Skill Sets and Needs for Behavior Science Lab Behavioral Studies

Within the scope of the project carried out in partnership between **Çanakkale Technopark**, **Çanakkale Onsekiz Mart University**, and **Ludwig Maximilian University of Munich**, needs analysis have been conducted for the establishment of the **Behavioral Science Laboratory**. The laboratory area has been identified, and efforts are ongoing to establish the necessary technical infrastructure. Processes related to the procurement of equipment, the identification of research projects to be conducted in the laboratory, and the training of personnel have been planned, implemented, and completed. The personnel assigned to the Behavioral Science Laboratory have received comprehensive training on equipment operation and data analysis, and all training processes have been successfully completed.
This report presents detailed information regarding the trainings conducted within the scope of behavioral studies, the data collected, and the meetings organized during the project.

1. Behavioral Studies to Be Conducted in the Laboratory

The primary activities in the Behavioral Science Laboratory involve conducting research on human behavior. The initial step, the **needs analysis**, identified the fundamental requirements for establishing the laboratory, the potential equipment to be used, and a roadmap for future actions, thus initiating preparations for experimental studies.
At this stage, researchers and students from Çanakkale Onsekiz Mart University and Çanakkale Technopark participated in behavioral science activities through a *train-the-trainer* approach, under the guidance of the researchers from the partner institution, Ludwig Maximilian University of Munich. The training covered topics such as hardware, software, and data analysis relevant to behavioral research.

Behavioral research activities included familiarizing participants with the laboratory environment and equipment, developing questionnaires and experiments, designing behavioral experiments, operating related hardware (such as eye-tracking systems and EEG machines), and analyzing the resulting data. Responsible researchers were trained in the types, purposes, and operating principles of the laboratory equipment within this work package. A laboratory tour and equipment demonstration were also carried out as part of the behavioral studies.

The activities conducted within the behavioral studies component provide numerous benefits for the laboratory being established. Firstly, they offer participants valuable insights into the functions of laboratory equipment and the nature of the research carried out. Secondly, familiarizing the personnel with experimental design processes and equipment usage supports the development of new research studies. Finally, the accumulated know-how from these activities will enable the laboratory to better meet future users' needs, produce greater societal benefits, and develop publicly accessible educational materials.

2. Target Group of the Activity

This activity targets the responsible personnel and researchers who will work in the Behavioral Science Laboratory, as well as students, academics, and members of the local community who are directly or indirectly related to the laboratory. Educators participating in laboratory

activities will also benefit from these efforts.
Moreover, the outcomes of the tests will contribute to the development of more effective educational materials related to behavioral sciences. These materials will be tailored to address existing knowledge gaps and areas requiring improvement. The enhanced training materials will benefit all laboratory users, including educators, enabling them to conduct research more efficiently and make better use of the available equipment.

3. Contribution of the Activity to Project Objectives

The behavioral studies component is a key element in building the necessary **know-how** for the Behavioral Science Laboratory. Personnel and researchers participating in these studies gain a comprehensive understanding of the laboratory's structure, the features of its equipment, and the nature of the ongoing research. Their acquired insights contribute to advancing the project's research goals, objectives, and strategies.
Furthermore, conducting and testing behavioral experiments helps identify areas that need improvement, which, once addressed, enhance the overall effectiveness of both the laboratory and its research projects.

4. Expected Outcomes of the Activity

Personnel and researchers participating in behavioral studies are expected to demonstrate competencies in various areas related to behavioral sciences. These include the ability to correctly identify and explain behavioral techniques and methods, effectively analyze behavioral data, and accurately interpret the findings. Competencies also cover the correct use of relevant equipment, such as EEG and eye-tracking systems.
In addition, the personnel and researchers should be able to clearly articulate the objectives and aims of the research projects conducted in the laboratory and explain how the equipment is utilized in these studies. The outcomes of the activities have significantly enhanced participants' knowledge and understanding of the research to be conducted in the Behavioral Science Laboratory.

5. Conducted Trainings and Behavioral Research

In parallel with the EU-funded project implemented for the establishment of the Behavioral Science Laboratory at Çanakkale Onsekiz Mart University, an application was submitted to establish the **Center for Cognitive and Behavioral Sciences Research and Practice**. This application was approved by the Council of Higher Education (YÖK), and the center, named **ÇOMÜ-BİLDAM**, has officially been established.
The **Center for Cognitive and Behavioral Sciences Research and Practice (ÇOMÜ-BİLDAM)** is located within the **Çanakkale Onsekiz Mart University Science and Technology Research and Application Center** building. The establishment of the center, identification of its physical location, and the setup of the technical infrastructure were completed within the scope of the first work package.

Following the determination of the laboratory location, research was conducted—with the consultation, recommendations, and support of Ludwig Maximilian University—on the types

of devices suitable for use in the laboratory. This report section provides fundamental information about the equipment planned to be included in the Behavioral Science Laboratory and examples of how these devices can be utilized in behavioral research.

Within the behavioral research activities, an exchange of ideas first took place among the project partners, and subsequently, in **May 2024**, an **online meeting** was held to initiate the training sessions related to behavioral studies. Visual materials and documentation related to the trainings are presented below.

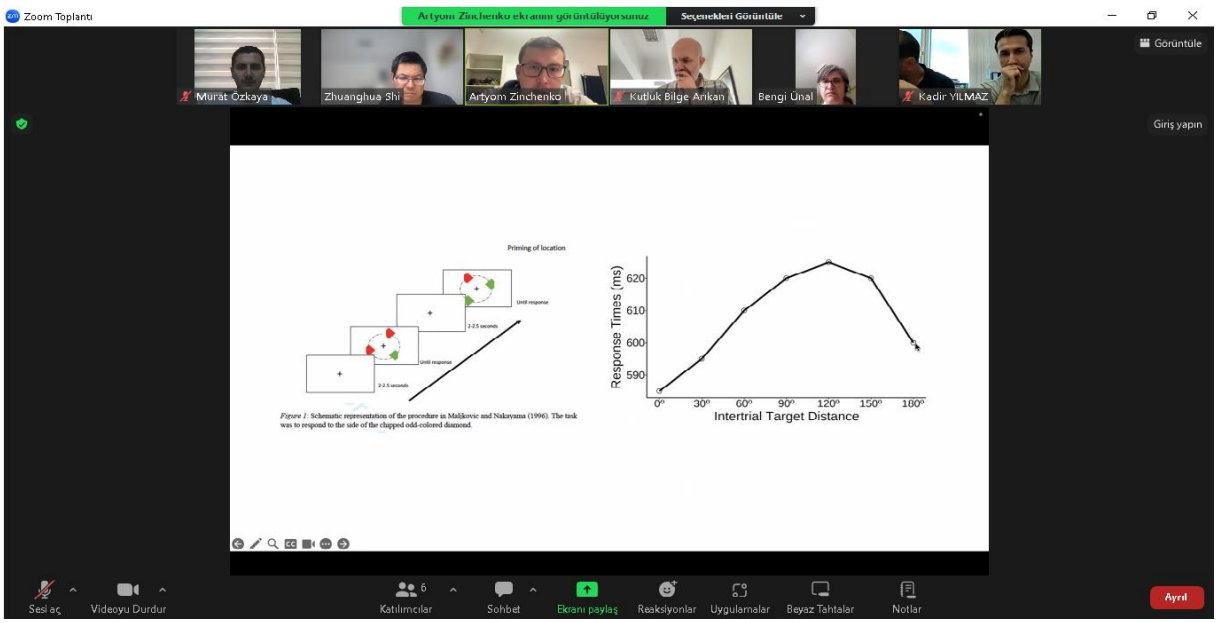

Figure 1. Response Time by Intertrial Target Distance

During the meetings and training sessions, the **"Response Time by Intertrial Target Distance"** study was used as the main reference.

As illustrated in **Figure 1**,
Left: The experimental setup is based on the paradigms of *Maljkovic & Nakayama (1996)*. Participants were instructed to report, as quickly as possible, the orientation (vertical or horizontal) of the line inside a diamond-shaped figure colored either red or green.

Right: The results graph displays the variation in **response times (ms)** as a function of the **intertrial target distance**, that is, the spatial distance between target positions across successive trials. A **reverse U-shaped pattern** can be observed: when the target reappears at locations close to its previous position, facilitation (faster responses) occurs, whereas targets appearing at more distant locations produce a different performance pattern.

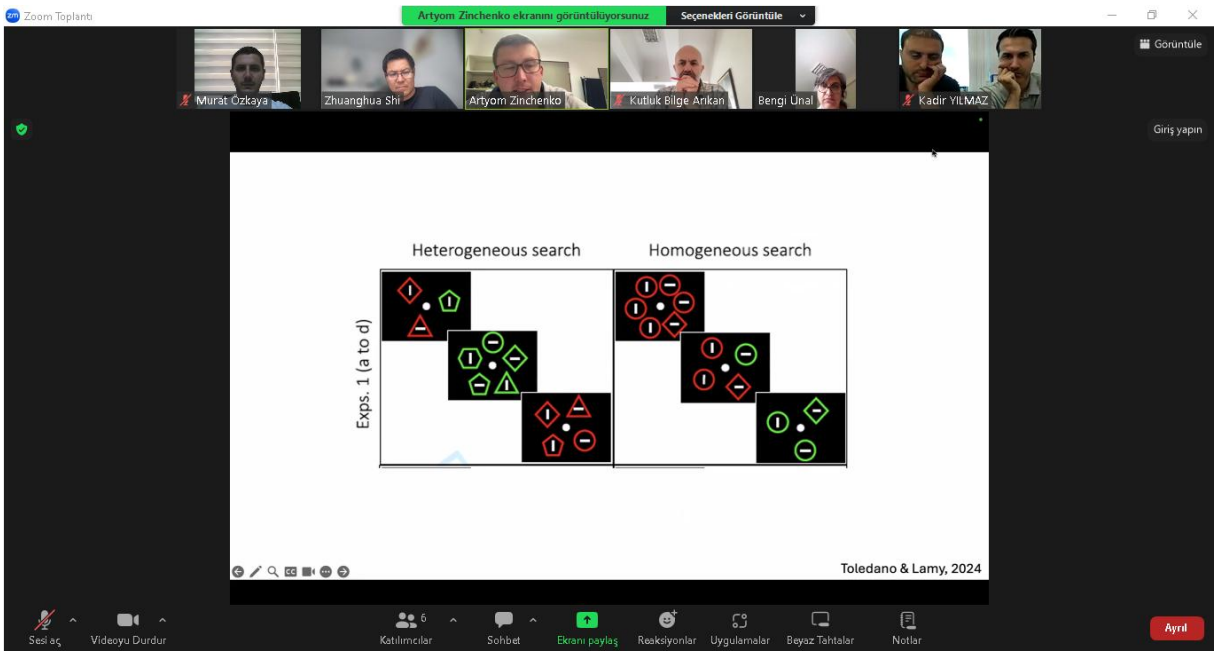

Figure 2. Heterogeneous vs. Homogeneous search

This figure is adapted from **Toledano & Lamy (2024)**.

In a **heterogeneous search**, various shapes (e.g., circles, triangles, squares, etc.) are used—making the target more difficult to detect due to the presence of strong distractors. In contrast, a **homogeneous search** involves similar distractors, allowing the target to be identified more easily. The focus of this analysis is to examine whether the **Priming of Location (PoL)** effect differs between homogeneous and heterogeneous search conditions.

Figures 3, 4, and 5 present visual documentation of idea exchanges, training sessions, and meetings held to discuss the ongoing project and potential new research collaborations.

Figure 3. Meeting

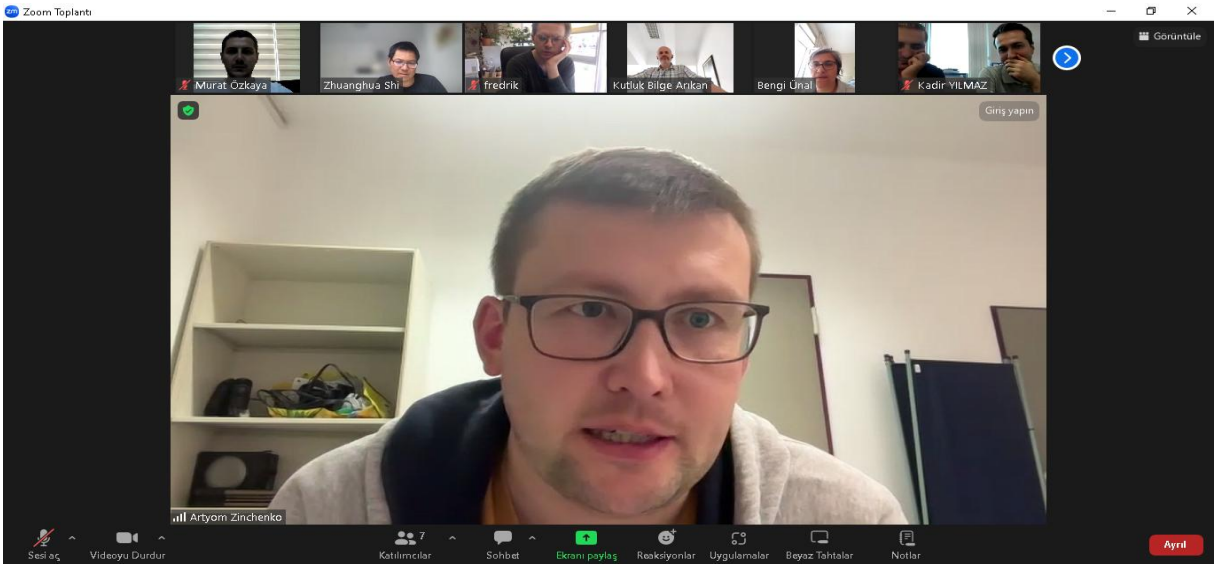

Figure 4. Meeting

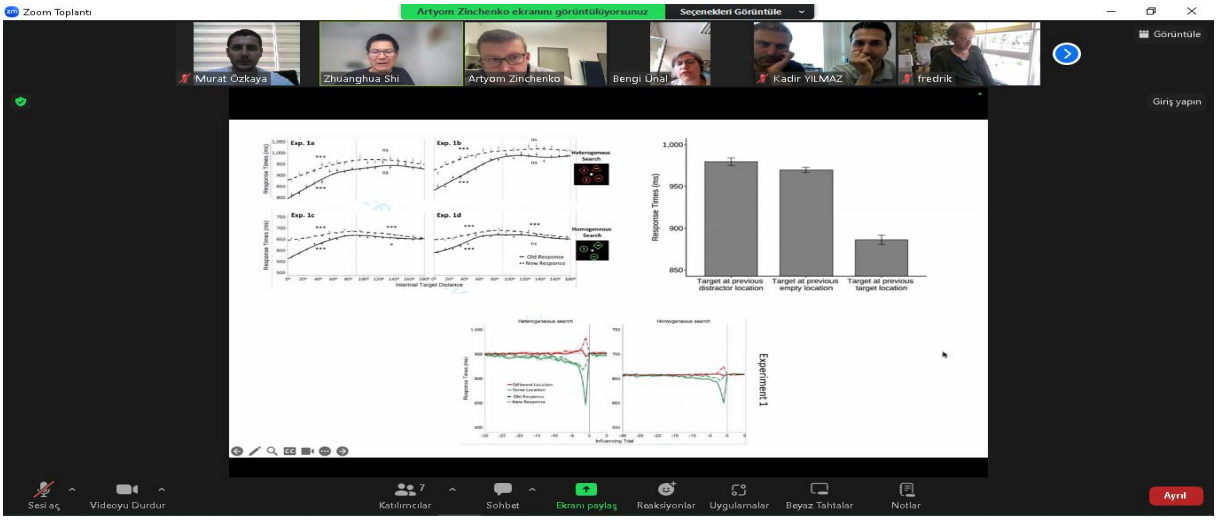

Figure 5. Meeting

During the online meetings, training sessions were conducted by **Prof. Dr. Zhuanghua Shi** and **Dr. Artyom Zinchenko** from **Ludwig Maximilian University**, with the participation of project partners from **Çanakkale Onsekiz Mart University** and **Çanakkale Technopark**.

Following the online sessions, the dates for the in-person trainings were scheduled, and **Prof. Dr. Zhuanghua Shi** and **Dr. Fredrik Allenmark** from Ludwig Maximilian University visited **Çanakkale between May 22–26, 2024**, to carry out the **Behavioral Studies** activities. Visual materials from the training sessions held in Çanakkale are presented below.

Figure 6. Çanakkale Meeting

Figure 7. Çanakkale Meeting

Figure 8. Çanakkale Meeting

The meetings and training sessions held at the **Çanakkale Technopark campus** were attended by **Prof. Dr. Zhuanghua Shi** and **Dr. Fredrik Allenmark** from **Ludwig Maximilian University**, **Assoc. Prof. Dr. Erkan Bil** (General Manager of Çanakkale Technopark and Project Coordinator), **Research Assistant Dr. Mert İnal** (Project Leader, representing Çanakkale Onsekiz Mart University), **Assist. Prof. Dr. Bengi Ünal**, **Assoc. Prof. Dr. Savaş Gürdal**, **Assist. Prof. Dr. Murat Özkaya**, **Research Assistant Atıf Çağlar Ababay**, and students from the **Department of Psychology at Çanakkale Onsekiz Mart University**.

Training and experimental studies were conducted with the participants involved in the sessions. The training primarily focused on developing participants' skills in **designing and conducting cognitive experiments using PsychoPy**. As part of the training, the **Stroop Task** was implemented. In this task, participants were asked to indicate the color of the word's font (e.g., "BLUE") while ignoring the semantic meaning of the word (e.g., "RED"), depending on whether the color and meaning were congruent or incongruent.

Participants and Procedure

- **20 undergraduate students** participated in the study (12 female, 8 male; *Mean Age = 21.4*).
- Each participant completed **60 trials** (30 congruent, 30 incongruent).
- Trials were presented in random order, and responses were collected via keyboard input.

Findings

- **Response Times (RT):** The mean response time for incongruent trials (*M = 685 ms, SD = 102*) was significantly longer than for congruent trials (*M = 590 ms, SD = 95*).
- **Accuracy:** The accuracy rate was **93%** for incongruent trials and **98%** for congruent trials.
- These results successfully replicated the **classical Stroop Effect**, demonstrating that the conflict between word meaning and font color increases cognitive processing difficulty.

Contribution to the Project Activity

- Students gained **hands-on experience** in experimental design, coding, and implementation using PsychoPy.
- The pilot study illustrated how **open-source tools** can be effectively utilized in behavioral science education and research capacity building.
- This activity strengthened participants' **methodological competencies** and contributed directly to the project's objective of enhancing **experimental research capability**.

Visual documentation from the training session is presented in **Figure 9**.

Figure 9. PyschoPy Studies

Following the trainings, meetings, and research activities held in Çanakkale, the project researchers from **Çanakkale Onsekiz Mart University** and **Çanakkale Technopark** visited **Ludwig Maximilian University** in **November 2024**, where they met with the local project researchers.

During the sessions and workshops conducted in Germany, studies were carried out using **EEG (Electroencephalography)**, **Eye-tracking**, and **TMS (Transcranial Magnetic Stimulation)** equipment.

Visual documentation from the activities and training sessions held in Germany is presented below.

Figure 10. Meetings and Studies

Figure 11. Meetings and Studies

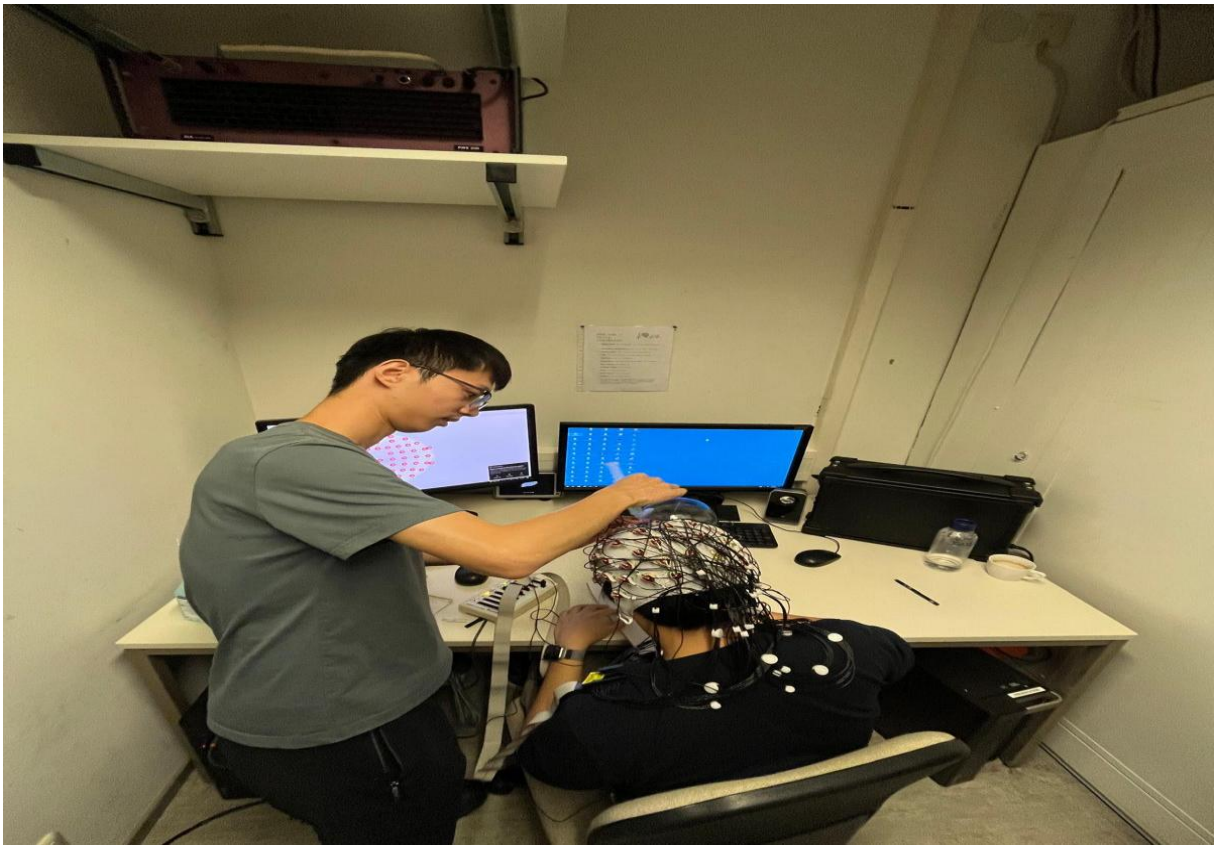

Figure 12. Meetings and Studies

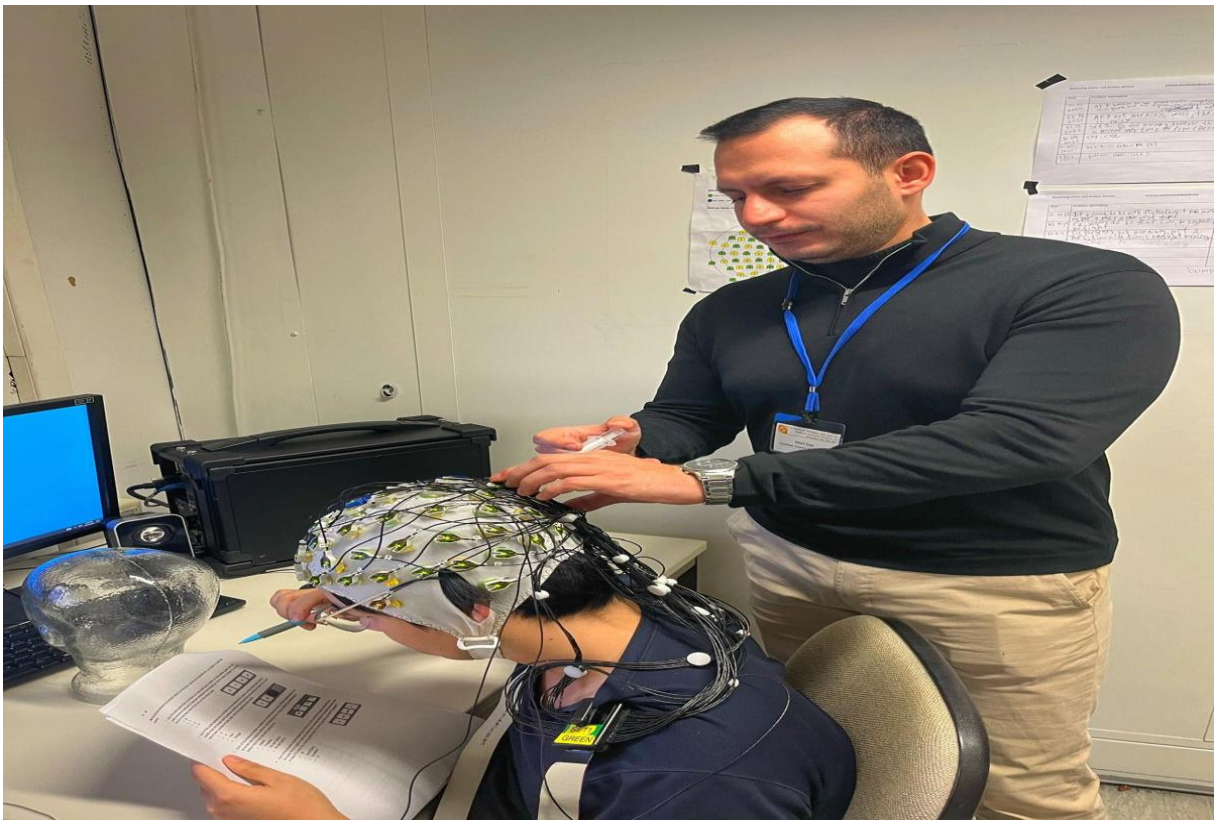

Figure 13. Meetings and Studies

Figure 14. Meetings and Studies

Figure 15. Meetings and Studies

Figure 16. Meetings and Studies

Figure 17. Meetings and Studies

Figure 18. Meetings and Studies

Figure 19. Meetings and Studies

Examining Visual Perception and Attention Processes: An Experimental Study within the Scope of the EU Project

Based on the expertise of our collaborators at LMU, a series of visual perception experiments have been implemented that will enable us to conduct simultaneous eye-tracking and EEG measurements in the future. In the visual search task, a set of shapes (typically circles along with a target diamond shape) is presented on the screen. The participants' task is to locate the target shape (the diamond) as quickly as possible and indicate the orientation of the line inside it (e.g., horizontal or vertical). This task represents a classical feature search paradigm, in which the target is defined by a specific feature (shape) while distractors stand out due to another feature (color).

Within the LMU project team, Dr. Artyom Zinchenko shared his Matlab-based codes with us. The experimental codes, along with the supplementary programs required for running the paradigm, were successfully executed. After adapting the codes into Turkish, seven participants (4 female, 3 male, Mean Age = 20.8) completed the experimental paradigms.

In these preliminary studies, participants detected and reported the orientation of the line inside the target shape (a red diamond) with comparable reaction times across conditions ($t(6) = 0.12$, $p > .05$) (Figure 1).

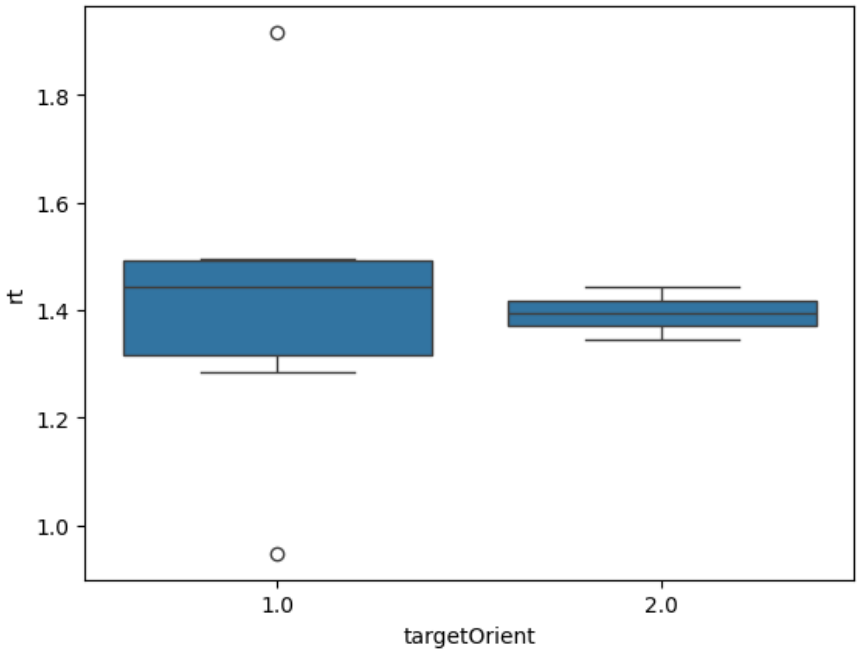

Figure 1. Mean reaction times for determining the orientation of the line within the target stimulus in the visual search paradigm are displayed. The identification of vertical (1) and horizontal (2) line orientations occurred with comparable reaction times.

However, differences emerged in terms of accuracy when identifying the horizontal versus vertical lines inside the target stimulus. While the accuracy rate for horizontal lines reached 100%, the accuracy rate for vertical lines remained at 71% (Figure 2).

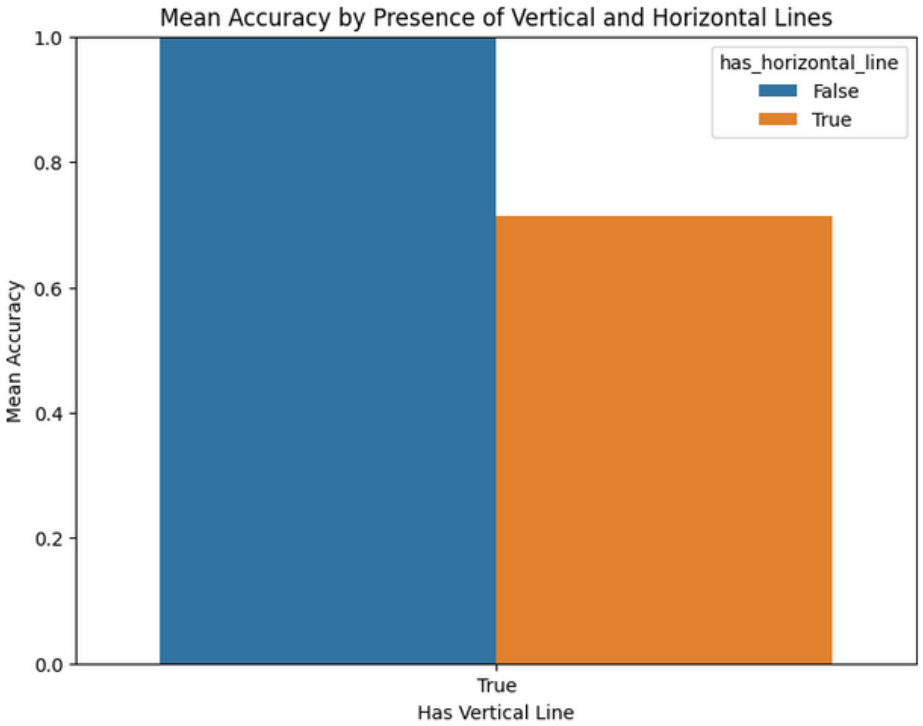

Figure 2. Mean accuracy rates are displayed according to the orientation of the line within the target stimulus.

When examining the reaction times for the red distractor stimuli, similar mean reaction times were obtained ($F(2) = 0.112$, $p > .05$). However, it should be noted that the variation in reaction times differed depending on the type of shape (Figure 3).

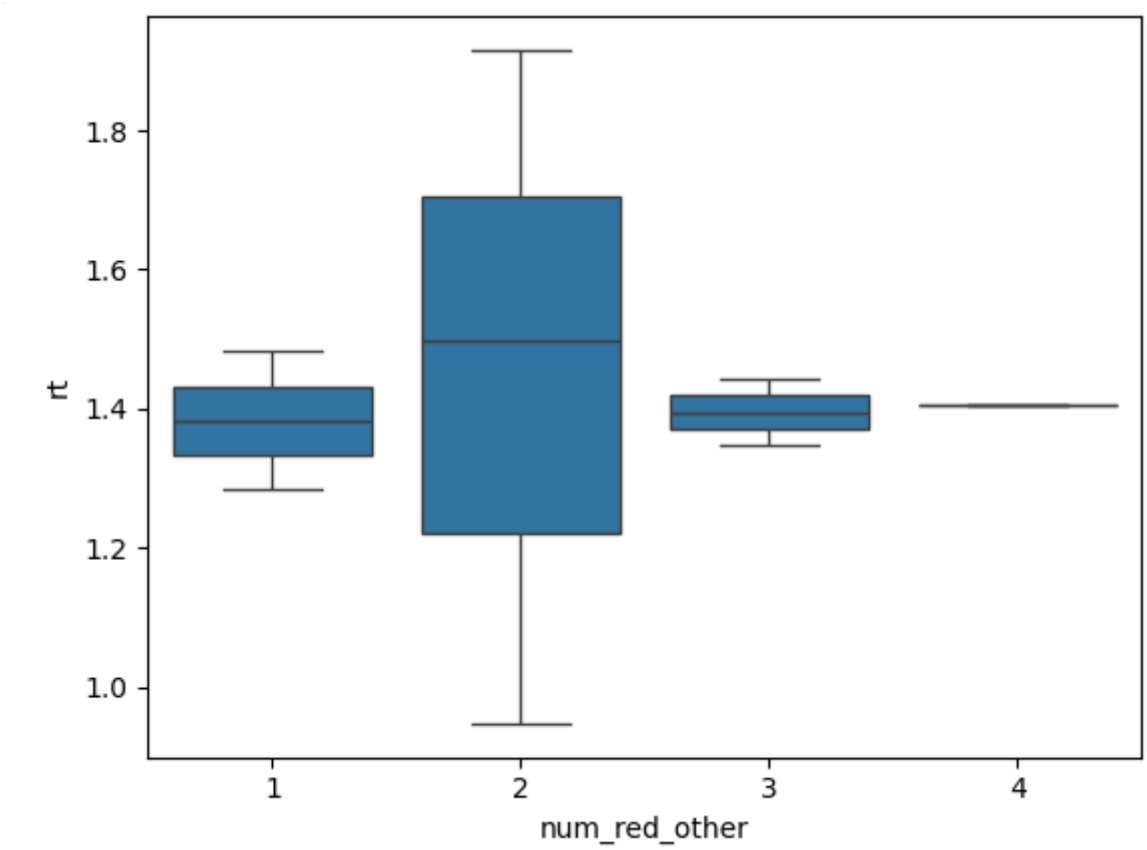

Figure 3. Reaction times are displayed for distractor stimuli presented alongside the red diamond target stimulus, including a red circle (1), red triangle (2), red square (3), and red pentagon (4).

Based on these experiments, the following key gains can be summarized:

- We acquired practical experience in constructing experimental paradigms that are widely used in cognitive neuroscience research and adapting them through coding to suit specific research questions.
- We developed knowledge regarding potential challenges encountered in computer-based cognitive experiments and strategies for addressing them.
- We gained experience in conducting Python-based analyses of computer-based cognitive experiments and in utilizing applications such as Google Colab for these analyses.

Following the completion of all activities carried out within the scope of the project, a **BAP (Scientific Research Projects)** guided project was prepared and approved for the procurement of equipment for the **Behavioral Science Laboratory** established at **Çanakkale Onsekiz Mart University**. Within the project budget, the purchase of an **EEG (Electroencephalography) device** has been planned, and the procurement process is currently ongoing.

Furthermore, as a continuation of the current project, a new **KA210-VET+ Erasmus+ Project** titled **"Immersive Eye-tracking Consumer VR/AR Lab for Vocational Education and Start-ups"**, jointly conducted by the same three partner institutions, has been **approved and funded by the German National Agency in 2025**.