supporting material

1. Allen, G. L et al. "Spatial Abilities, Cognitive Maps, and Wayfinding: Bases for Individual Differences in Spatial Cognition and Behavior." *wayfinding behavior*,46--80 (1999).
2. Antoine Verghote, Sara Al-Haddad, Paul Goodrum, Sylvie Van Emelen.The Effects of Information Format and Spatial Cognition on Individual Wayfinding Performance. *Buildings*,**9(2),**29 (2019).
3. Antti Oulasvirta,Sara Estlander,Antti Nurminen. Embodied interaction with a 3D versus 2D mobile map. *Personal and biquitous Computing*, **13(4),** 303-320(2009).
4. Ashly Martin et al. Indoor Navigation using Augmented Reality. *EAI Endorsed Transactions on Creative Technologies,***8(26),** (2021).
5. Ben-Elia E. An exploratory real-world wayfinding experiment: A comparison of drivers' spatial learning with a paper map vs. turn-by-turn audiovisual route guidance. *Transportation Research Interdisciplinary Perspectives,***9** (2021).
6. [Bosco, A., Picucci, L., Caffò, A. O., Lancioni, G. E., & Gyselinck, V. Assessing human reorientation ability inside virtual reality environments: The](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref6) [effects of retention interval and landmark characteristics.](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref6) [*Cognitive Processing,*](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref6)[**9**(**4)**,299–309](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref6)(2008)[.](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref6)
7. Brewer M B. Research design and issues of validity.[*Handbook of research methods in social and personality psychology3*](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref100)*–*[*16.*](http://refhub.elsevier.com/S0747-5632%2818%2930416-3/sref100)11-26(2000).
8. Bryan, JL. Human behaviour in fire: The development and maturity of a scholarly study area*.Fire and materials,***23(6),**249-253(1999).
9. Chen, JL et al. A theoretical model of *way-finding* in virtual environments: Proposed strategies for navigational aiding. *Presence*,**8(6),**671-685(1999).
10. Chrastil, Elizabeth et al. Active and Passive Spatial Learning in Human Navigation: Acquisition of Graph Knowledge. *Journal of Experimental Psychology. Learning, Memory & Cognition,* 41(4),1162-1178 (2015).
11. Christian Kray, Christian Elting, Katri Laakso, Volker Coors. Presenting route instructions on mobile devices. *Intelligent user interfaces,* 117-124 2003.
12. Christoph Hölscher, Simon J. Büchner, Tobias Meilinger, Gerhard Strube. Adaptivity of way-finding strategies in a multi-building ensemble: The effects of spatial structure, task requirements, and metric information.*Journal of Environmental Psychology*,**29(2),** 208-219(2008).
13. Delamater Andrew R. Inaugural editorial for Journal of Experimental Psychology: Animal Learning and Cognition. *Journal of experimental psychology. Animal learning and cognition,* **46(2),** 99-100（2020）.
14. Dolins ,Francine et al. Technology advancing the study of animal cognition: using virtual reality to present virtually simulated environments to investigate nonhuman primate spatial cognition*.Current Zoology,* **63(1),**97-108(2017)
15. Dong Weihua et al. What is the difference between augmented reality and 2D navigation electronic maps in pedestrian wayfinding? *Cartography and Geographic Information Science***,48(3),**225-240(2021) .
16. G. Proulx. A stress model for people facing a fire. *Journal of Environmental Psychology*, **13(2),**137-147(1993).
17. GoebelR, et al. Learning, Reasoning, and Talking about Space. *Berlin: Springer-Verlag,*: 171- 187.(2008).
18. Golledge, R.G., Dougherty et al. Acquiring Spatial Knowledge: Survey Versus Route‐Based Knowledge in Unfamiliar Environment. *Annals of the Association of American Geographers* **85(1),**134-158(1995).
19. He,Qiliang et al.Acquisition and Transfer of Spatial Knowledge During Wayfinding.Journal of Experimental Psychology. *Learning, Memory & Cognition,***45(8),**1364-1386(2019).
20. HerganI. et al.. Comparison of children's wayfinding, using paper map and mobile navigation. *International research in geographical and environmental education,***26(2)**,91-106(2017).
21. Hiromune Namie, Osamu Suzuki. Indoor Location Estimation by Bluetooth Low Energy for Pedestrian Navigation: Paper. *IEEJ Journal of Industry Applications,***10(1),**45-52(,2021).
22. Hurst, Paul et al. Will we be lost without paper maps in the digital age? *Journal of Information Science*, **39(1),**48-60(2013).
23. Iaria Giuseppe, Slone Edward. The relationship between mental and physical space and its impact on topographical disorientation. *Handbook of clinical neurology***178,**195-211(2021)
24. Ishikawa, T et al. Spatial knowledge acquisition from direct experience in the environment: Individual differences in the development of metric knowledge and the integration of separately learned places. *Cognitive Psychology*,**52(2)**,93-129(,2006).
25. Ishikawa, T. et al. Wayfinding with a GPS-based mobile navigation system: A comparison with maps and direct experience. *Journal of Environmental Psychology,* **28,** 74 – 82 (2008).
26. Jamshidi Saman, et al. "A Narrative Review of Theories of Wayfinding Within the Interior Environment." *HERD: Health Environments Research & Design Journal* **14.1,** 290-303 (2021)
27. Jansen Osmann Petra, Schmid Juliane, Heil Martin. Wayfinding behavior and spatial knowledge of adults and children in a virtual environment: The role of environmental structure. *Swiss Journal of Psychology / Schweizerische Zeitschrift für Psychologie / Revue Suisse de Psychologie*, **66(1),** 41-50(2007)
28. K. A. Jellinger. way-finding Behavior, Cognitive Mapping and Other Spatial Processes Reginald G. Golledge, ed. *The Johns Hopkins University Press, Baltimore & London, 1999. ISBN 0–8010–5993–X. European Journal of Neurology,* **7(5),** 590-591 (2000).
29. Kirsten M. Kinsley, Dan Schoonover, Jasmine Spitler. GoPro as an ethnographic tool: A way-finding study in an academic library. *Journal of Access Services,* **13(1),** 7-23(2016).
30. Lin, Jing et al. Do people follow the crowd in building emergency evacuation? A cross-cultural immersive virtual reality-based study. *Advanced Engineering Informatics,*43,2020,.
31. Lloyd, R Bunch et al. Technology and map-learning: Users, methods, and symbols. *Annals of the Association of American Geographers,* **93(4),**828-850(2003).
32. Lokka, Ismini et al. Perspective switch and spatial knowledge acquisition: effects of age, mental rotation ability and visuospatial memory capacity on route learning in virtual environments with different levels of realism. *Cartography and Geographic Information Science,* **47(1),**14-27(2020).
33. Lovreglio, Ruggiero et al Prototyping virtual reality serious games for building earthquake prepae goiredness: The Auckland City Hospital case study. *Advanced Engineering Informatics*, **38,**670-682(2018).
34. Mallory C. et al. Where are wng and where have we been? Examining the effects of maps on spatial learning in an indoor guided navigation task. *Cognitive Research: Principles and Implications,***5(3),**73-86 (2020).
35. Manning, J.R. et al. Magellan: A cognitive map-based model of human wayfinding. *Journal of experimental psychology. General,* **143(3),**1314-1330(2014).
36. Mark D M et al. Cognitive Models of Geographical Space. *INT. J. Geographical Information Science,* **13（8）,**747-774(1999).
37. Meng, Fanxing et al .Way-finding during a fire emergency: an experimental study in a virtual environment.*Ergonomics,***57(6),**816-827(2014).
38. Montello D R. D Waller, Hegarty M , et al. Spatial memory of real environments, virtual environments, and maps. *Atherosclerosis,* **41(2–3)**,185-192(2004).
39. Montello D R. Raubal M. Waller D. et al. Functions and applications of spatial cognition. *Handbook of Spatial Cognition*,249–264, 2013.
40. Montello, Daniel et al. Cognitive map-design research in the twentieth century: Theoretical and empirical approaches. *Cartography and Geographic Information Science,***29(3)，**283-304（2002）.
41. Münzer Stefan, Lörch Lucas, Frankenstein Julia. Wayfinding and acquisition of spatial knowledge with navigation assistance. *Journal of experimental psychology. Applied,* **26(1),** 73-88(2020).
42. Münzer,S. Zimmer et al. Computer-assisted navigation and the acquisition of route and survey knowledge. *Journal of Environmental Psychology,* **26(4),**300-308(2006).
43. Münzer,S. Zimmer et al. Navigation assistance: A trade-off between wayfinding support and configural learning suppor.*Journal of experimental psychology.Applied*, **18(1),**18-37(2012).
44. Münzer,S., Zimmer et al. Computer-assisted navigation and the acquisition of route and survey knowledge. *Journal of Environmental Psychology*, **26(4),**300-308(2006).
45. Ozel, F. Time pressure and stress as a factor during emergency egress. *Safety Science,***38(2),**95-107(2001).
46. [Parush, A., Ahuvia, S., Erev, I., Degradation in spatial knowledge acquisition](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0245) [when using automatic navigation systems. *Spatial Inf. Theory*, 238](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0245)–[254](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0245)(2007).
47. Proulx, G. A. stress model for people facing a fire.*Journal of Environmental Psychology,* **13(2)，**137-147(1993).
48. Shi, Yangming et al. Spatial knowledge and firefighters' way-finding performance: A virtual reality search and rescue experiment.*Safety Science*, 139(2021).
49. Siegel, A. W., & White, S. H. The development of spatial representations of large-scale environments. *Advances in Child Development and Behavior*, **10,** 9– 55(1975).
50. Spiers H J, Maguire E A. The dynamic nature of cognition during wayfinding. *Journal of Environmental Psychology ,***28(3)**,232-249(2008)
51. [Spiers, H.J., Maguire, E.A. Thoughts, behaviour, and brain dynamics during](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0320) [navigation in the real world. *NeuroImag* **31,** 1826](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0320)–[1840](http://refhub.elsevier.com/S2590-1982%2820%2930191-3/h0320)(2006).
52. Steinke T R. Eye movement studies in cartography and related fields. *Cartographica,* **24(2)**,197-221(1987).
53. Steuer, J. Defining Virtual Reality: Dimensions Determining Telepresence.*Journal of Communication,* **42(4),**73-93(1992).
54. Tejera, Gonzalo et al. Bio-Inspired Robotics: A Spatial Cognition Model integrating Place Cells, Grid Cells and Head Direction Cells. *Journal of intelligent & robotic systems*,**91(1),**85-99(2018).
55. van, der, Kuil et al. Spatial knowledge acquired from first-person and dynamic map perspectives. *Psychological research*, **85(6)**,2137-2150(2020).
56. Wang Duming et al. A comparative study of spatial orientation performance of YAH map in different display modes. *Human ergonomics,***16(4),**1-6. (2010).
57. Wang,,Zhuo et al. The role of user-centered AR instruction in improving novice spatial cognition in a high-precision procedural task.*Advanced Engineering Informatics,*2021,47.
58. Wu Zenghong, Chen Weifen. New products in map science and the transformation of human spatial cognitive ability. *Beijing surveying and mapping*, **(04),**11-14(2008).
59. Xiong, Qing et al. A Dynamic Indoor Field Model for Emergency Evacuation Simulation. *ISPRS International Journal of Geo-Informatio*n, **6(4),**104(2017).
60. Zhao, Haifeng et al. A Time-Aware Routing Map for Indoor Evacuation. *Sensors,* **16(1)**,112(2016).
61. Zheng Meng-Cong et al. Designing indoor navigation interfaces on smartphones compatible with human information processing in an emergency evacuation scenario. *Journal of Asian architecture and building engineering,* **18(6),**599-616(2019).
62. Zou, Hao et al. Emotional Response-Based Approach for Assessing the Sense of Presence of Subjects in Virtual Building Evacuation Studies. *Journal of Computing in Civil Engineering*, **31(5),**4017028.1-4017028.1(2017).

1. Bouchekioua,Youcef et al. Spatial inference without a cognitive map: the role of higher-order path integration.*Biological reviews of the Cambridge Philosophical Society*, **96(1),**52-65(2021).
2. Jing Lin, Lijun Cao, Nan Li. Assessing the influence of repeated exposures and mental stress on human *way-finding* performance in indoor environments using virtual reality technology. *Advanced Engineering Informatics,* **39, 5**3-61(2019).
3. Li et al."How the completeness of spatial knowledge influences the evacuation behavior of passengers in metro stations: A VR-based experimental study". *Automation in Construction*,113(2020).
4. Lijun Cao, Jing Lin, Nan Li. A virtual reality based study of indoor fire evacuation after active or passive spatial exploration. *Computers in Human Behavior*, **90,** 37-45(2019).
5. Montello, D. Spatial cognition. *Int. Encyclo. Soc. Behav. Sci.* **7,** 14771–14775(2001).
6. Meilinger T. et al. How Much Information Do You Need Schematic Map sin *Way-finding* and Self Localisation [M]//*Barkowsky T, Knauff M. Spatial Cognition V. Reasoning, Action, Interaction. Berlin: Springer-Verlag*,381- 400(2006).
7. Van, Asselen, M. et al. The influence of intentional and incidental learning on acquiring spatial knowledge during navigation. *Psychological research*, **70(2),**151-156(2006).
8. Zhu, Runhe et al. Influence of architectural visual access on emergency wayfinding: A cross-cultural study in China, United Kingdom and United States. *Fire safety journal,*113(,2020).