



**ifgi**

Institute for Geoinformatics  
University of Münster

# **Gamification for spatial literacy:** The use of a desktop application to foster map-based competencies

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**SPATIAL  
INTELLIGENCE  
LABORATORY**





# Outline

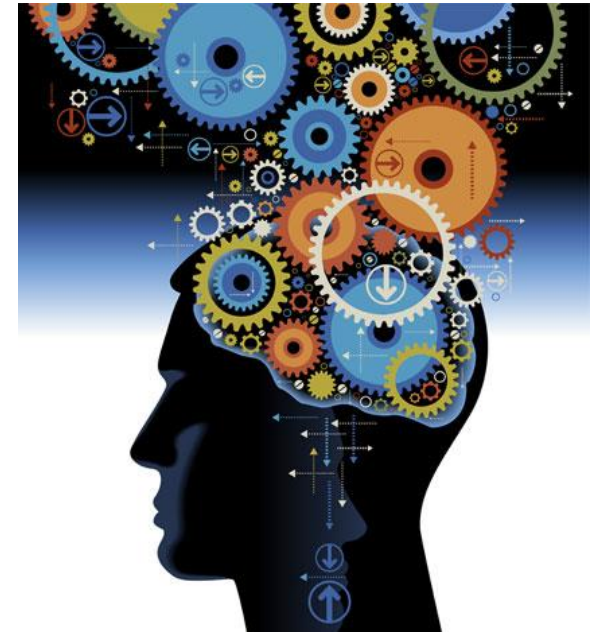
- Motivation
- Ori-Gami
- Testing spatial competencies
- Results
- Conclusion
- Future work



# Motivation

- Developmental / Cognitive
  - Spatial thinking / Learning
  - Individual differences

„GIS as a support system  
to think spatially“  
(NRC Report „Learning to think spatially“)



- Usability / User centered Design
  - Focussed Apps

# THE MODERN SCHOOLTEACHER

GIS?  
WTF?

PRANK FROM  
STUDENT  
(FUTURE CARTOONIST)

DISHEVELED HAIR  
FROM GETTING UP  
AT 5:00 AFTER  
GETTING TO BED  
AT 1:16

LESSON PLANS,  
PAPERS TO GRADE  
AND GRADE BOOKS  
TO UPDATE BY  
TOMORROW

MONEY FOR CLASSROOM  
SUPPLIES (OUT OF HER  
OWN POCKET)

NOTE FROM  
PARENT SAYING  
TEACHERS GET  
PAID TOO MUCH

SHOES FOR TRAFFIC  
DUTY, PLAYGROUND DUTY,  
CAFETERIA DUTY AND  
THAT REALLY FAST BRAT





# Motivation

- Educational
  - Educational Standards / Curricula
  - Spatial Competencies
    - Spatial Orientation
    - Map understanding



„move in real space with the aid of maps and other aids for orientation“ (German Geography Standards)

- Learning with ICT (UNESCO 2011)
- Mobile Learning (UNESCO 2012)
- Engagement => Gamification



# Ori-Gami App

- „Orientation Gaming“
- Game idea
  - Game leader (teacher or student) creates a route and adds verbal route instructions to reach each waypoint
  - Player follows instructions step by step
- Mobile (iOS) and desktop version (Browser)
  - Esri ArcGIS Server APIs
- Game-based elements:
  - Visual feedback
  - Audio feedback





# Ori-Gami App (Editor)

OriGami Editor   Route ▾   FAQ   Über   Basemap ▾

Details

Bitte geben Sie hier die Wegbeschreibung an:

Please walk north until the entrance of the train station

Bitte geben Sie hier die Hilfe ein:

Löschen   Speichern

Map data © OpenStreetMap contributors, CC-BY-SA   POWERED BY esri



# Types of routes

- Egocentric (left / right)
- Allocentric (north / south)
- Landmark (church, restaurant)





# Ori-Gami App (iOS)





# Ori-Gami App (Browser)

OriGami - Mozilla Firefox

giv-learn.uni-muenster.de/geogames/orientation/

Angela SIL leo google doc Osvaldino

OriGami

Bitte gehen Sie in die Straße der Piazza (auf der linken Seite). Die Straße heißt Via Giuseppe Verdi. Gehen Sie bis zum ersten Kreuzungspunkt.



# Ori-Gami App

- Measurement functionalities
  - Recording of clicks / touches
    - time
    - distances
    - zoom-level
    - amount of clicks / errors
  - iOS only:
    - Tracking of user (GPS)
    - Orientation of device
    - Gestures
    - Sound recording



# Testing Spatial Competencies

- study on spatial competencies
  - 26 psychology / pedagogy students
  - Spatial ability tests
    - Hidden patterns test
    - Perspective taking / Spatial Orientation test
    - Mental Rotation
  - Ori-Gami performance (desktop version)
    - Three routes with 10 waypoints each
    - Each with egocentric, allocentric, landmark instructions

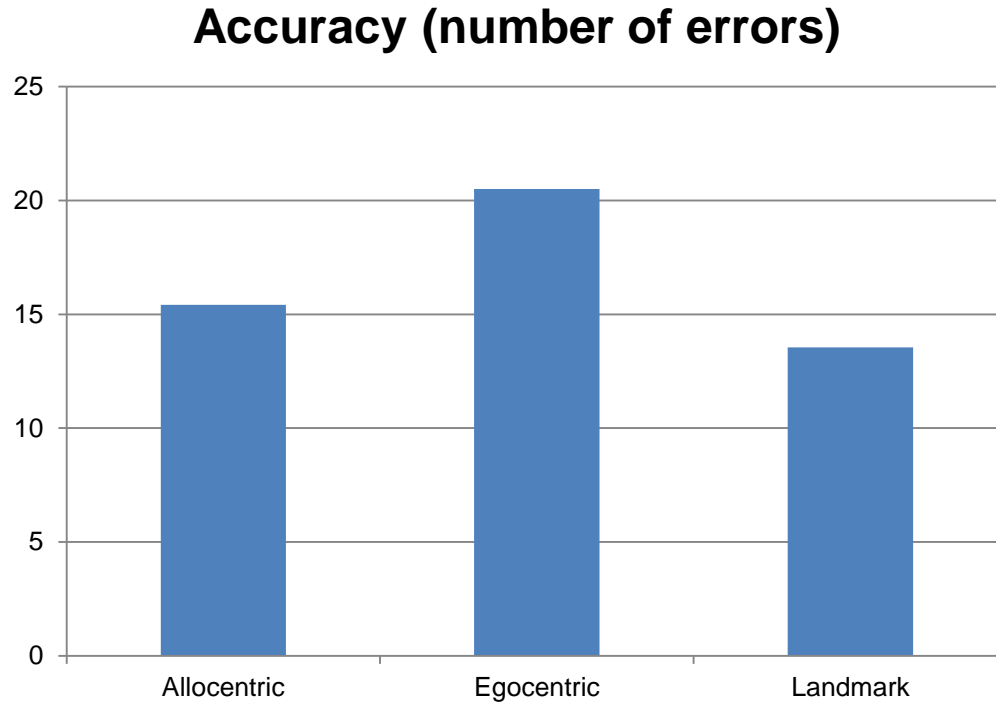


# Route Examples

	Landmark	Egocentric	Allocentric
Initial instruction for orientation	On your right you see the Sacred Heart Church. On your left you see the Old Postman Pub. Go to the next junction.	You are looking in the direction of "Cologne Street". Go straight until you reach the next junction.	Go south until you reach the next junction.
Instruction at a waypoint	Turn and go to the Art house.	Turn right and walk along the street until you reach the second junction	Turn north and walk until you reach the second junction.



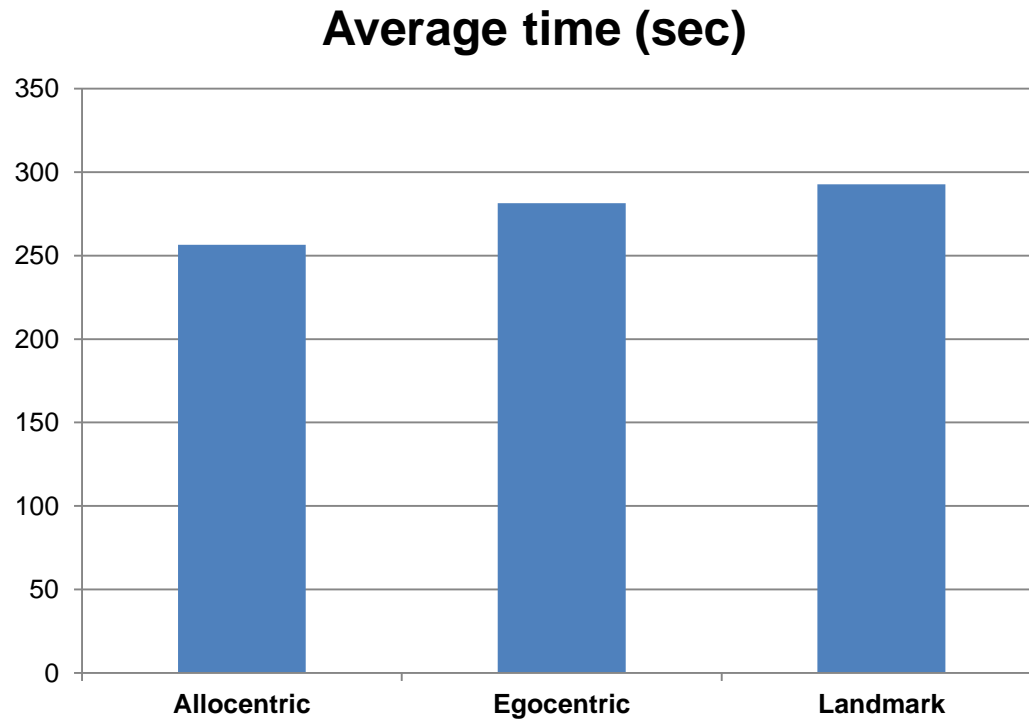
# Results: Accuracy



$$F(2,46) = 3.16, p = .052$$



# Results: Time



Non-significant difference



# Results: Correlation

	HP	PT	MR	ACC-ALLO	ACC-EGO
Perspective taking test average angular error (PT)	-.15				
Mental rotation test average reaction time (MR)	-.51*	-.26			
Accuracy in the allocentric condition (ACC-ALLO)	-.25	-.00	.11		
Accuracy in the egocentric condition (ACC-EGO)	-.20	-.05	.42*	.49*	
Accuracy in the landmark-based condition (ACC-LANDM)	.00	.29	-.00	.28	.16

Note. \* $p < .05$





# Conclusions

- Ori-Gami as an educational game
  - performed well in usability tests
  - fits curricular and developmental „requirements“
- Ori-Gami as an measurement tool for spatial competencies
  - recording facilities
  - players with good performance in **mental rotation** test performed significantly better in **egocentric** routes on Ori-Gami
- Ori-Gami as a game for language learning!



# Future Work

- Further studies
  - Mobile vs. Indoor use
  - Influence of basemap
  - Impact on spatial learning
- Further development of Ori-Gami
  - More game-elements
  - Recommender system for the editor



# Thank you for your attention!



SPATIAL  
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Questions?



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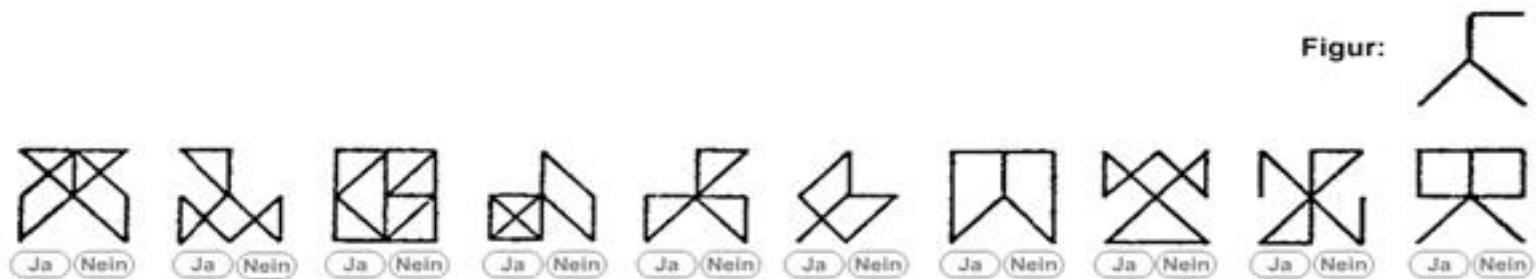
supported by:





# Hidden Patterns Test

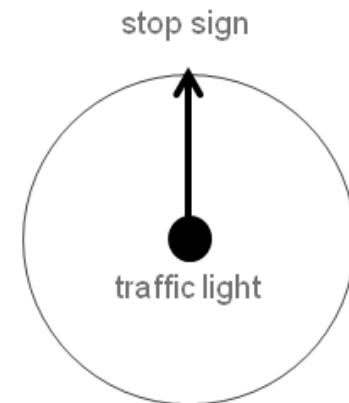
- measures encoding and recognizing a simple figure which is embedded in a more complex line drawing





# Perspective Taking Test

- requires estimating directions from imagined positions with orientations that deviate from the “upright/north” orientation of the map typically more than 90 degrees.



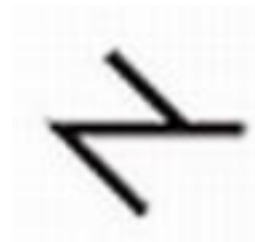


# Mental Rotation Test

- Comparing symbols



original symbol



comparison symbol