Introduction

Digital technologies have a major impact on the way people arrange different everyday activities, including travel and recreation. Such interactions require complex cognitive processes and a seamless interaction with digital systems and the physical world. To better understand improvements and achieve more efficient user experiences, it is critical to understand these contextual interactions. This study uses two complementary HCI theoretical frameworks to provide an in-depth understanding of user interaction: Mental Models (Norman, 1983; Weinschenk, 2011) for remote interactions, and Distributed Cognition for Teams (DiCoT, Blandford & Furniss, 2006)—to analyze user behavior and propose practical guidelines for future travel technologies. Using these models, this study aims to reveal key insights and make practical suggestions to improve digital tool design in real-world user settings.

Data Collection and Analysis

Data Collection Approach

The study employed naturalistic observation methods to examine remote and in-person interactions. This method is widely recognized in the discipline of Human-Computer Interaction (HCI) for its ability to reveal genuine user behavior in real-world environments (Suchman,1987; Hutchins, 1995). The choice of method was intentional, as it reveals actual interaction with digital tools and environmental artifacts, free from researcher biases. The participant group consisted of six adults (aged between 23 and 30), recruited through convenience sampling from the researcher's network. All participants were digitally literate and had prior experience using travel-related digital platforms. Each participant gave informed consent and agreed to the recording of their sessions. During remote sessions, conducted via video conferencing software with screen-sharing enabled, a think-aloud protocol was used to systematically document the participants' cognitive processes, and decision-making steps. The Mental Models framework fits with the use of such a methodological approach as it allows direct identification of user expectations and reaction to system behavior mismatches (Norman, 1983). The participants performed real tasks like booking a trip to Zurich, Mykonos, and Rome using digital platforms such as Skyscanner, Omio, Ferryhopper, and Booking.com. During the in-person observations, an additional three participants were observed during real spontaneous planning tasks, like choosing museums or restaurants, as they were travelling in Berlin and London. Although DiCoT was originally developed for teams, it was well-suited here to analyze individuals' distributed interactions across environments, artefacts, and digital tools (including mobile apps like Google Maps and TripAdvisor) (Blandford & Furniss, 2006). The observations captured how the organization of physical space and artefacts closely influenced the participants' cognitive processes and decision-making. While naturalistic observation methods minimized artificiality, there is possibility of minor observer effects on the behavior of participants. To minimize this, participants were requested to act as naturally as possible, and interaction with the observer was kept to a minimum and for clarification reasons (e.g. user says "*This is too expensive*" and observer asks "*What's your budget?*" to understand context).

Data Analysis Approach

The collected data were transcribed and subjected to manual thematic analysis, appropriate for the manageable dataset size. In preparation for coding, all transcripts were first annotated to highlight user actions, decisions, and verbalized thoughts, alongside contextual details where applicable (e.g., screen interactions, map navigation, time constraints mentioned). These annotations supported a deeper understanding of the interactions, enabling a more structured application of thematic analysis linked to Mental

Models and DiCoT principles. Analysis was carried out independently for the two sets of observations (remote vs. in-person) according to the theoretical frameworks guiding the study.

Mental Models (Remote Observations):
Transcripts were analyzed using clearly defined themes:

- **Expectations** (what users anticipated regarding the behavior of the systems)
- **Mismatches** (where the actual system behavior deviated from user expectations)
- **Adaptations** (change of user behaviors in response to inconsistencies)
- **Prior Knowledge** (how past experiences with similar systems shaped their expectations and decisions)

This approach is validated by being directly aligned to the theory of Mental Models (Weinschenk, 2011; Norman, 1983), which clearly outlines how differences in expectations significantly contribute to usability and users' decision-making.

Distributed Cognition for Teams (DiCoT) (In-person Observations)
Transcripts were coded according to four explicitly defined themes drawn directly from DiCoT principles:

- **Physical Layout** (decisions determined by spatial configuration and proximity)
- **Artifacts and Representations** (how digital and physical tools, such as maps support cognitive processes)
- **Information Flow** (how information moved, transformed, and was integrated across digital and physical spaces)
- **Social and Temporal Context** (how social interactions, time constraints, preexisting routines, and individual or collective decision-making heuristics affect user interactions)

The overt use of the Social/Temporal dimension is strongly evidenced in DiCoT analysis of cognition as situated within social settings and over time. This understanding highlights how user interactions are shaped by proximal social interactions, time constraints, and culturally or personally specified standards of decision-making—factors that figure largely in DiCoT assessments in naturalistic, day-to-day situations (Blandford & Furniss, 2006; Hutchins, 1995). Therefore, each of the theoretical approaches provides thorough, theory-grounded explanations of the complexity involved in user interaction with digital artifacts, and provides a firm empirical ground on which to construct useful design principles and guidelines.
Coding was conducted manually, appropriate for the manageable data size, and codes were directly derived from Mental Models and DiCoT theoretical constructs. Although think-aloud methods captured many cognitive processes, it was sometimes challenging to detect implicit expectations or distributed cognitive strategies without inference, which reflects common challenges in qualitative analysis of situated tasks.
(Examples of coded transcripts can be found in Appendix D)

Findings

1. Mental Models (Remote Observations)
Analysis of the three remote sessions identified four basic themes of Mental Model concepts that impacted user interaction. These themes explain not just the ways users understand how the system is working but also how deviations from these models derail task flow and necessitate cognitive adjustments. Results are explained within the Mental Model theory that suggests users create simplified internal models of how systems are working (Norman, 1983; Weinschenk, 2011).

Expectations
The participants interacted with the tasks with specific, often tacit, expectations regarding the behavior of the systems used. For example, Participant 1 (Zurich trip) expected Skyscanner to offer the ability to sort flights by departure time "*I'll try to set the departure after 4 PM.*" [P1, Zurich]. Similarly, Participant 2 expected ferries to be a cheaper option compared to air travel, stating: "*Let's check ferries. Usually, ferries are cheaper*." [P2, Mykonos]. Participant 3 (Rome trip) expected the Booking.com map-based interface to support easy filtering by location and price, "*I mostly know where I want to stay — I'll search based on the map*." [P3, Rome]
The findings are aligned with the theory, which stresses that users base their behavior on simplified representations that are formed from their past experiences and limited knowledge in their interaction with systems (Norman, 1983).

Mismatches
Despite strong expectations, participants frequently found experiences where the system behavior didn't fit into their conceptual structures and thus created ambiguity and the necessity of reframing strategies. A mismatch was seen when Participant 1 could not identify a time-filter option on Omio: "*I don't see a departure time filter here*." [P1, Zurich] Participant 2 also experienced a mismatch when ferry prices were unexpectedly high: "*It is not very cheap, either*." [P2, Mykonos]. Participant 3 (Rome trip) faced mismatches in price expectations, discovering that centrally located hotels were far more expensive than anticipated, "*Most hotels are insanely expensive even when I filter by price*." [P3, Rome].
The research above suggests that conflicts between a person's cognitive representation of a system and the real operation of the system could create high levels of cognitive dissonance, thus disrupting task flow and requiring users to put additional effort adjusting search parameters (Weinschenk, 2011). This research also suggests a principle of design: systems should minimize hidden complexities and ensure key affordances and distinctions become evident.

Adaptations
Based on the differences noted, the participants made real-time strategy adjustments. Participant 1 moved from searching for flights to considering the use of a train and bus when flight alternatives did not meet the budget and time limitations. "*Maybe I could go to Basel instead and take a day trip to Zurich*." [P1, Zurich]. Similarly, Participant 2 recalled a promotion of a free domestic flight and went back to thinking about air travel, "*Yes, I think that flying is the best option— I have a free domestic flight*." [P2, Mykonos]. Participant 3 adapted by loosening their hotel criteria and focusing more on review quality than price alone, "*I'd like it to have a lot of reviews. This one has 2,000 reviews. 4.1 rating — its pricey but it's fine*." [P3, Rome].
These adaptations illustrate a basic premise of the Mental Models theory, which is that when systems deviate from users' expectations, users do not abandon their goals; instead, they adapt their mental models or create new strategies to accommodate the new information (Norman, 1983). This phenomenon highlights the resourcefulness of users while also suggesting that design could better support smooth adaptations by offering more explicit cues and more routes.

Prior Knowledge
Participants' prior experiences strongly shaped their initial expectations and responses to mismatches. Participant 2, familiar with airline baggage policies, used this prior knowledge to guide airline selection, "*It's better because SkyExpress allows both backpack and carry-on baggage*." [P2, Mykonos]. Participant 3 based accommodation decisions on prior knowledge of Rome's urban layout, "*I mostly know where I want to stay—close to central*

locations to reduce travel time." [P3, Rome]. Participant 1 expected price variances on Skyscanner based on past experiences, "*Sometimes Skyscanner prices change. Let me refresh to check again*." [P1, Zurich]
The reliance on prior knowledge validates the proposition that mental models are not static; they evolve gradually through continued interaction with the system. Nonetheless, when the behavior of the system differs radically from expected outcomes, users, despite their rich prior knowledge, can become confused. This highlights the need for design strategies that successfully span the cognitive models of novice and experienced users.

Summary of Mental Models Findings
Concerning Mental Models Across the participants, the interaction patterns followed the expected order of Expectation → Mismatch → Adaptation consistently, grounded in Prior Knowledge. This finding confirms Mental Models' relevance for travel planning and highlights how mismatched systems increase cognitive friction and force unnecessary adaptations.

2. DiCoT (In-Person Observations)
A comparison of three face-to-face planning-for-leisure observations using the Distributed Cognition for Teams (DiCoT) framework as suggested by Blandford and Furniss (2006) offered interesting insights into the ways in which cognitive activities were successfully distributed through different physical environments, digital tools, information channels, and temporal social constraints. Unlike screen-based tasks, the decision-making of participants was heavily impacted by spatial configurations, mobile interactions, and contextual situational factors. The findings are organized in accordance with the following analytical themes: Physical Layout, Artefacts and Representations, Information Flow, and Social/Temporal Structure.

Physical Layout
Participants generally used the spatial layout of sites and distances as a basis for the decision-making process. For the task of searching for museums the participant clearly restricted choices to nearby museums visible on the map, "*I'm checking what's close by. I don't want to spend too much time traveling*." [P1, Berlin Museum]. Similarly, during the Berlin restaurant search spatial proximity influenced the decision-making process while walking, "*It's just a minute away — really close. We just need to turn to the next street*." [P2, Berlin Restaurant]. Also in the case of Participant 3, decisions were based on proximity of location, "*I don't have to walk; I just need to turn around*." [P3, London].
The findings show that spatial organization, whether physical or digital, reduced decision-making complexity by encouraging selection of conveniently located options.

Artefacts and Representations
Mobile maps, digital listings, and visual representations served as vital tools that eased user comprehension in all sessions. In the museum exploration by P1, visual features like star ratings and user-contributed images substituted the necessity for further questioning, "*I prefer to look at pictures instead of reading long written descriptions*." [P1, Berlin Museum]. Similarly, during restaurant selection, P2 evaluated options through review counts and map markers, dynamically interacting with visual symbols over textual descriptions, "*It has 2,384 reviews and 4.6 stars. That's decent*." [P2, Berlin Restaurant]. Participant 3's decision-making relied heavily on map interface representations and platform ratings as well, "*This one has 2,000 reviews, and 4.1 rating — seems fine*." [P3, London]. The reliance on artefacts for decision-making illustrates a key DiCoT principle: external representations do not simply inform internal cognition; they are part of the cognitive system itself (Hutchins, 1995).

Information Flow
The flow of information between digital artifacts, physical cues, and articulated rationale was central to the participants' task performance. Participant 1's decision-making in the museum environment involved an effortless integration of digital map data, opening hours, and distances to be covered, "*I want to make sure I can be there before 5 PM — it's already 3:30 now.*"[P1, Berlin Museum]. P2 filtered restaurants dynamically while walking, cross-referencing in-app information with physical observations (e.g., noticing stores were closed or deserted), "*This one's closed because of holiday hours — we'll have to find another*" [P2, Berlin Restaurant]. P3,actively flowed between apps, double-checking restaurant information on TripAdvisor after initial map inspection, "*Let me check it on TripAdvisor too — looks like a proper restaurant*" [P3, London].
Across all tasks, participants used different sources of information, constantly toggling between them in real time and not depending on any single artifact or medium. This reinforces the suggestion made by DiCoT that cognitive processes were not confined to the physical environments but also spread along networks of artifacts and mechanisms of transforming information (Blandford & Furniss, 2006).

Social/Temporal Structure
Time constraints and social reasoning patterns further shaped decision processes. P1 emphasized time as a critical factor, limiting museum options to those reachable before 5 PM, "*I don't want to go far, because I have things to do later*. [P1, Berlin Museum]. Similarly, P2 included social heuristics in the selection process thinking that a certain number of reviews might not be adequate for a big city capital "*Since we're in Berlin, 400 reviews might not be enough*." [P2, Berlin Restaurant]. Participant 3 had a similar thinking process, "*More reviews usually mean better trust*." [P3, London].
Temporal constraints, like expected arrival times and required walking times, as well as social norms, like standards for deciding what constitutes a "reliable" option, thus played essential roles in the decision, appearing as externally driven cognitive influences instead of purely internal factors.

Summary
Far from relying solely on internal memory and cognitive reasoning, individuals used external tools, spatial environments, and time/social conventions to guide decisions and counter uncertainty. This validates the theoretical prediction of DiCoT, namely, that user cognition in public environments emerges from the interactions between participants, artefacts, environments, and social structures. The findings demonstrate the need for HCI design to consider not only the usability of single interfaces but also the context in which tools fit into broader real-world workflow, environments, and time patterns.

Design Principles and Guidelines

Principles and Guidelines Derived from Mental Models Analysis

Principle 1: Create Alignment between system behavior and User Expectations
The analysis identified that user expectation and system capability mismatches (e.g., missing filters and unexpected prices) heavily impaired the process of making decisions. To reduce friction, interfaces must be designed to predict potential user expectations and align their operating logics accordingly.
Guideline: Ensure that key functions (e.g., filters, sorting options) are immediately visible and predictable across pages. For example, ensure that travel search platforms like Omio provide consistent filtering tools (e.g., departure time filters) across all transport types, not just flights.

Principle 2: Effective Communication for System States and Changes
Participants were confused when systems demonstrated dynamic properties, including changing prices, without sufficient signaling. Given that users have pre-existing expectations, it is crucial for changes to the system to be signaled expressly.
Guideline: Provide accurate and timely alerts for any variations that happen, like flight fare increasing or changes for availability, to reduce unexpected discrepancies.
e.g. Skyscanner could visually flag when refreshed search results differ from previously viewed prices to help users maintain a stable mental model of the system state.

Principle 3: Allow for User Flexibility During the Task Performance Process
In case of mismatches, users also showed substantial adaptability. Interfaces need to enable this adaptability behavior rather than requiring users to follow rigid workflows.
Guideline: Allow users to easily modify search parameters mid-task without restarting the search process. E.g. For trip planning, it is crucial that sites enable easy modal transfer between modes of transportation (e.g., from aircraft to bus) without requiring full resubmission of search details.

Principles and Guidelines Derived from DiCoT Analysis

Principle 4: Seamlessly Integrate Spatial Context within Digital Tools
In in-person observations, participants' decision-making was tightly coupled to spatial layout and proximity. Digital systems should reflect and enhance spatial awareness to facilitate situated decision-making.
Guideline: Map interfaces must prioritize real-time, distance-related information such as walking times and direct-line accessibility. E.g. Google Maps could make "1-minute walk" alternatives more prominent for searches like restaurants or museums.

Principle 5: Design for Distributed, Multi-Channel Information Use
Participants did not rely exclusively on one application or artefact, but switched between multiple sources, for example, moving between maps and TripAdvisor. Systems need to identify and enable this distributed cognitive activity.
Guideline: Provide effortless transitions between various interfaces or introduce cross-links (such as showing TripAdvisor ratings on Maps.google.com) to reduce the cognitive load involved in the verification process. A Google Maps listing for a restaurant can show TripAdvisor and Yelp ratings alongside Google reviews.

Principle 6: Enable Time-Aware and Travel-Aware Decision-Making
Participant decision-making was affected not just by proximity of location but also by temporal constraints, such as how long it would take to get somewhere before it would close. Computer systems should merge location and time information to allow realistic, time-constrained decision-making.
Guideline: Calculate and report whether a user can realistically arrive at a location before it closes, combining real-time travel time estimates with event closing times.
For example, a map system could automatically light up venues which are still reachable ("20 min travel, closes in 45 min") and gray out ones which are no longer realistically accessible.

Critical Evaluation of Theoretical Approaches

The two theories used together complemented and allowed for overall observation and analysis of user interactions. Mental Models provided a robust foundation to observe how users' anticipations directed their interactions on online travel websites and how mismatch resulted in adjustments. DiCoT allowed for scrutiny of how cognition was distributed across

artefacts, space, and time for situated activities. Mental Models was particularly useful for structuring remote observations and for showing where interface design differed from user expectation, mapping directly to design guidelines for transparency, consistency, and flexible adaptation. Recording users' active, multiple-source activity across several systems was more difficult to do within the framework. Users' expectations were not always overtly spoken and adaptations were quick, so determining explicit changes to their mental models was difficult without inference. Applying Mental Models analysis across more cross-system activity would bring out its potential for producing design guidelines for more complex, multi-app experiences. DiCoT provided us with a robust framework for describing how people moved conceptually and spatially within their environment and, more concretely, how artefacts (maps, reviews) and physical placement shaped decision-making. It enabled us to make design recommendations that better included spatial context and external representations within digital interfaces. DiCoT's team-based origins occasionally made it stretch to extend to single task contexts, however; not all of its categories (e.g., formal organisational layouts) were pertinent. Selective application of DiCoT principles, more concerned with artefacts and information flow and less concerned with team structures, would make it more appropriate for examining individual tasks. This study also highlighted the interconnectedness of the frameworks: the distributed cognitive strategies and user mental models are entangled together within mobile world interaction. While this study provided valuable insight into how users engage with digital travel and leisure tools, several limitations must be mentioned. The participant sample was relatively small and from digitally experienced groups, which may limit the generalizability of findings to less experienced users or users with accessibility needs. Additionally, the tasks undertaken were relatively brief and pertaining to short-term planning contexts; longer term planning and more complex multi-stage tasks were not investigated. Follow-up research could surmount these limitations by recruiting a more diverse sample with varying digital capabilities and by scaling task situations up to longer, more complex journeys. It could also implement Mental Models and DiCoT frameworks on emerging technologies, such as AI travel organizers or augmented reality navigation, to test the frameworks' generic nature in new settings and extend design recommendations to suit evolving user needs.

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Link to One Drive Folder containing:

- Raw Interview Data
- Coded Transcripts
- Signed Consent Forms
- Ethics Form and Participant Information sheet

Appendix

Appendix A - Completed research ethics checklist

Research Ethics Review Form: BSc, MSc and MA Projects
Computer Science Research Ethics Committee (CSREC)
http://www.city.ac.uk/department-computer-science/research-ethics

A.1 If you answer YES to any of the questions in this block, you must apply to an appropriate external ethics committee for approval and log this approval as an External Application through Research Ethics Online - https://ethics.city.ac.uk/		*Delete as appropriate*
1.1	Does your research require approval from the National Research Ethics Service (NRES)? *e.g. because you are recruiting current NHS patients or staff?* *If you are unsure try - https://www.hra.nhs.uk/approvals-amendments/what-approvals-do-i-need/*	**NO**
1.2	Will you recruit participants who fall under the auspices of the Mental Capacity Act? *Such research needs to be approved by an external ethics committee such as NRES or the Social Care Research Ethics Committee - http://www.scie.org.uk/research/ethics-committee/*	**NO**
1.3	Will you recruit any participants who are currently under the auspices of the Criminal Justice System, for example, but not limited to, people on remand, prisoners and those on probation? *Such research needs to be authorised by the ethics approval system of the National Offender Management Service.*	**NO**
A.2 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee, you must apply for approval from the Senate Research Ethics Committee (SREC) through Research Ethics Online - https://ethics.city.ac.uk/		*Delete as appropriate*
2.1	Does your research involve participants who are unable to give informed consent? *For example, but not limited to, people who may have a degree of learning disability or mental health problem, that means they are unable to make an informed decision on their own behalf.*	**NO**
2.2	Is there a risk that your research might lead to disclosures from participants concerning their involvement in illegal activities?	**NO**
2.3	Is there a risk that obscene and or illegal material may need to be accessed for your research study (including online content and other material)?	**NO**
2.4	Does your project involve participants disclosing information about special category or sensitive subjects? *For example, but not limited to: racial or ethnic origin; political opinions; religious beliefs; trade union membership; physical or mental health; sexual life; criminal offences and proceedings*	**NO**
2.5	Does your research involve you travelling to another country outside of the UK, where the Foreign & Commonwealth Office has issued a travel warning that affects the area in which you will study?	**NO**

	Please check the latest guidance from the FCO - http://www.fco.gov.uk/en/	
2.6	Does your research involve invasive or intrusive procedures? *These may include, but are not limited to, electrical stimulation, heat, cold or bruising.*	**NO**
2.7	Does your research involve animals?	**NO**
2.8	Does your research involve the administration of drugs, placebos or other substances to study participants?	**NO**
A.3 If you answer YES to any of the questions in this block, then unless you are applying to an external ethics committee or the SREC, you must apply for approval from the Computer Science Research Ethics Committee (CSREC) through Research Ethics Online - https://ethics.city.ac.uk/ Depending on the level of risk associated with your application, it may be referred to the Senate Research Ethics Committee.		*Delete as appropriate*
3.1	Does your research involve participants who are under the age of 18?	**NO**
3.2	Does your research involve adults who are vulnerable because of their social, psychological or medical circumstances (vulnerable adults)? *This includes adults with cognitive and / or learning disabilities, adults with physical disabilities and older people.*	**NO**
3.3	Are participants recruited because they are staff or students of City, University of London? *For example, students studying on a particular course or module.* *If yes, then approval is also required from the Head of Department or Programme Director.*	**NO**
3.4	Does your research involve intentional deception of participants?	**NO**
3.5	Does your research involve participants taking part without their informed consent?	**NO**
3.5	Is the risk posed to participants greater than that in normal working life?	**NO**
3.7	Is the risk posed to you, the researcher(s), greater than that in normal working life?	**NO**
A.4 If you answer YES to the following question and your answers to all other questions in sections A1, A2 and A3 are NO, then your project is deemed to be of MINIMAL RISK. If this is the case, then you can apply for approval through your supervisor under PROPORTIONATE REVIEW. You do so by completing PART B of this form. If you have answered NO to all questions on this form, then your project does not require ethical approval. You should submit and retain this form as evidence of this.		*Delete as appropriate*
4	Does your project involve human participants or their identifiable personal data? *For example, as interviewees, respondents to a survey or participants in testing.*	**YES**

PART B: Ethics Proportionate Review Form

B.1 The following questions must be answered fully. All grey instructions must be removed.		*Delete as appropriate*
1.1.	Will you ensure that participants taking part in your project are fully informed about the purpose of the research?	**YES**
1.2	Will you ensure that participants taking part in your project are fully informed about the procedures affecting them or affecting any information collected about them, including information about how the data will be used, to whom it will be disclosed, and how long it will be kept?	**YES**
1.3	When people agree to participate in your project, will it be made clear to them that they may withdraw (i.e. not participate) at any time without any penalty?	**YES**
1.4	Will consent be obtained from the participants in your project? Consent from participants will be necessary if you plan to involve them in your project or if you plan to use identifiable personal data from existing records. "Identifiable personal data" means data relating to a living person who might be identifiable if the record includes their name, username, student id, DNA, fingerprint, address, etc. *If YES, you must attach drafts of the participant information sheet(s) and consent form(s) that you will use in section B.3 or, in the case of an existing dataset, provide details of how consent has been obtained.* *You must also retain the completed forms for subsequent inspection. Failure to provide the completed consent request forms will result in withdrawal of any earlier ethical approval of your project.*	**YES**
1.5	Have you made arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential?	**YES**

B.2 If the answer to the following question (B2) is YES, you must provide details		*Delete as appropriate*
2	Will the research be conducted in the participant's home or other non-University location? Details: ***Observations will be conducted digitally or in public spaces. No private home visits. Safety is guaranteed since the participants belong to family and family circle of the researcher.***	**YES**

B.3 Attachments **ALL of the following documents MUST be provided to supervisors if applicable.** **All must be considered prior to final approval by supervisors.** **A written record of final approval must be provided and retained.**	***YES***	***NO***	***Not Applicable***

Details of arrangements to ensure that material and/or private information obtained from or about the participating individuals will remain confidential (see B1.5) *Any personal data must be acquired, stored and made accessible in ways that are GDPR compliant.* *Details:* **Data will remain confidential, stored securely and only used for the scope of the module – access will be granted only to the researcher and the lecturer.**	**YES**		
Participant information sheet(s)	**YES**		
Consent form(s)	**YES**		
Questionnaire(s) *sharing a Qualtrics survey with your supervisor is recommended.*			**Not applicable**

Appendix B – Blank Participant Information Sheet

Participant Information Sheet

Title of Study: INM314 Understanding User Interactions Coursework 2025
Name of researcher: **Elena Vergopoulou (**Supervised by Sylwia Frankowska-Takhari)

Invitation

I would like to invite you to take part in a research study. Before you decide whether you would like to take part, it is important that you understand why the research is being done and what it would involve for you. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. You will be given a copy of this information sheet to keep.

What is the purpose of the study?

This study is a coursework project for the module **INM314 Understanding User Interactions** on the MSc in Human-Computer Interaction Design programme, at City, University of London. The purpose of this study is to **observe how people use digital tools (such as mobile apps and websites) to plan leisure and travel activities**. The findings will help inform the design of future digital systems that better support real-world user needs.
The findings will be written up in a report, submitted for marking as part of the module assessment.

The findings will be written up as a report, that I will submit to City St George's, University of London, for marking, to determine my final grade for the module.

Why have I been invited?

You have been invited to take part in this study because

- you are an adult, aged at least 18 years old.
- you do not consider yourself to be vulnerable.
- You use digital systems (e.g., apps, websites) for leisure or travel planning.

Do I have to take part?

Participation in the project is voluntary. It is up to you to decide whether or not to take part, and you can choose not to participate in part or all of the project; this includes choosing not to answer any questions which you feel are too personal or intrusive, or undertake specific tasks. If you do decide to take part, you will be asked to sign an Informed Consent form. If you decide to take part, you are still free to withdraw at any time and without giving a reason, and without being penalised or disadvantaged in any way.

What will happen if I take part? What will I have to do?

If you participate, you will:

- Complete a real-world task (such as planning a trip or selecting a restaurant) using a digital platform.
- Be observed either via screen-sharing or in-person observation while using your device.
- The session will last approximately 15 minutes.
- If relevant, the session may involve light walking (e.g., checking mobile apps while navigating outside).

Your activity may be recorded (screen recording or observational notes) to support the analysis.

What are the possible disadvantages and risks of taking part?

There are no foreseeable risks or harms or possible side effects for participating in this study.

What are the possible benefits of taking part?

While there are no specific benefits of taking part, I hope you enjoy the experience of participating in the study.

Expenses and Payments

You will not be paid or have any expenses compensated for taking part in this study, but I am very grateful for your help.

What should I do if I want to take part?

Once you have read this participant information sheet in full and are confident that you understand what participating in the study would involve, if decide that you are willing to take part, please contact me via email and we will arrange a time for a session.

Data privacy statement

City St George's, University of London is the sponsor and the data controller of this study based in the United Kingdom. This means that we are responsible for looking after your information and using it properly. The legal basis under which your data will be processed is City St George's public task.

Your rights to access, change or move your information are limited, as we need to manage your information in a specific way in order for the research to be reliable and accurate. To safeguard your rights, we will use the minimum personally identifiable information possible (for further information please see https://ico.org.uk/for-organisations/guide-to-data-protection/guide-to-the-general-data-protection-regulation-gdpr/lawful-basis-for-processing/public-task/).

City St George's will use your name and contact details to contact you about the research study as necessary. The only people at City St George's who will have access to your identifiable information will be the researcher (student), staff responsible for assessing the coursework, and, if appropriate, individuals with responsibility for monitoring and auditing at City St George's. There may be occasions when regulatory authorities may access research data in accordance with their statutory powers. City St George's will keep identifiable information about you from this study until the coursework mark has been approved by the Examinations Board, after which, it will be destroyed.

You can find out more about how City St George's handles personal data by visiting https://www.city.ac.uk/about/governance/policies/data-protection-policy. You can also read City St George's general privacy notice by visiting https://www.city.ac.uk/about/governance/policies/general-privacy-notice . If you are concerned about how we have processed your personal data, you can contact the Information Commissioner's Office (ICO) directly https://ico.org.uk/.

Will my taking part in the study be kept confidential?

Only the researcher (me) and any staff responsible for assessing the coursework will have access to your data at any point. The data gathered in this study, including your identity and personal information, will be kept confidential. Data will be anonymised or de-identified where possible, and stored securely in a password protected location, in accordance with the University's data

protection regulations. No personally identifiable data will be published; any quotes will be anonymised.

The raw data, including any recordings, will be destroyed once the marks for the coursework have been approved by the University's Examinations Board.

What will happen to the results?

The anonymised results of the study will be included in a coursework report for the module INM314 Understanding User Interactions, which will be submitted to the University for marking (assessment). They may also be used in a future portfolio of my work.

Who has reviewed the study?
This coursework project has been approved by a representative of City St George's, University of London Computer Science Research Ethics Committee.

What if there is a problem?

If you have any problems, concerns or questions about this study, you should ask to speak to a member of the research team (see contact details at the bottom of this document).

If you remain unhappy and wish to complain formally, you can do this through City St George's complaints procedure. To complain about the study, you need to phone 020 7040 3040. You can then ask to speak to the Secretary to Senate Research Ethics Committee and inform them that the name of the project **is INM314 Understanding User Interactions 2025 coursework project.**

You can also write to the Secretary at:

Annah Whyton
Research & Enterprise Office
City St George's, University of London
Northampton Square
London, EC1V 0HB
Email: senaterec@city.ac.uk

Insurance

City St George's, University of London holds insurance policies which apply to this study, subject to the terms and conditions of the policy. If you feel you have been harmed or injured by taking part in this study, you may be eligible to claim compensation. This does not affect your legal rights to seek compensation. If you are harmed due to someone's negligence, then you may have grounds for legal action.

Further information and contact details

For further information about this study, please contact one of the following people, as appropriate:

Researcher (student):	Elena Vergopoulou	elena.vergopoulou@citystgeorges.ac.uk
Module Leader / Lecturer:	Sylwia Frankowska-Takhari	sylwia.frankowska-takhari@citystgeorges.ac.uk

Thank you for taking the time to read this information sheet.

Appendix C – Blank Consent Form

Participant Informed Consent Form

Title of Study: INM314 Understanding User Interactions coursework project.

1	I confirm that I have read the *Participant Information Sheet*, for this student coursework project, and can keep a copy of that information for my records. The project has been explained to me, and I had opportunity to ask questions, which were answered satisfactorily.	
2	I understand that my participation is voluntary, that I can choose not to participate in part or all of the project, and that I can withdraw at any stage, without penalty or disadvantage	
3	I agree to be interviewed (asked verbal questions).	
4	I agree to undertake given tasks on a computer/mobile device while being observed.	
5	I agree to 'think aloud' while undertaking tasks.	
6	I agree to screen-recording of tasks I undertake.	
7	I agree to the session being audio recorded.	
8	I agree to the session being video recorded.	
9	I understand that anonymised direct quotes from me, de-identified results and screen images, may be reused in future teaching.	
10	I understand that anonymised direct quotes from me, de-identified results and screen images, may be used in publications, reports, presentations, posters, and portfolios of the researcher's work.	
11	I understand that no information that could lead to the identification of any individual will be shared with any other party other than the researcher and those involved in assessing the coursework.	
12	I agree to City St George's recording and processing this information about me. I understand that this information will be used only for the purpose(s) explained in the Participant Information Sheet, and my consent is conditional on City St George's complying with its duties and obligations under the General Data Protection Regulation (GDPR).	
13	I understand that data from this study will be stored securely, on a password-protected and encrypted device, and/or in locked storage, and deleted/destroyed after the marks for the coursework have been approved by the examinations board.	
14	I agree to take part in this study.	

_____ _____ _____

Name of Participant	Signature	Date
Name of Researcher	Signature	Date

Appendix D – Data Analysis

INM314 – Understanding Interactive Systems

Type of Observation: In the world

Participant No : 1

Date: 5 April 2025

Location: In person

Session Duration: 7 minutes

Color Key: Physical Layout / Artefacts & Representations / Information Flow / Temporal or Social Structure

Interviewer:
Hello, thank you very much for your time. So, what are you doing today?

P1:
Since the weather's not that good, I'm looking for a museum to visit.
[opens map/search app on phone]
We're in Berlin, and this area has a lot of museums.
[zooms into current neighborhood on map]
This is the area I live in — I'm checking what's close by.

[types "museum" in search bar]
[views list of nearby museums]
Okay, I see the Stasi Museum.
That's more historical — focused on East Berlin history.

Interviewer:
Do you have a specific preference?

P1:
Not really. I like art, but I'm also curious to learn about the neighborhood.
So I'm mostly looking at what's nearby so I can go quickly and do other things after.
[clicks on another museum: "Rehengort"]
I haven't seen this one before.

[opens review section]
I always check the comments — not just the star rating.
[scrolls through user reviews]
Okay, people say it's another historical one.
[views photos]
I prefer to see pictures more than reading long info.

[returns to list]
Balloon Museum — sounds a bit too generic.

Not really my thing.

[scrolls further]
Chroma, Dark Matter, Lighthouse — I'm seeing some art/interactive names.

[checks opening hours]
I want to make sure I can be there by 5 PM. It's already 3:30 now.

[zooms map view out to broader area]
Okay, checking a bit wider to see if there are better options.

Interviewer:
What's your limit for travel?

P1:
About 30 minutes — that's the max I'd go for.

[scrolls through new options]
Okay, here's the Spirit Museum — about motorcycles. Not for me.

[sees Puppet Theatre Museum]
Oh! I do animation and puppet-making, so that's super interesting.
But maybe too niche for today — I'll save it for another time.

[returns to first museum]
I think I'll go with the Stasi Museum.

Interviewer:
How will you get there?

P1:
[opens transport directions]
Okay — I can take the tram. It takes about 7 minutes.

[compares other options]
There's metro too, but that takes 19 minutes.
Let's check the tram times.

[views tram schedule]
Next one is at 15:45 — they come every 5 minutes.

[checks walking time to tram stop]
3 minutes — that's close.

[checks final walk from tram to museum]
11 minutes — hmm, a bit long.
[compares with another option]

In the world coded transcript example

INM314 – Understanding Interactive Systems

Type of Observation: In the mind

Participant No : 1

Date: 8 April 2025

Location: Remote (Messenger Call)

Session Duration: 7 minutes

Color Key: Expectation / Mismatch / Adaptation / Prior Knowledge

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Interviewer:
Hello and thank you very much for your time.
So, what are you doing today?

P1:
I want to search for a way to go to Zurich for next weekend. I have a limited budget — around €100 — and the dates are specific. I want to leave on Friday afternoon and return on Sunday.

[opens Skyscanner]
I'll start by searching for flights. I'm using Skyscanner to find the cheapest way.
[switches language from German to English]
Didn't translate, but that's okay.

[enters Berlin to Zurich]
[selects dates: Friday to Sunday]
[opens time filter and selects "after 4 PM"]

[scrolls flight results]
Okay, this one is the cheapest, but it's at 6 AM. I can't do it.
This one is at a good time, but it's €200, so not really an option.

[switches to Omio tab]
I'll check Omio — mostly for trains and buses.

[enters: Berlin Ostbahnhof to Zurich, same dates]
[scrolls Omio results, looks for a filter]
I don't see a filter for departure time here.
[clicks on FlixTrain result]

It's a long trip — 15 hours. Let me check the details.
[reads journey breakdown: Berlin → Karlsruhe → Zurich]

I'll check the return option too. It could work.

[switches to Bus tab in Omio]
[clicks on bus options]
Round trip is €100. Also 15 hours.

If I leave at 5 PM and arrive in the morning, that's okay.

[clicks return trip options]
These look similar. One is 15 minutes faster — I'll pick that one.

[adds tickets to cart → sees total: €126]
That's over budget. I'll check flights again.

[switches back to Skyscanner]
Maybe I can fly into another Swiss city.

[enters: Switzerland]
[selects Zurich]

[scrolls flights again]
This one seemed cheaper before.
[refreshes results]
I've seen this before on Skyscanner — prices move around.
Ah, yes — that one was really early, that's why I didn't choose it.

[switches to new tab → searches for buses to Basel]
Maybe I can go to Basel, then Zurich for a day.

[scrolls Basel trip options]
€43. 13 hours. Seems okay.

[clicks on Flixbus to Basel]
Leaves around 3:40 PM — I'll take that.

[checks return from Basel]
€48 or €49 — both okay. I'll go with the second-cheapest.

Leaves at 6 PM — I'll sleep on the bus. Works for me.

[opens search for train from Basel to Zurich]
Let's see how much a day trip would cost, it's a short trip so it should be okay.

[scrolls results]
€23. One hour. Nice.

[scrolls return options]

In the mind coded transcript example