



The effect of the task locations on a pointing task performed in a VR spatial navigation study

by

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Declaration of Authorship

I hereby certify that the work presented here is, to the best of my knowledge and belief, original and the result of my own investigations, except as acknowledged, and has not been submitted, either in part or whole, for a degree at this or any other university.

City, Date

Signature

Eidesstattliche Erklärung

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Datum

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Abstract

Acknowledgements

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1. Introduction

- what is space and how is it related to human cognition
- what is spatial navigation
- role and place of distance in navigation
- VR and spatial navigation
- hypothesis
- why studying this hypothesis
- we are looking at role of distance in the accuracy and RTs in the pointing task

2. Methodology

2.1. Participants

A total number of 26 participants, # of females and rest with the average age of average age with the standard deviation of sd age took part in the experiment. The participants were all students of the University of Osnabrück. Before the start of the first exploration session all participant gave their written consent for taking part in the experiment (see appx. F, Einverständniserklärung). The participation was voluntary and only students with no health issue were selected (see appx. F, Anamnese). The participants were compensated by test-subject hours and/or 5€ per hour.

Due to the Covid-19 pandemic sessions were conducted according to the laboratory hygiene regulations with a mask and under 3G rule.

3 participants were excluded due to not being able to comply with the experimental requirements, i.e., come in less than 3 days and more than 4 hours apart.

2.2. Experimental Design

2.2.1. City

This study is conducted in a virtual reality (VR) city with an area of about 1 km². The city (see figure 2.1) is consisted of 284 buildings. 56 buildings are used in the experimental task of this study from which 4 are global landmarks, 26 are context meaningful locations, e.g., shops, construction sites, and 26 are residential, not context meaningful buildings. These 56 buildings have human agents in front of them and an artwork on one of their walls. Human agents belonging to the shops take the pose of an act according to the functionality of that store (meaningful) (see figure 2.3a), e.g., has a book in the hand in front of a bookstore, or are just standing in front of the residential building (standing human agent) (see figure 2.3c). The artworks on the shops are also depicting the functionality of the

2. Methodology

shop.

A sun with a detectable origin is avoided in the city, no street is named and no building is numbered to implicitly direct the participants to prioritize their spatial learning. Furthermore, there are borders around the city so that the participants cannot exit the city area.



Figure 2.1.: the virtual city

2.2.2. Application and Technology

The application of the experiment is implemented with unity version 2019.4.11f1. The assets of the city, e.g., buildings, streets were obtained from a previous study called SpaRe, made also at the university of Osnabrück. They were modified with blender version 2.83 LTS (Long Term Support), as were also the human agents picked from Adobe Mixamo collection. They were modified for this experiment in a way that some contextual objects were added to the human agents in front of context meaningful buildings with regard to the context of the building.

The experiment consisted of two separate parts, i.e., Exploration and Testing. Each section had the option to choose the language of the instructions, i.e., German and English. The experiment was conducted using a HTC Vive Pro Eye VR-Headset. For the virtual moving purposes inside the virtual city the participants were given Index valve controller to navigate inside a city by moving the joystick of the controller. They had both the right and left controllers to be able to use their dominant hand.

2.3. Experimental Procedure

Participants were seated on a backless rotating chair that enabled them to physically rotate in the virtual city. Any forward, backward and sideways movement were done utilizing the controllers.

2.3.1. Exploration

The exploration consisted of 5 sessions. The sessions had to be no more than 3 days and no less than 4 hours apart.

The total duration of each session was 30 minutes broke down into 10 minutes segments for breaks to reduce the possibility of motion sickness. Before starting each segment the built-in eye-tracker of the VR-Headset was calibrated and validated.

After inserting participant-ID and choosing the preferred language the exploration session started with a tutorial. The tutorial was held in a scene separate from the main city. The purpose of the tutorial was to allow the participant to move around, get acquainted with the controller and practice the possible movement options the experiment allowed for. After participants confirmed their confidence in using the controllers the experiment was continued to the exploration session. In the main city participants were advised to explore the city freely.

2.3.2. Testing

Testing comprised of one session of approximately 2 hours. The testing starts after inputting the participant-ID and choosing the language. There is then a tutorial scene outside of the main city used in the experiment for participants to get acquainted with how to use the controller for performing the tasks. Before presenting the trials and in intervals of 112 trials eye-tracker was calibrated and validated.

Testing was a pointing task comprised 336 trials performed from 28 different starting locations in the city. The distribution of the starting locations can be seen in figure 2.2. At each starting location 12 target buildings were randomly chosen from a pull of 112 targets (56 task buildings with and without human agents). Some examples are shown in figure 2.3. Each of the four conditions of the experiment, i.e., context meaningful with human agent

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present (CmA), context meaningful with no human agent present (CmANo), non-context meaningful with human agent present (Sa), non-context meaningful with no human agent present (SaNo) built up 25% of the trials. The starting locations themselves were consistent for all participants and their order of execution was randomized for each participant. All movements except the rotation were blocked for the whole testing session to maintain the consistence of the participants' position in the starting locations between participants.

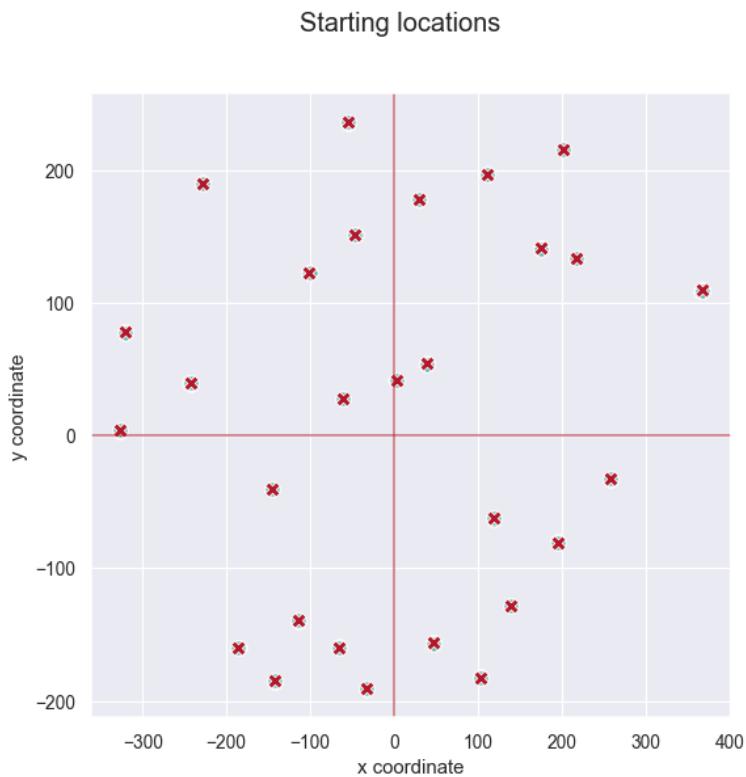


Figure 2.2.: distribution of the starting locations in the city

At each starting location the 12 consecutive trials were performed. Before each trial begin a green circular loading bar (Go cue) was shown in the middle of the screen for 25ms. As soon as the bar was complete, a beep sound was played informing the participants of the start of a new trial. In each trial a photo of one of the task buildings, with or without human agent in front of it (see figure 2.3), was presented at the top center of the screen (see figure X). The participants had the option to press the trigger button to bring the picture to the middle of the screen (see figure X). As soon as the button was released the photo moved back to the upper center part of the screen. Since there was no visual virtual body, there was a green dashed laser beam (see figure X) attached to the virtual hand of the participants

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Figure 2.3.: Examples of photos shown in the pointing task as target buildings. A selection of all four experimental conditions. **CmA:** context meaningful with human agent present. **CmANO:** context meaningful without human agent present. **Sa:** not context meaningful with human agent present. **SaNo:** not context meaningful without human agent present.

that moved as they moved their hand. The purpose of the laser beam was to assist the participants with the visualization of the direction they are pointing at. The maximum duration of each trial was 30 seconds. If there was no answer given to the task after 20 seconds from the start of the trial, i.e., no direction was selected by the participant indicating in which direction the target building is located from their current location, a countdown timer appeared on the bottom center of the screen (see figure 2.4) and terminated the trial after 10 seconds if there was still no answer given.

Selecting an answer for the task, i.e., selecting the direction of the target building was possible with a button press. With once pressing the button it locked the laser beam onto a direction and detached it from the hand. The participants had the option to either confirm the chosen direction with the same button or cancel it with another. Moving on to the next trial was the result of either the participant confirming a direction or by running out of time. Behavioral and technical data, e.g., the chosen direction, participant position and rotation, reaction times were gathered during each trial. The

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Figure 2.4.: the countdown timer appears at the bottom of the screen after 20s has passed from the trial

human agents were present during the testing in the city at their exact designated positions and poses in the exploration sessions. A gray screen fade out and fade in occurred while transporting the participants from their current location to another starting location. This was to serve the purpose of decreasing the chance of motion sickness and also avoiding leaking environmental information while moving in the city.

2.4. Analysis method

The data of this experiment is gathered from unity in JSON ¹ format. All the further processes for analysis were done in python (Van Rossum & Drake, 2009) v3.8. For the preprocessing the pandas (McKinney, 2010; pandas development team, 2022), numpy (Harris et al., 2020) and scipy (Virtanen et al., 2021) libraries, and for the analysis python's statmodels (Seabold & Perktold, 2010) module were utilized. Matplotlib (Hunter, 2007) and Seaborn (Waskom, 2021) were used for the visualizations.

After importing and converting the data into a pandas dataframe, the preprocessing is done to prepare the data for analysis. In this process the dependent variable `absolute_180_angle` is derived. The variable contains the absolute angular deviation of the participant's chosen direction from the actual target position.

¹Introducing JSON: <https://www.json.org/json-en.html>

2. Methodology

2.4.1. Preprocessing

Different functions of pandas (`pd`) and numpy (`np`) used for the preprocessing. In all the calculations involving directions and positions, only the right direction (x) and the forward direction (z) are taken into account. The up direction (y) was excluded as it is not relevant for the analysis at hand.

The main preprocessing steps are as follow:

1. Removed trials in which the participants did not select any direction. These were the trials that were terminated due to timeout. Hence, only the trials where their respective `TimeOut` variable was `False` were kept for the analysis. a total of **number of removed trials** trials were removed.
2. Calculated the participant's chosen direction's absolute angular deviation from the actual location of the target building.
 - a) Translated the target building's center position (`Tpos`) by the participant's body position (`Ppos`) to be able to derive the translated building center position `Tpos_t` take the body position as the origin at the (0,0) coordinates.

$$Tpos_t_{x,z} = Tpos_{x,z} - Ppos_{x,z}$$

The direction vector of participant's chosen direction doesn't need to be translated because unity's output for a direction is a normalized vector and therefore it's origin lies already at (0,0).

- b) Now that body position is at (0,0) with respect to the translated building center position, the angle difference between the participant's chosen direction (`Cdir`) to the positive x-axis and the translated building center position (`Tpos_t`) to the positive x-axis were calculated using numpy `arctan2(z, x)`² function. This function calculates the angle in radian between the positive x-axis and the vector given to the function as parameter.
Due to the translation done in step *a* the body position was implicitly translated to the origin (0,0), i.e., subtracting body position from body position results in (0,0), it was possible to pass the z and x coordinates of the `Tpos_t` and the `Cdir` to the `arctan2` function separately to calculate the angle between the `Cdir` and

²Numpy arctan2: <https://numpy.org/doc/stable/reference/generated/numpy.arctan2.html>

2. Methodology

the positive x-axis (`Cdir_to_x`) and the `Tpos_t` and the positive x-axis (`Tpos_to_x`). The results are directly translated to degree utilizing numpy `rad2deg()`³ function.

$$Tpos_to_x_\theta = np.rad2deg(np.arctan2(Tpos_t_z, Tpos_t_x))$$
$$Cdir_to_x_\theta = np.rad2deg(np.arctan2(Cdir_z, Cdir_x))$$

- c) After creating `Tpos_to_x` and `Cdir_to_x` the angles were respectively converted to `Tpos_to_x_360` and `Cdir_to_x_360` in the 360 degree environment.

$$Tpos_to_x_360_\theta =$$

if

$$Tpos_to_x_\theta < 180$$

then

$$360 + Tpos_to_x_\theta$$

else

$$Tpos_to_x_\theta$$

$$Cdir_to_x_360_\theta =$$

if

$$Cdir_to_x_\theta < 180$$

then

$$360 + Cdir_to_x_\theta$$

else

$$Cdir_to_x_\theta$$

- d) Calculated the angular difference between the selected direction (`Cdir_to_x_360`) and the target building (`Tpos_to_x_360`). They were directly converted to the signed 2 quadrant environment.

$$signed_180_angles_\theta = ((Tpos_to_x_360_\theta - Cdir_to_x_360_\theta) + 180)\%360 - 180$$

- e) The final step was to create `absolute_180_angles`, the dependant variable for the main analysis in LMM. This variable

³Numpy `rad2deg`: <https://numpy.org/doc/stable/reference/generated/numpy.rad2deg.html>

2. Methodology

stores the absolute value of the angular differences contained in signed_180_angles. The reason for using absolute values is that the direction of the deviation is not a deciding factor in how accurate the participants performed the pointing task. Taking the absolute values is done with numpy abs() ⁴ function.

$$\text{absolute_180_angles}_\theta = \text{np.abs}(\text{signed_180_angles}_\theta)$$

3. Calculated the Euclidean distance from the participant's body position to the target building for each trial. This was done using the Euclidean distance function ⁵ of scipy spatial.

$$\text{body_to_target}_{dis} = \text{Euclidean_distance}((Ppos_x, Ppos_z), (Tpos_x, Tpos_z))$$

2.4.2. Analysis

Due to the hierarchical structure of the data, Linear Mixed Models (LMM) were chosen as the method of analysis. For that the MixedLM function ⁶ from python's statmodels module were used. Participants' ID is the grouping component of all the models.

Independent variables

1. **Starting locations:** the 28 different starting locations spread out through the city. See the full list of the locations in appx. A.
2. **Distance to the target:** this variable is the distance of the participant to the target building at each starting location.

Dependent variables

1. **Absolute angular deviation** (absolute_180_angles): the absolute value of the angular deviation of the direction chosen by the participant from the actual location of the target building shown at each trial. Two models are used to predict this dependent variable.

⁴Numpy absolute: <https://numpy.org/doc/stable/reference/generated/numpy.absolute.html>

⁵Scipy spatial Euclidean distance: <https://docs.scipy.org/doc/scipy-1.8.0/reference/generated/scipy.spatial.distance.euclidean.html#scipy.spatial.distance.euclidean>

⁶Statsmodels function for linear mixed effects model:
https://www.statsmodels.org/dev/generated/statsmodels.regression.mixed_linear_model.MixedLM.html

2. Methodology

a)

$$\text{absolute angular error} \sim \text{starting locations}$$

b)

$$\begin{aligned}\text{absolute angular error} \sim & \text{starting locations} + \text{distance to target} \\ & \text{+ starting locations : distance to target}\end{aligned}$$

2. **Reaction times** (RT) : this variable stores the duration between start of each trial and the time the participants confirmed a direction as their respond. The begin timestamp of the trial is directly after the go cue is completed and the end timestamp instantly after the response is given. Calculating the duration is done in unity.

$$RT = \text{end_timestamp} - \text{begin_timestamp}$$

For the analysis two models are used to predict this dependent variable.

a)

$$\text{reaction times} \sim \text{starting locations}$$

b)

$$\begin{aligned}\text{reaction times} \sim & \text{starting locations} + \text{distance to target} \\ & \text{+ starting locations : distance to target}\end{aligned}$$

3. Results

From the data gathered from the measurements a total of 23 datasets with the average of 335 and a total of 7708 trials were used for the analysis. The starting location IDs are identical with the building-IDs inside the unity environment and are not replaced with new numbers for the analysis.

3.0.1. Summary statistics of dependent variables

1. Absolute angular deviation:

This variable has the mean of 48.08 with the standard deviation of 44.30, and median of 33.70. (See figure 3.1)

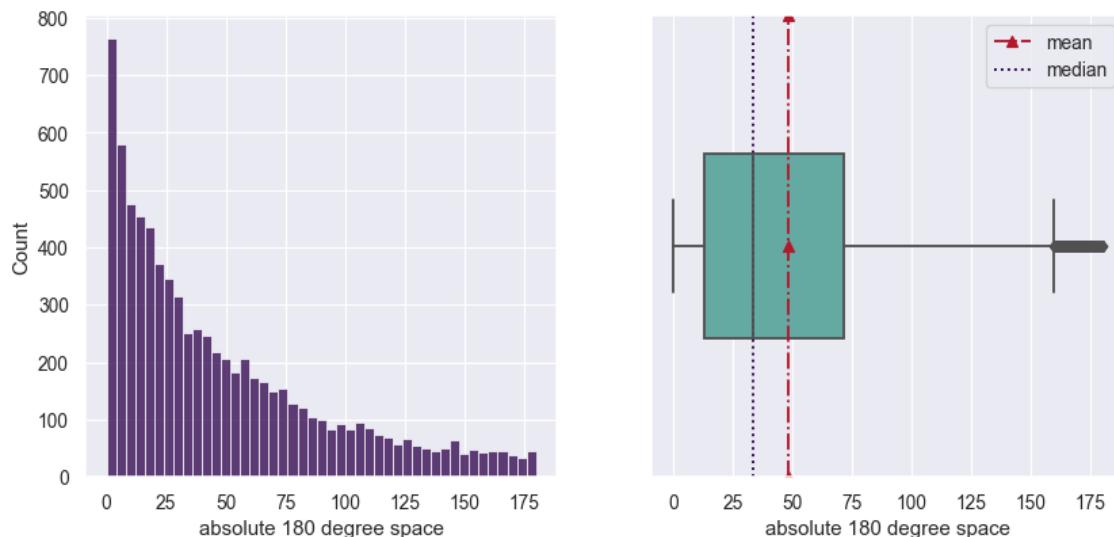


Figure 3.1.: distribution of the absolute angular deviation

2. Reaction times:

This variable has the mean of 7.77 with the standard deviation of 5.56, and median of 6.06. (See figure 3.2)

3. Results

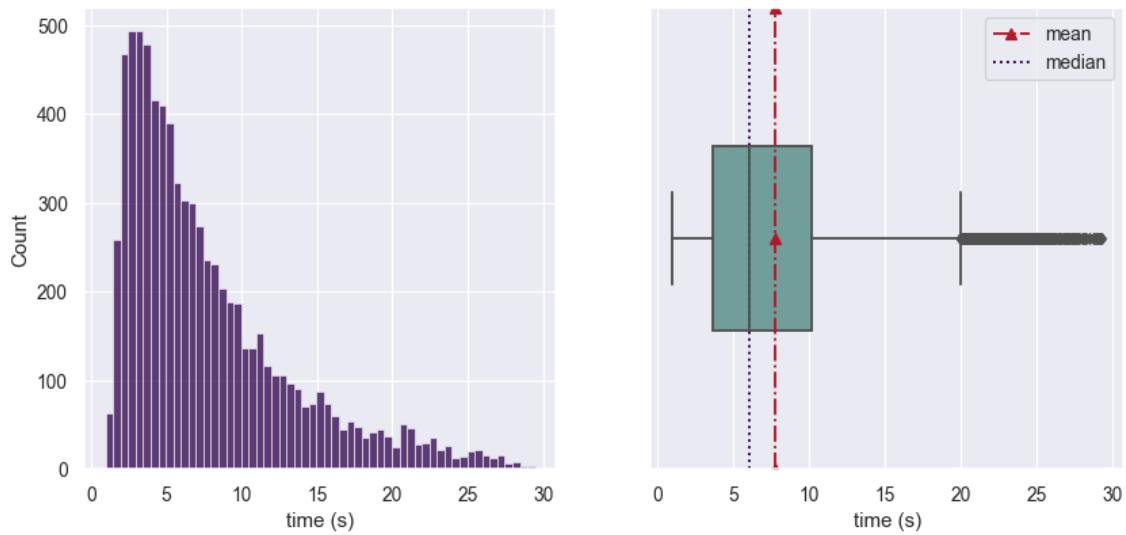


Figure 3.2.: distribution of the reaction times in the pointing task

3.0.2. Extremes at starting locations

Absolute angular deviation

In order to find out which of the 28 starting locations were the best and worst in performance with respect to the angular deviation from the target, the minimum and maximum medians of angular deviation grouped by the starting locations were taken.

As a result the starting location with the ID 9 which is a "patisserie" shop, therefore a context meaningful location, with the median of 19.18 degree deviation from the targets and the difference of 16.03 degree from the overall median (35.21) is the best location, i.e., has the lowest degree deviation from the target. See figure 3.3a.

Furthermore, the starting location with the ID 35, one of the residential, thus not context meaningful, buildings with the angular deviation median of 52.49 degree away from the target and overall distance of 17.28 degree from the overall median (35.21) was the worst location of performing the task with regard to the angular deviation. See figure 3.4a.

Reaction times

For finding the fastest and the slowest performance among the 28 starting locations, the medians of reaction times grouped by the starting locations were Calculated.

3. Results

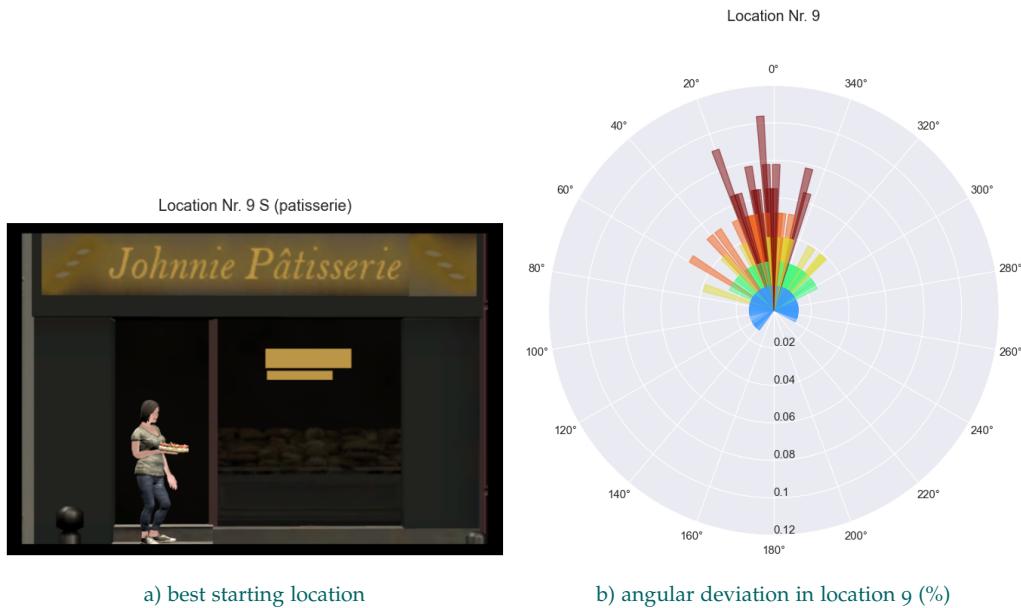


Figure 3.3.: the best starting location is chosen by taking the least median angular deviation among all starting locations.

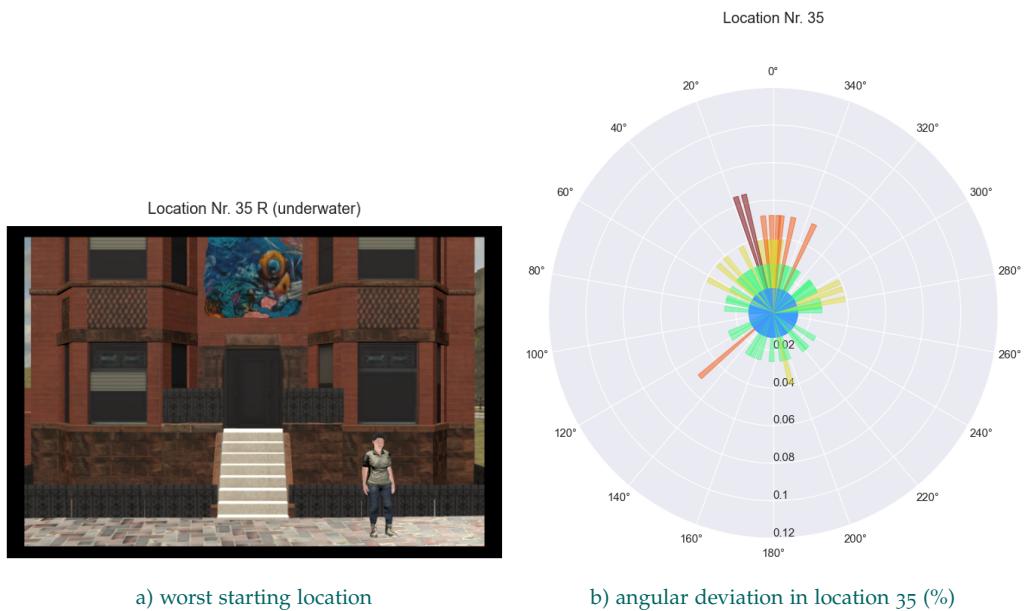


Figure 3.4.: the worst starting location is chosen by taking the highest median angular deviation among all starting locations.

The starting location number 51 which was a wine shop, hence a context meaningful location, with the median of 4.63s and the difference of 1.38s from the overall median (6.01) was the fastest location. See figure 3.6a.

3. Results

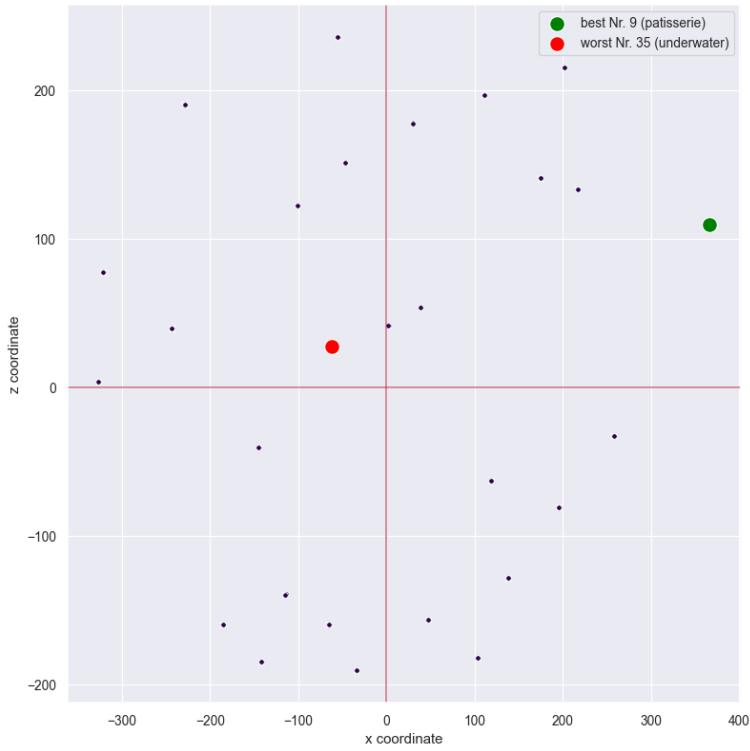


Figure 3.5.: the locations of the best and worst starting locations inside the city coordinates.



Figure 3.6.: the fastest starting location is chosen by taking the least median reaction time among all starting locations.

Furthermore, the starting location 35, the residential not context meaningful location with the worst angular deviation performance with the median of 7.75s and overall distance of 1.74s from the overall median (6.01) was the slowest location among the 28. See figure 3.7a.

3. Results

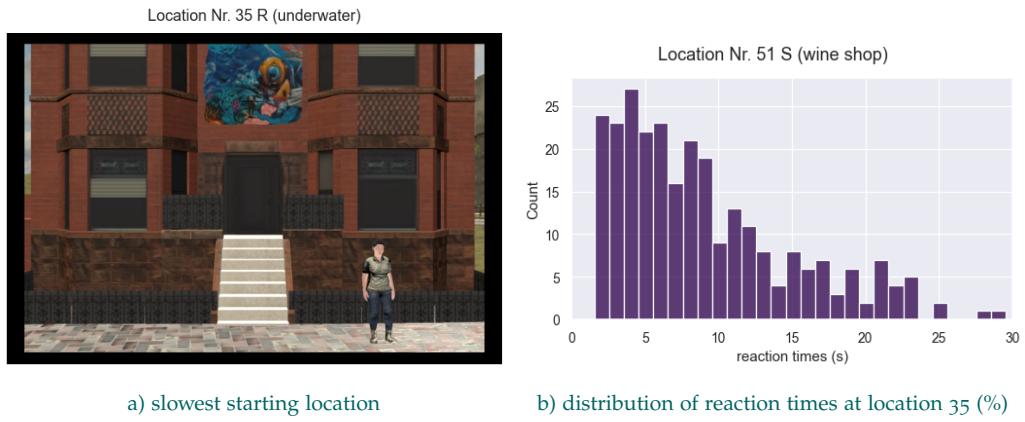


Figure 3.7.: the slowest starting location is chosen by taking the highest median of reaction times among all starting locations.

3.0.3. Linear mixed effects model (absolute angular error)

- analysis results to be added

3. Results

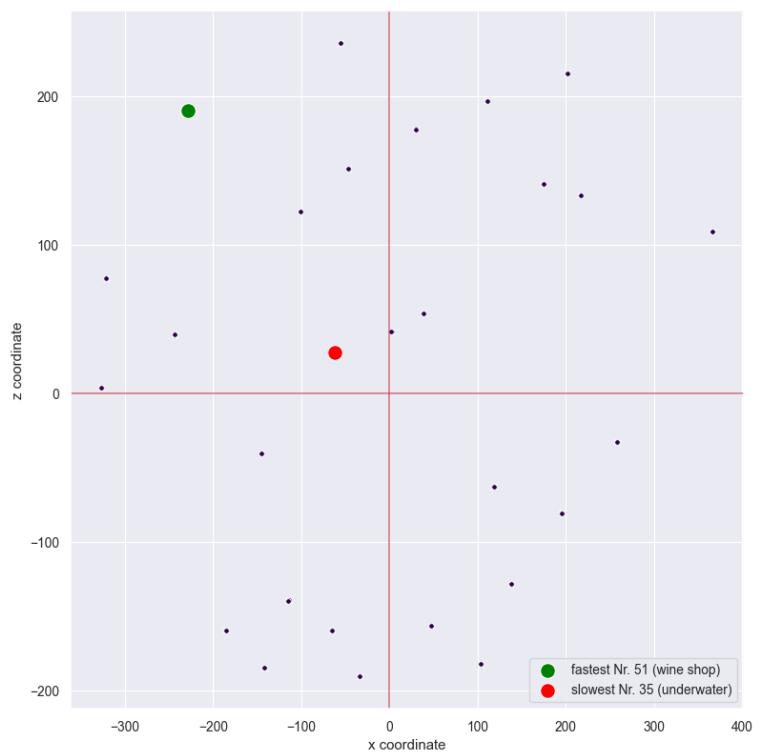


Figure 3.8.: the locations of the fastest and the slowest starting locations inside the city coordinates.

4. Conclusion

- in case there are differences found between starting locations discuss the reasons
- if there are previous studies, compare the results
- discuss limitations and suggest improvements if needed
- what can be done further on this topic
- summarize conclusion

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Appendix

Appendix A.

List of starting locations

add the table of starting locations with their id and names, human agent id and meaningfulness

Appendix B.

Collected Variables

list of variables gathered + explanation

Appendix C.

Plots

plots that are not used but could be informative

Appendix D.

Task buildings

list of task buildings with their specification

Appendix E.

Experimental protocol

the complete experimental protocol

Appendix F.

Forms

Einverständniserklärung

Titel der Studie: Untersuchung des Effektes von menschlichen Avataren auf räumliches Lernen und räumliche Navigation in einer virtuellen Stadt unter Einbeziehung des Blickverhaltens

Zweck der Studie: Das Ziel des vorliegenden Forschungsprojekts ist es, den Effekt von menschlichen Avataren auf das Lernen durch aktive Navigation in einer virtuellen Stadt zu untersuchen. Zu diesem Zweck werden wir menschliche Avatare strategisch neben Gebäuden innerhalb einer virtuellen Stadt platzieren. Auf Basis der erhobenen Daten werden wir evaluieren, ob die Teilnehmer sich die Teile der Stadt, in denen wir Avatare platziert haben, besser merken konnten.

Projektleitung: Prof. Dr. Peter König, Dr. med. Sabine König, Prof. Dr. Gordon Pipa, Tracy Sánchez (Lic.), Institut für Kognitionswissenschaften, Wachsbleiche 27, 49082 Osnabrück

Sehr geehrte Studienteilnehmerin, sehr geehrter Studienteilnehmer, hiermit bitten wir Sie um Ihre Einwilligung zur Teilnahme an dem oben genannten Forschungsvorhaben und zur Nutzung Ihrer personenbezogenen Daten, wie sie Ihnen in der Probandeninformation und der Aufklärung näher erläutert worden sind.

I. Allgemeines

Appendix F. Forms

Hiermit erkläre ich, _____, geboren am _____, dass ich durch die Projektleitung mündlich und schriftlich über das Wesen, die Bedeutung, die Risiken und Folgen der wissenschaftlichen Untersuchungen im Rahmen der o.g. Studie informiert und aufgeklärt wurde und ausreichend Gelegenheit hatte, meine Fragen mit der Projektleitung zu klären.

Mir ist bekannt, dass ich das Recht habe, meine Einwilligung jederzeit ohne Angabe von Gründen und ohne nachteilige Folgen für mich zurückzuziehen. Mir ist bekannt, dass meine Daten nach Abschluss der Datenerhebung nur in anonymisierter Form gespeichert, analysiert und veröffentlicht werden. Dies führt dazu, dass ein späteres Löschen meiner Daten nicht mehr möglich ist, da die Daten nicht mehr meiner Person zugeordnet werden können.

Ich habe eine Kopie der schriftlichen Studieninformation und der Einwilligungs-erklärung erhalten.

Ich erkläre, dass ich freiwillig bereit bin, an der wissenschaftlichen Studie, die für mich aus 5 wiederholten Erkundungen in der virtuellen Stadt „Westbrück“, die jeweils 45 Minuten dauern werden und einer Testses-sion in der virtuellen Umgebung, die ungefähr 120 Minuten dauern wird, teilzunehmen. Die Erkundungs- und Testsessions finden jeweils an unter-schiedlichen Tagen statt.

Insbesondere erkläre ich mich damit einverstanden,

1. dass die in der Studie aufgenommenen Daten in anonymisierter Form gespeichert und analysiert werden, auch auf elektronischen Datenträgern;
_____ (Initialen Proband)

2. dass meine persönlichen Daten zu Zwecken der Vergütung und Doku-mentation gespeichert werden. Diese persönlichen Daten werden nur in Papierform und nicht mit den experimentellen Daten verbunden aufge-hoben.
_____ (Initialen Proband)

3. dass an dieser Studie folgende beteiligte Wissenschaftler Zugang zu den erhobenen anonymisierten experimentellen Daten zum Zweck der Durchführung und wissenschaftlichen Verwertung der Studie haben: Prof. Dr. Peter König, Dr. med. Sabine König, Prof. Dr. Gordon Pipa, Tracy

Appendix F. Forms

Sánchez, Institut für Kognitionswissenschaften, Universität Osnabrück;
----- (Initialen Proband)

4. dass die Studienergebnisse und die Studiendaten in anonymisierter Form, die nach heutigem Stand der Technik keinen Rückschluss auf meine Person zulässt, veröffentlicht werden; die Veröffentlichung kann zum Beispiel in einer wissenschaftlichen Zeitschrift oder im Internet erfolgen;
----- (Initialen Proband)

5. dass meine Daten, im Sinne der guten wissenschaftlichen Praxis, in anonymisierter Form der Öffentlichkeit über eine Creative Commons Lizenz (CCo) zugänglich gemacht werden;
----- (Initialen Proband)

6. dass ich aktiv eine virtuelle Stadt erkunde. Anschließend werde ich Orientierungstests in der virtuellen Stadt durchführen. Während des Navigationstrainings werde ich eine virtuelle Realitätsbrille tragen. Die Messungen finden in einem Labor des Instituts für Neurobiopsychologie der Universität Osnabrück statt
----- (Initialen Proband)

7. dass die in der Studie aufgenommenen Daten entsprechend der Empfehlung durch die DFG mindestens 10 Jahre lang aufbewahrt werden.
----- (Initialen Proband)

II. Ausschlusskriterien, Verhaltensregeln

II.1 Ausschlusskriterien

Ich versichere, den mir vorgelegten Anamnesebögen wahrheitsgemäß ausgefüllt zu haben. Mir ist bewusst, dass während des Trainings in der virtuellen Stadt „Seekrankheits-“ ähnliche Symptome („Bewegungsübelkeit“) wie Schwindel und Übelkeit auftreten können. Des Weiteren ist mir bewusst, dass das Tragen der virtuellen Brille ein Druckgefühl bis hin zu leichten Kopfschmerzen und ein Verspannungsgefühl im Nacken auslösen kann.

II.2 Zustimmung zur Einhaltung von Verhaltensregeln

Appendix F. Forms

Ich wurde vor der Durchführung der Studie darauf hingewiesen, dass ich vor oder während der Untersuchung auftretendes körperliches oder psychisches Unwohlsein der Projektleitung unverzüglich mitzuteilen habe. Ich wurde zusätzlich informiert, dass ich jederzeit während des Experimentes eine Pause einlegen darf.

III. Datenschutzrechtliche Einwilligungserklärung

Einblick in die anonymisierten Daten durch Dritte findet statt:

Ich bin damit einverstanden, dass die erhobenen Daten in anonymisierter Form in wissenschaftlichen Zeitschriften und über eine Creative Commons Lizenz (CCo) im Internet veröffentlicht werden. Dies bedeutet, dass die Daten frei zugänglich sind und frei analysiert und veröffentlicht werden dürfen.

IV. Aufwandsentschädigung

Ich bin damit einverstanden, dass ich für die Teilnahme an der Studie mit 5€ pro Stunde für die Zeit der Exploration und Messungen in VR vergütet werde. Alternativ, wird mir auf Wunsch ein Teil der Zeit entsprechend in Versuchspersonenstunden bestätigt. Weitere Vorteile wurden nicht zugesagt.

V. Unterschrift

Ich erkläre hiermit, dass ich freiwillig und unter Kenntnis der oben genannten Punkte an der Studie „Untersuchung des Effektes von taktiler Wahrnehmungsweiterung auf räumliches Lernen und räumliche Navigation in einer virtuellen Stadt unter Einbeziehung des Blickverhaltens“ teilnehme.

Osnabrück, den _____ (Unterschrift Proband)

Osnabrück, den _____ (Unterschrift Projektleitung)

ALLGEMEINE ANAMNESE (A1)

Bei Problemen mit dem Ausfüllen wenden Sie sich bitte an die studienbegleitenden Mitarbeiterinnen und Mitarbeiter!

VP- Nummer			
Geschlecht:	<input type="checkbox"/> m <input type="checkbox"/> w <input type="checkbox"/> andere	Datum:	

Nervensystem

- | | | |
|---|---------------------------------------|-------------------------------|
| Bewusstseinsstörungen | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Krampfanfälle (Epilepsie) | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Schwindel/Gleichgewichtsstörung | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Seekrankheit/“Bewegungsübelkeit“ z.B. beim Autofahren | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Tinnitus | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Kopfschmerz | <input type="checkbox"/> gelegentlich | <input type="checkbox"/> oft |
| Migräne | <input type="checkbox"/> gelegentlich | <input type="checkbox"/> oft |
| Tremor (Zittern) | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Gedächtnisprobleme | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Sprach- oder Sprechbeschwerden | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Verhaltensstörungen | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Halluzinationen/Wahnvorstellungen | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Weiteres: | | |
| Wenn „ja“, welche: | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Psychopharmaka | | |
| Wenn „ja“, welche: | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Augen | | |
| Sehstörung | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Wenn „ja“, welche: | | |
| Scheinschränkung | <input type="checkbox"/> ja | <input type="checkbox"/> nein |
| Wenn „ja“, welche: | | |
| Art der Sehhilfe | | |
| Stärke der Sehhilfe | | |

Doppelbilder	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Lichtempfindlichkeit/-scheuheit	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Weiteres: Wenn „ja“, welche:		
Bewegungsapparat		
Schmerzen	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Wenn „ja“, welche:		
Schwäche	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Steifigkeit	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Rückenprobleme	<input type="checkbox"/> ja	<input type="checkbox"/> nein
Weiteres (auch Verlust von Körperteilen):		

Bei Problemen mit dem Ausfüllen wenden Sie sich bitte an die studienbegleitenden Mitarbeiterinnen und Mitarbeiter!