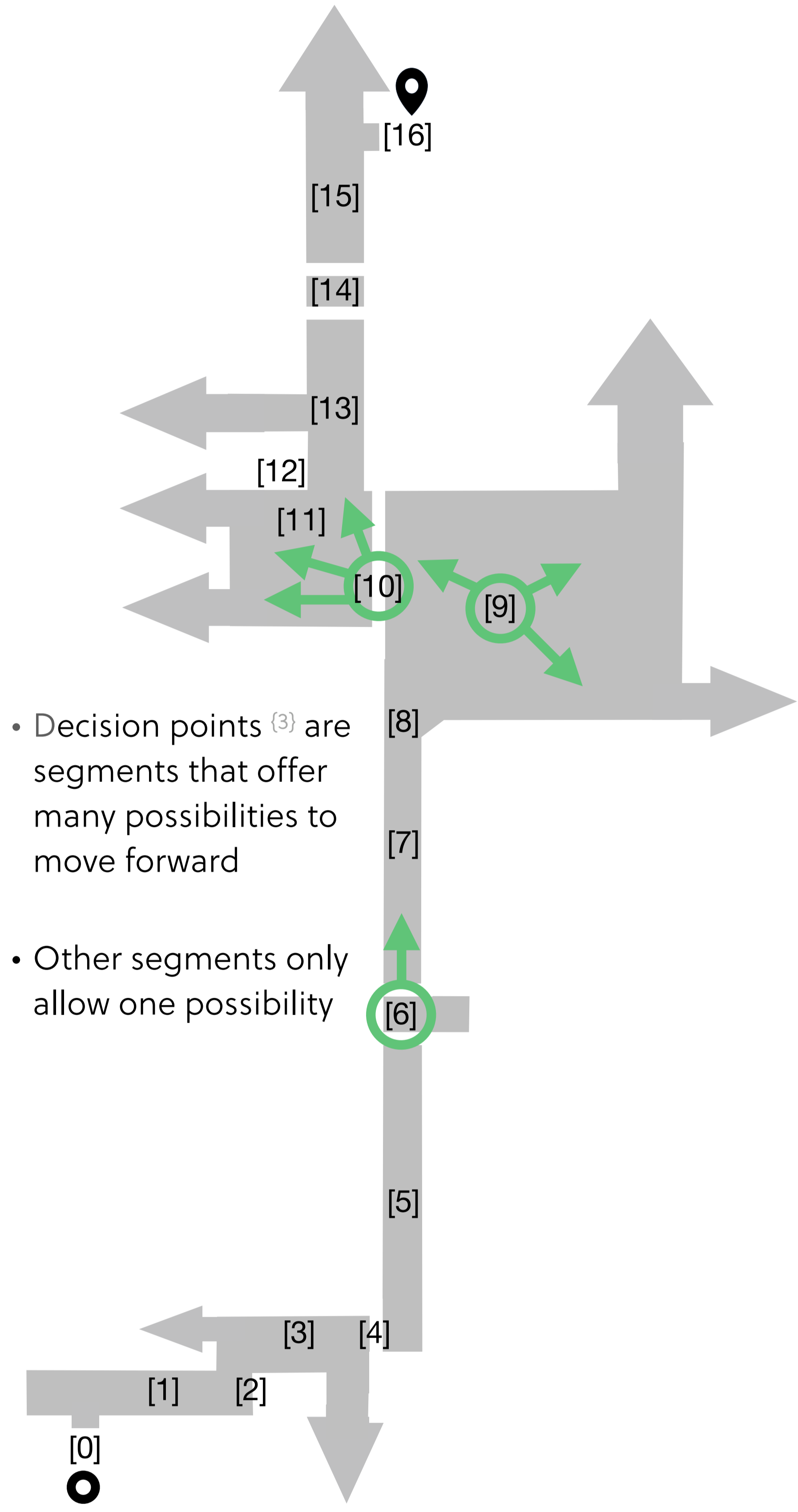
Stimulus

- Video (1 min) shown 3 times
- Indoor environment in 1st person view
- Conditions: with and without extra mini-map

only video   **video + mini map**

n = 111   n = 111

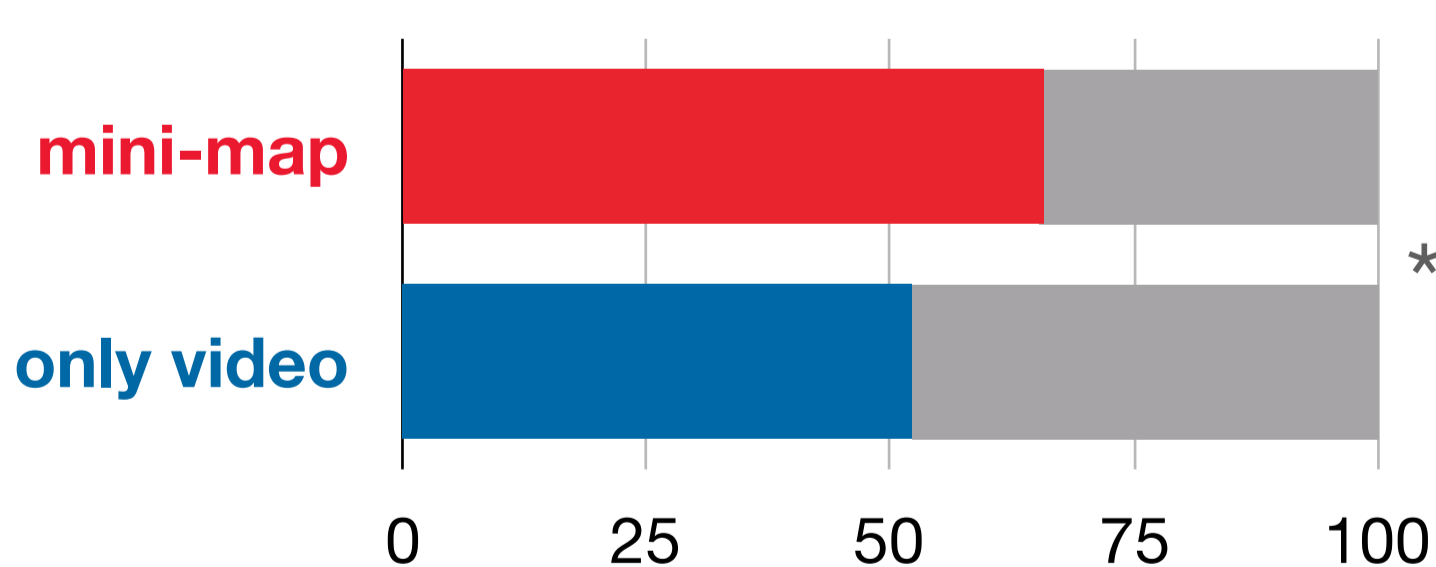|	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
Condition X							16		40		86	14	107	40	104	34	42	60
Condition O							47		50		76	25	97	44	92	24	35	79

Table 2

Methods

- Route segmented using intermediate goals in texts [1]
- Route abstracted to ordered sequence of segments
- Part-of-texts tagged to the segments of the route

- Decision points [3] are segments that offer many possibilities to move forward
- Other segments only allow one possibility

Results

texts that actually lead to the goal (%)

	Leads to final goal	Does not lead to final goal
O	65.765765765765	34.234234234234
X	52.252252252523	47.747747747747

Table 2-1

- Mini-map aided route directions are more likely to succesfully lead to the goal

number of participants that placed at least one landmark in each segment

— only video   — video + mini-map
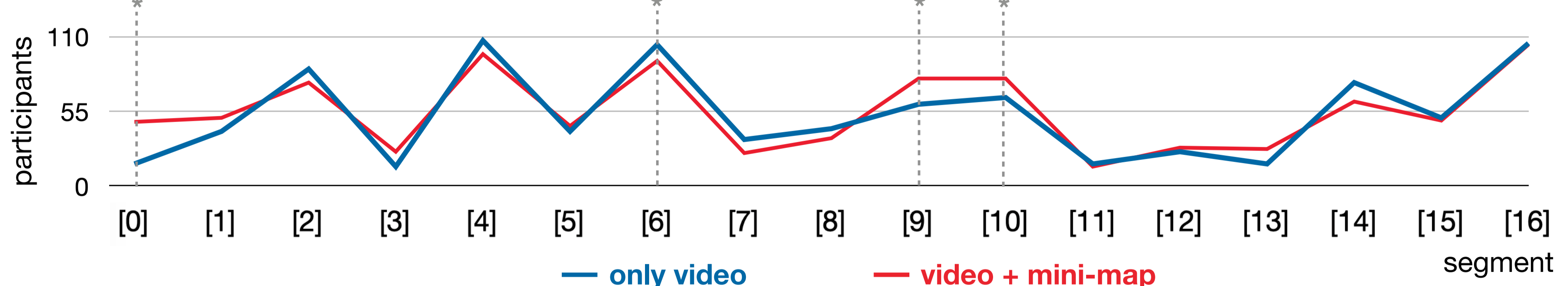
Mini-map route directions prioritized:

- More often placing landmarks at decision points such as [9] and [10]
- More mentions of landmarks at the office [0], not visible in the video
- Fewer mentions of landmarks at the double door [6]. Aerial map view shows is it unlikely to get lost at this point

Conclusions

- Mini-maps seem to aid wayfinding, judging by produced texts
- Presence of information only visible on the map proves cognitive integration of both information sources
- Map allows for more strategic placing of landmarks at decision points

References: [1] Delucchi Danhier, R. (2018). Media Exposure Influences Cognition and the Informational Content of Texts. Alman Dili ve Edebiyatı Dergisi, 2 (40), 55–75. [2] Khan N. & Rahman, A.U. (2018) Rethinking the Mini-Map: A Navigational Aid to Support Spatial Learning in Urban Game Environments. International Journal of Human−Computer Interaction. 34(12): 1135-1147 [3] Michon, P. E., & Denis, M. (2001). When and why referring to visual landmarks in direction giving? In C. Freksa & D. M. Mark (Eds.), Spatial Information theory: Cognition and computational foundations of geographic information science (pp. 292–305). Berlin, DE: Springer.

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