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CIDAS Campus Institute Data Science

Human Computer Interaction and Privacy

Supporting citizens in adopting privacy tools

Shirin Shams, M.Sc.

University of Göttingen
Institute of Computer Science and Campus Institute Data Science
Computer Security and Privacy (CSP)
Email: shirin.shams@uni-goettingen.de

Our Research Group - Computer Security and Privacy (CSP)

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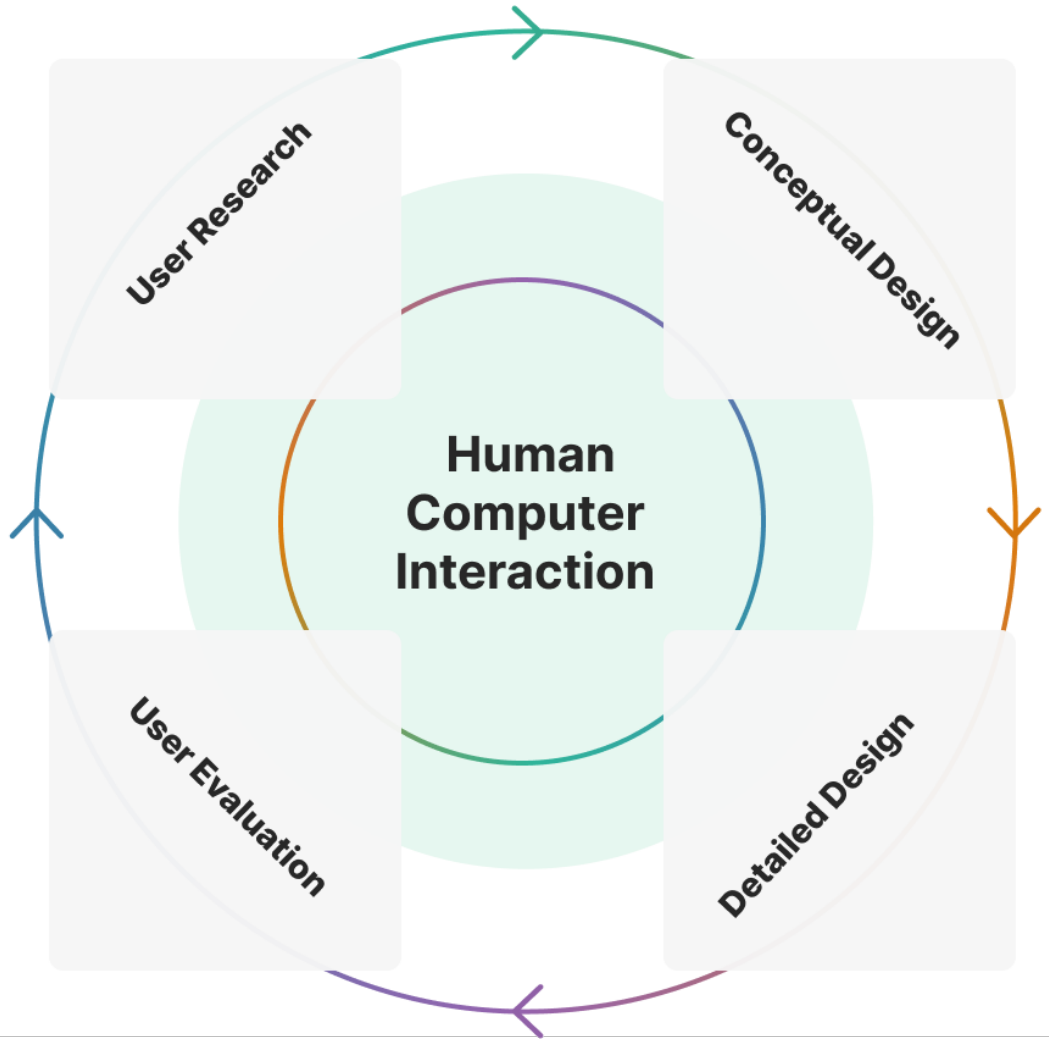
Human Computer Interaction Cycle

Human Computer Interaction (HCI) Cycle [28]



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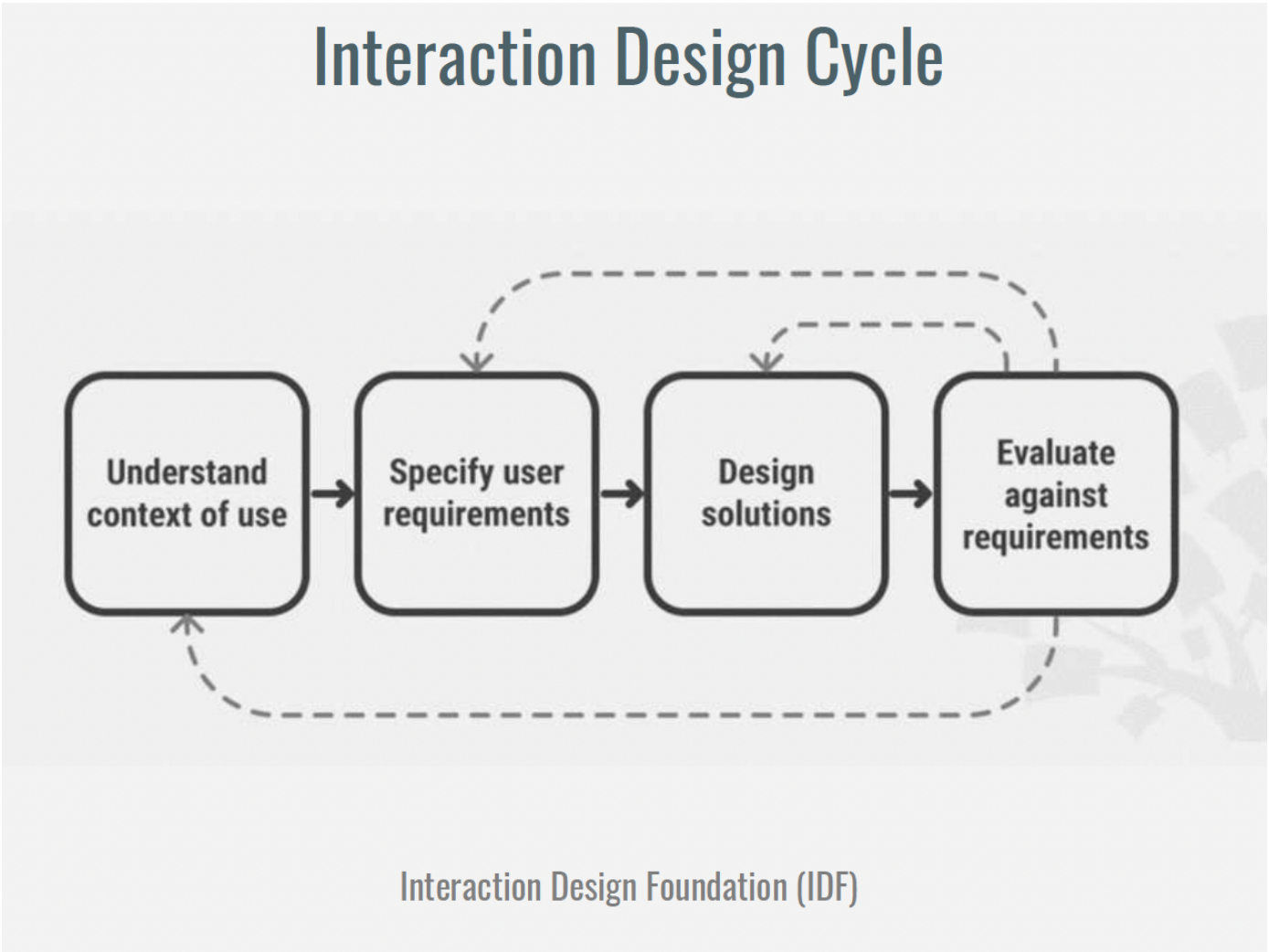
Human Computer Interaction (HCI) Cycle [12]



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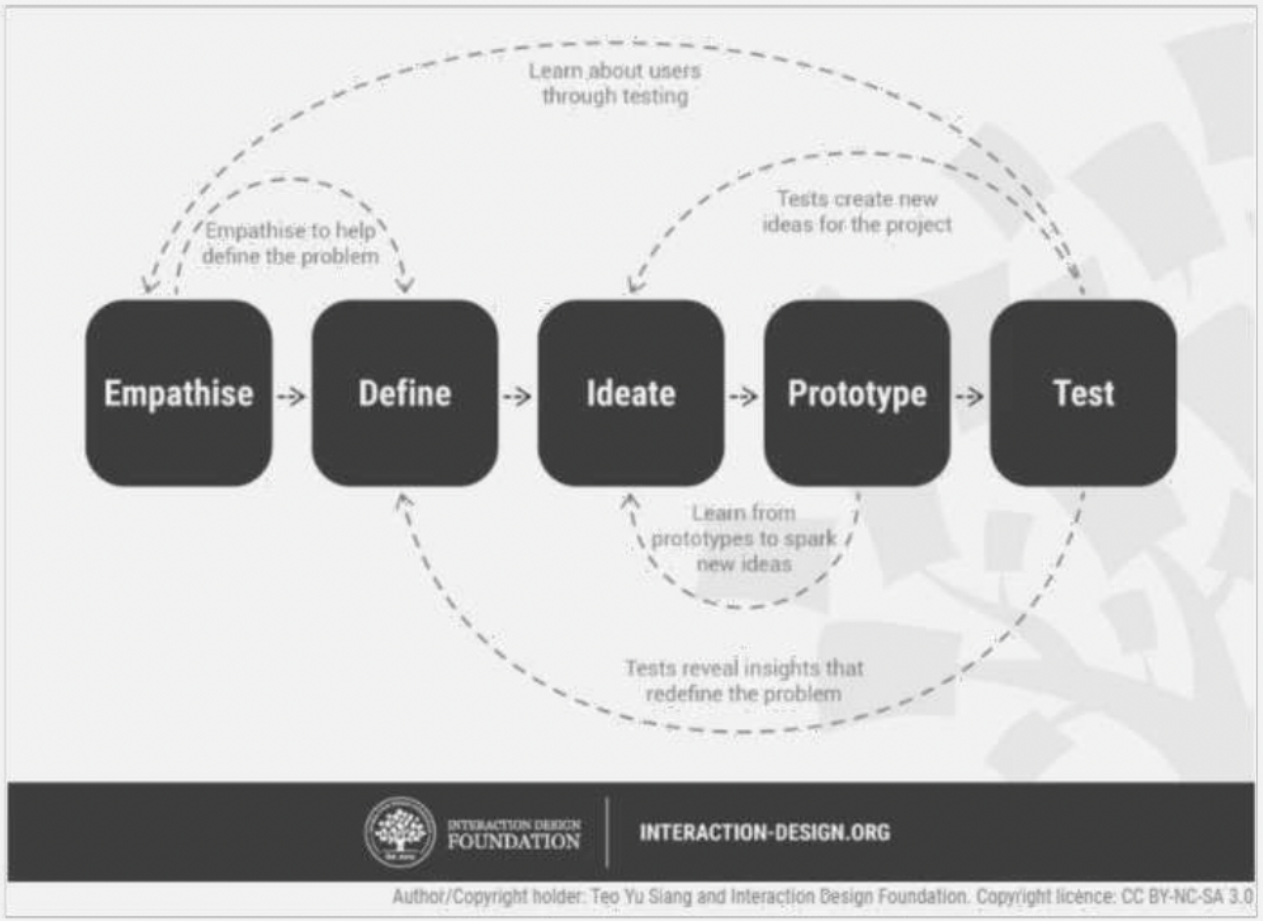
Human Computer Interaction (HCI) Cycle [12]



Interaction Design Foundation (IDF)

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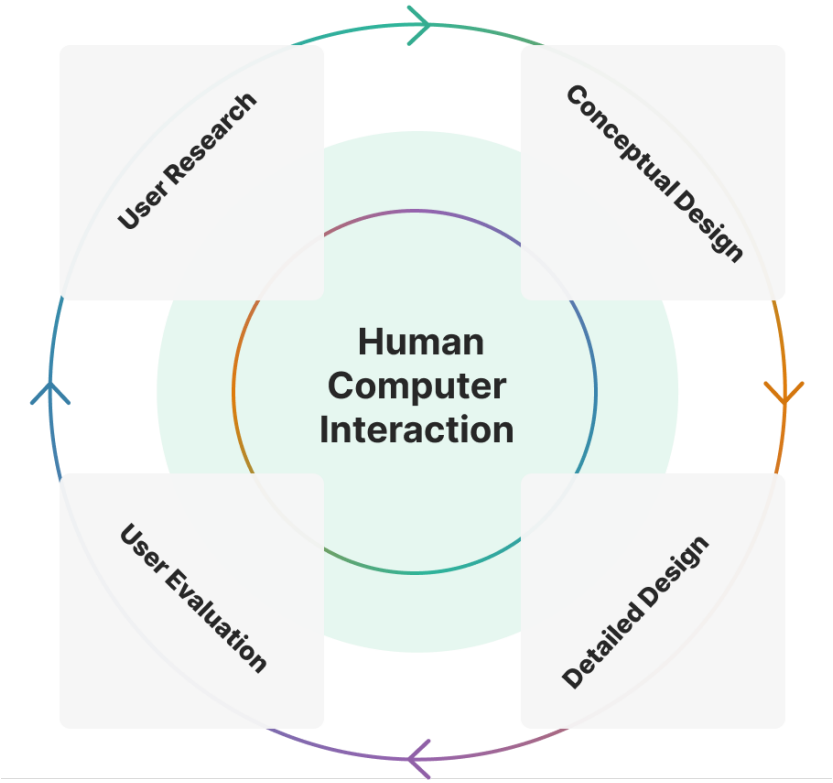
Human Computer Interaction (HCI) Cycle [28]



- Can you think of methods for the **User Research** phase?
- What about the **User Evaluation** phase?

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A Study: Left Alone Facing a Difficult Choice

Left Alone Facing a Difficult Choice [27]

Problem

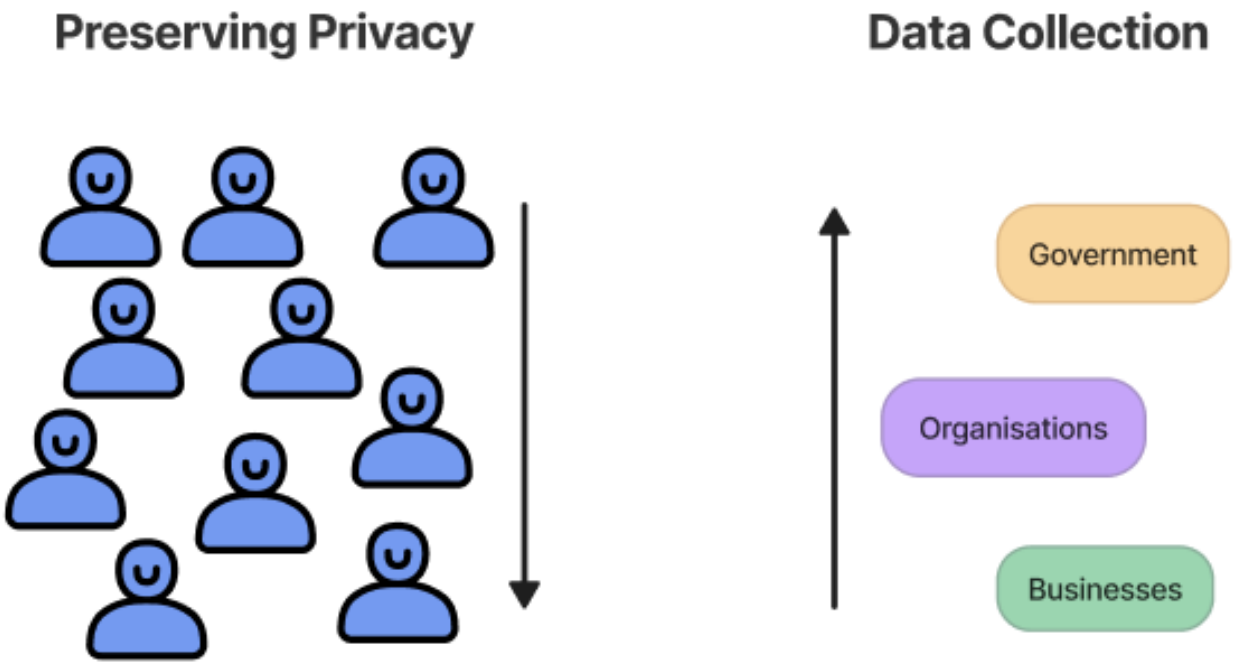

Fig. 1: On going trend

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Problem

Why?

- **Increase in collecting users' data, for e.g.:**
  - Targeted Advertising
  - Dynamic Pricing
  - Revenue Optimization
  - Product Development
  - Customer Support
- **Low Privacy Enhancing Technologies (PETs) Adoption, beacause of e.g.:**
  - Users' general uncertainty [16]
  - Users' unfamiliarity with PETs [24, 29, 22]
  - Users' misconceptions about security and privacy concepts [16]
  - PETs' poor usability [10, 19]

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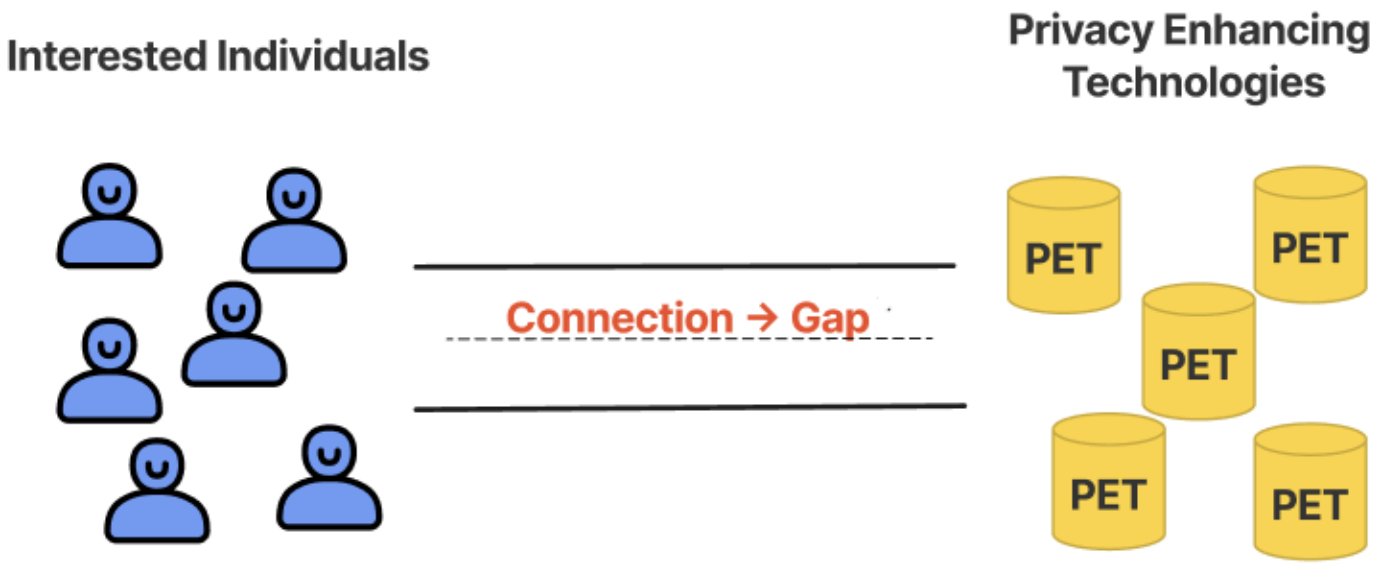
Closer Look

Our Question



For Instance: **80%** of the 257 participants of the study conducted by [2] expressed privacy concerns, while only **6%** had installed privacy-preserving applications on their mobile devices.

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Research Question

Research Question: What are the strengths and weaknesses of websites promoting PETs in supporting individuals in their decisions?

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Methodology

Context

- Personal search - online landscape
- Four PETs
  - Virtual Private Network (VPN)
  - Tor
  - Private Browser (PB)
  - Private Search Engine (PSE)

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Methodology

Expert Analysis

- 69 websites promoting PETs
  - Single product
  - Comparing product
- 24 criteria in 7 categories, e.g.:
  - Technology explanation
  - Technology limitation and coverage
  - Trust to provider and product
  - Usability
- Two experts evaluated and rated websites

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Methodology

Fogg Behaviour Model

- Is anybody familiar with the Fogg Behaviour Model? - Have you ever thought about why we do some ”stuff” and why we do not do some other ones? - Have you ever wondered why we choose to do certain things while avoiding others?

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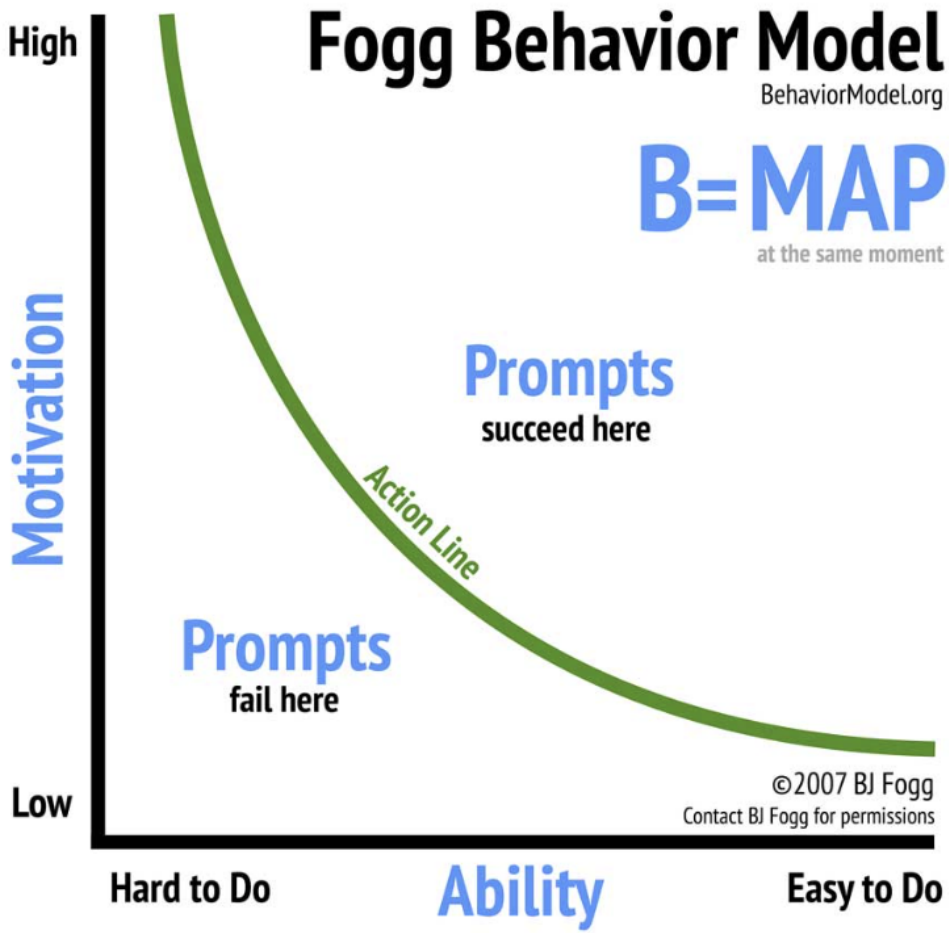
Methodology

Fogg Behaviour Model [11]



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Result

Single-Product [27]

Table 2. Mean score of 45 *single-product* websites. The higher the score (the darker the blue), the better the criterion fulfilled. $\bar{x}$: weighted mean, - : not applicable.

		Categories															
		Technology					Trust				Information				Usability			
Number of websites	PETs	Explanation	Coverage	Limitation	Easiness	Speed	Provider	Product	User feedback	Interpersonal	Layout	Presentation variety	Gap coverage	Language formality	Visual design	Demo	Interaction	$\bar{x}_i$
20	VPN	.4	.2	.1	.3	.6	.5	.5	.9	.3	.6	.3	.4	.5	.8	.6	.0	.4
11	Tor	.5	.2	.2	.2	.3	.5	.3	.2	.0	.4	.3	.2	.5	.5	.5	.0	.3
4	PB	.0	.6	.0	.4	.4	.8	.6	.6	.0	.8	.6	.1	.4	.8	.5	.0	.4
10	PSE	.2	.4	.0	-	.1	.3	.4	.2	.0	.5	.4	.1	-	.5	-	.0	.4
$\bar{x}$		.4	.3	.1	.3	.4	.5	.4	.5	.1	.5	.3	.3	.5	.7	.6	.0	$\approx \frac{1}{3}$

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Findings

Multiple-Product [27]

Table 4. Mean score of 24 *comparing-product* websites. The higher the score (the darker the blue), the better the criterion fulfilled. $\bar{x}$: weighted mean.

		Categories																	
		Technology				**Trust**				**Information**			**Usability**			**Comparison**				
Number of websites	PETs	Explanation	Coverage	Limitation	Easiness	Provider	Product	User feedback	Interpersonal	Presentation variety	Gap coverage	Language formality	Visual design	Demo	Interaction	Review per product	Key benchmarks	Snapshot	Ratting per product	$\bar{x}_{\text{I}}$
6	VPN	.7	.5	.6	.1	.8	.3	.0	.0	.8	.3	.2	.7	.4	.0	.8	.9	.6	.7	.5
8	PB	.0	.1	.3	.1	.9	.1	.0	.0	.3	.4	.5	.5	.6	.0	.6	.3	.2	.1	.3
10	PSE	.1	.2	.2	.1	.8	.4	.0	.1	.3	.4	.5	.7	.5	.0	.7	.5	.4	.1	.3
$\bar{x}$		.2	.2	.3	.1	.8	.3	.0	.0	.4	.4	.4	.6	.5	.0	.7	.5	.4	.3	$\approx \frac{1}{3}$

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Findings

Accessibility [27]

Table 6. Mean score of observed **accessibility issues**

Number of websites	**Issues** / **PETs**	Impact			Sum
		High	**Medium**	**Low**	
26	VPN	22	33	143	198
11	Tor	16	17	82	115
12	PB	20	27	97	144
20	PSE	12	25	62	99
69	$\bar{x}$	**18**	**27**	**73**	**147**

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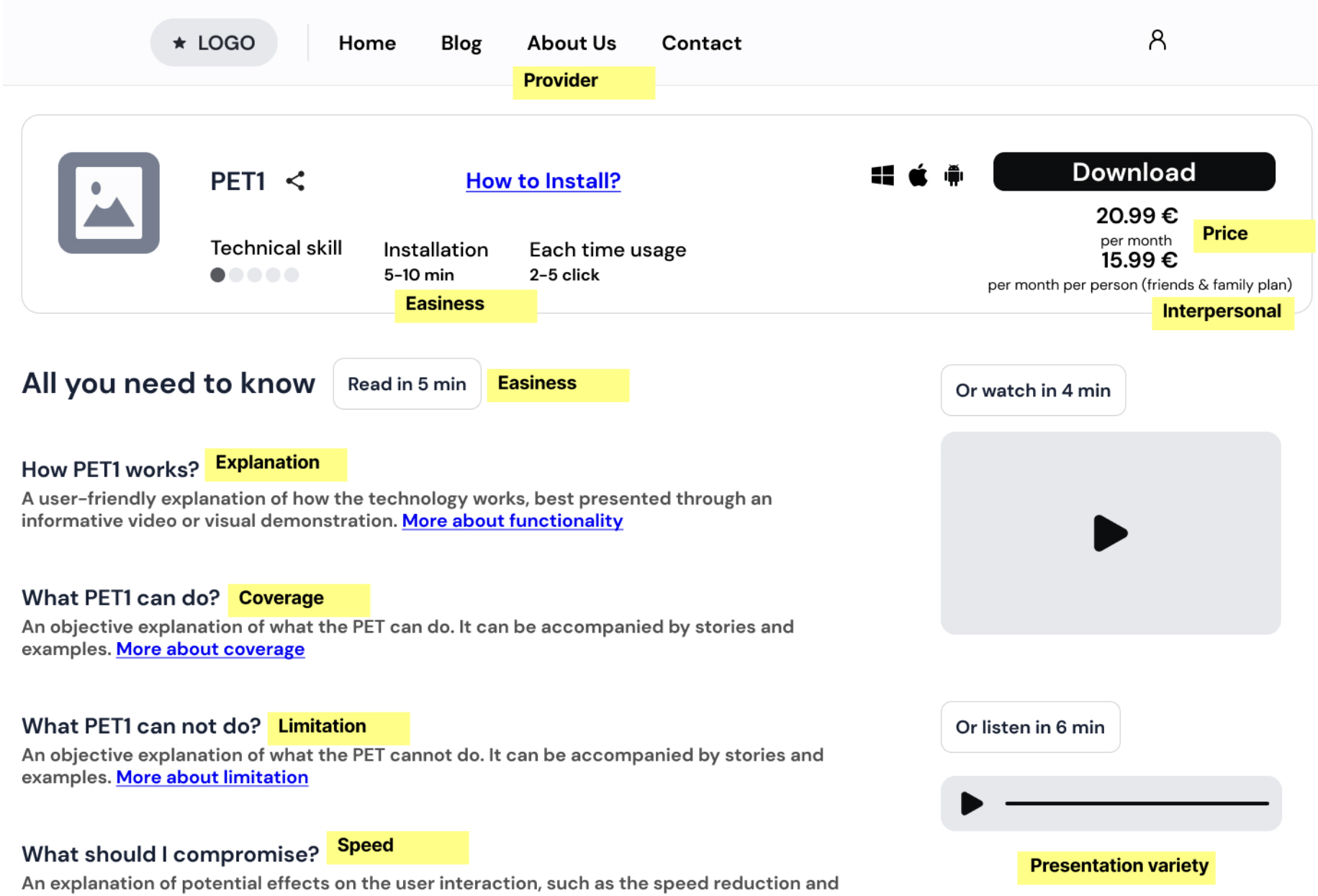
★ LOGO
Home
Blog
About Us
Contact
Provider
PET1
How to Install?
Download
Technical skill
Installation
5-10 min
Each time usage
2-5 click
Easiness
20.99 €
per month
15.99 €
per month per person (friends & family plan)
Price
Interpersonal
All you need to know
Read in 5 min
Easiness
Or watch in 4 min
How PET1 works?
Explanation
A user-friendly explanation of how the technology works, best presented through an informative video or visual demonstration. More about functionality
What PET1 can do?
Coverage
An objective explanation of what the PET can do. It can be accompanied by stories and examples. More about coverage
What PET1 can not do?
Limitation
An objective explanation of what the PET cannot do. It can be accompanied by stories and examples. More about limitation
Or listen in 6 min
What should I compromise?
Speed
An explanation of potential effects on the user interaction, such as the speed reduction and changes in the search results.
Presentation variety
How you can trust us and our product?
Product, trust
Evidence or explanation of the trustworthiness of the product and provider, such as revenue plans, company, and other customers.

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Provider

What should I consider when choosing PET? Key benchmarks

- Communicating the key elements users should look into
- The goal is to educate users about the important aspects

Written by
Dr Science Science
Updated 01.01.2024

Provider

Comparison Table Snapshot

PET	Provider-Jurisdiction	PET Feature	PET Feature	Devices	Free Trial	Price per month
	Product, trust				Price	
PET 1 * ★ 4,8 (1,002) More about PET 1 Review per product	PET Company-Italy	VPN: Number of server	PSE: Search results resource	Up to 5 device	Basic version	10 € p\m 7 €p\m group plan
PET 1 ★ 3,0 (300) Rating per product	Open source-Unknown	VPN: Number of server	PSE: Search results resource	Up to 7 device	7 days	10-20 € p\m
PET 1 ★ 1,5 (500) More about PET 1	PET Company-USA	VPN: Number of server	PSE: Search results resource	Up to 2 device	1 month	7-21 € p\m
PET 1 ★ 3,0 (30) More about PET 1	PET Company-Germany	VPN: Number of server	PSE: Search results resource	Up to 8 device	Basic version	10 € p\m

* PET1s are different products of one PET type, for example, different VPN products.

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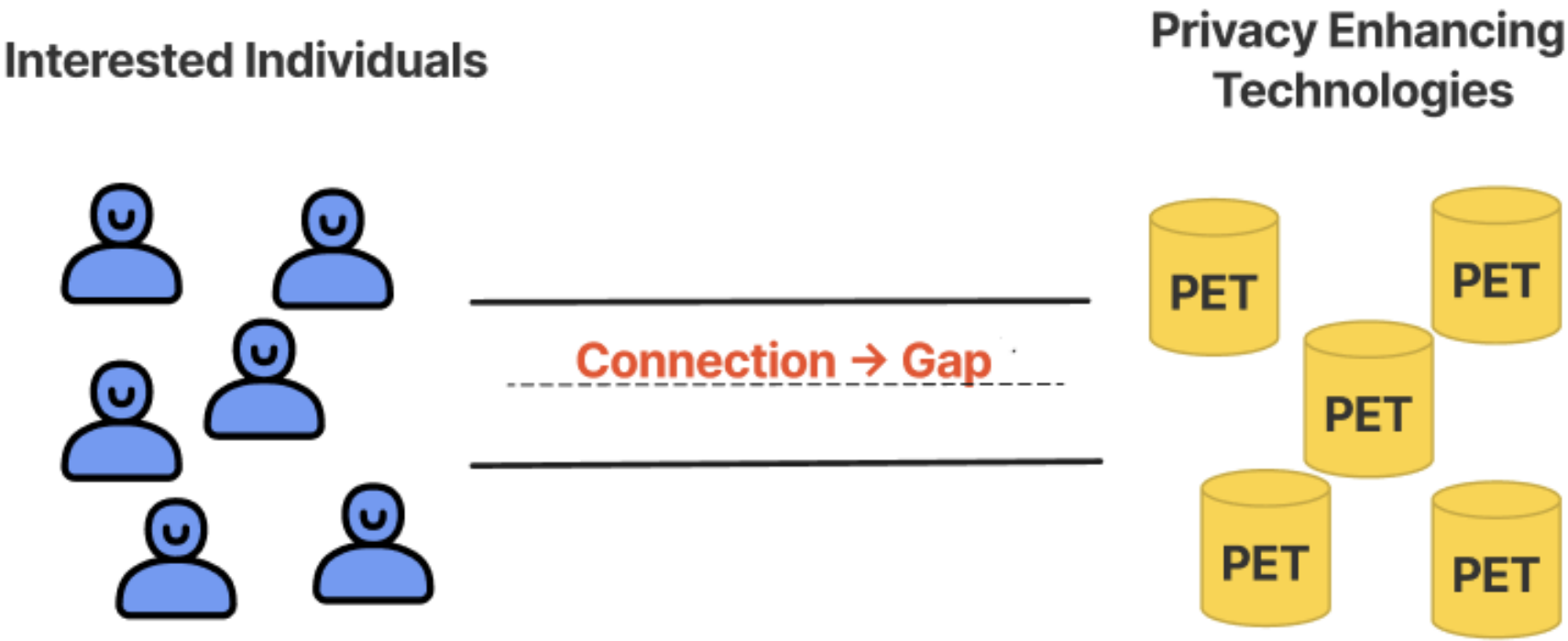
Back to the beginning



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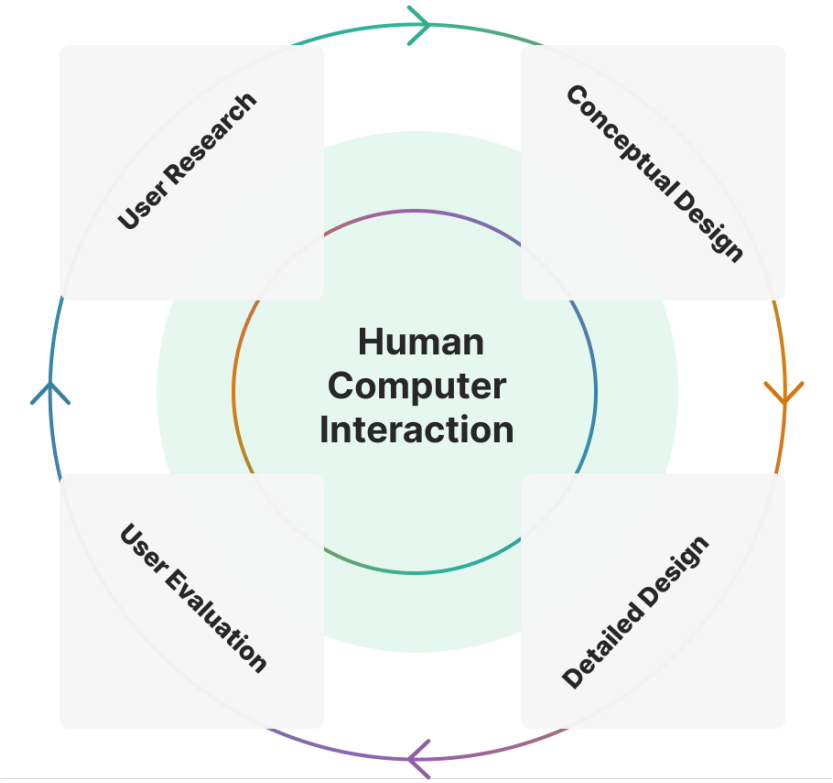
A Question!

Question!



Based on what we've learned together, **to which stage of the human-computer interaction cycle does this study belong?**

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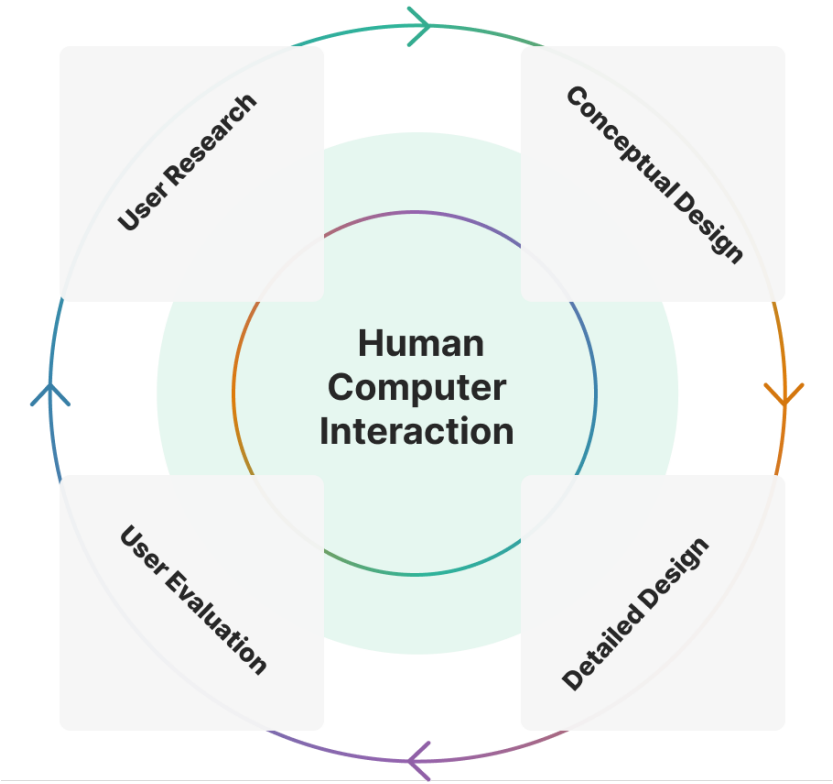
Question



I interviewed a group of privacy and security expert to learn how they might support citizens in enhancing their online privacy and making informed decisions.
To which stage of the human-computer interaction cycle does this study belong?

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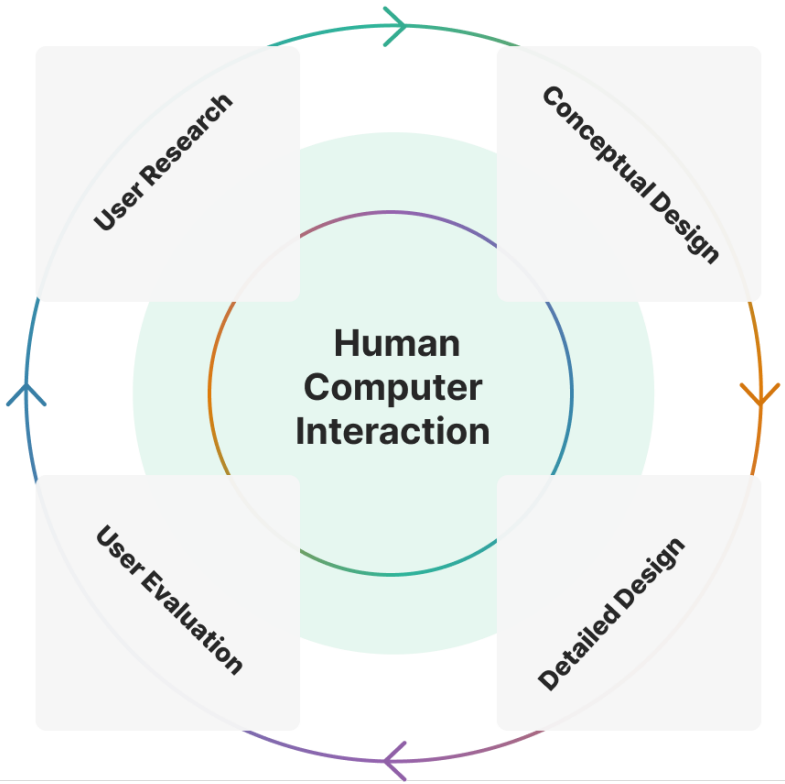
Question



I plan to recruit members of the general public to visit our lab and interact with various websites that promote PETs, aiming to study these interactions.
To which stage of the human-computer interaction cycle does this study belong?

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Feedback

Thanks For Your Attention

Comments and Questions Are Welcome

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Recommended Reading

[1] Ruba Abu-Salma et al. **"Obstacles to the Adoption of Secure Communication Tools".** In: Proc. IEEE Symposium on Security and Privacy. 2017.

[2] Hala Assal et al. **"What's the Deal With Privacy Apps? A Comprehensive Exploration of User Perception and Usability".** In: Proc. 14th International Conference on Mobile and Ubiquitous Multimedia. 2015.

[3] Zinaida Benenson, Anna Girard, and Ioannis Krontiris. **"User Acceptance Factors for Anonymous Credentials: An Empirical Investigation".** In: Proc. Workshop on the Economics of Information Security (WEIS). 2015.

[4] Zinaida Benenson et al. **"User Acceptance of Privacy-Abcs: An Exploratory Study".** In: Proc. 2nd Human Aspects of Information Security, Privacy, and Trust. 2014.

Recommended Reading

[5] Vanessa Bracamonte, Sebastian Pape, and Shinsaku Kiyomoto. **"Investigating User Intention to Use a Privacy Sensitive Information Detection Tool".** In: 2021.

[6] Franziska Brecht et al. **"Are You Willing to Wait Longer for Internet Privacy?"** In: 2011.

[7] Franziska Brecht et al. **"Communication Anonymizers: Personality, Internet Privacy Literacy and Their Influence on Technology Acceptance".** In: 2012.

[8] Johana Cabinakova, Christian Zimmermann, and Guenter Mueller. **"An Empirical Analysis of Privacy Dashboard Acceptance: The Google Case".** In: 2016.

[9] Sauvik Das et al. **"The Security & Privacy Acceptance Framework (SPAF)".** In: 2022.

[10] Alexander De Luca et al. **Expert and Non-expert Attitudes Towards (Secure) Instant Messaging** 2016.

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Recommended Reading

[11] Brian J Fogg. **"A Behavior Model for Persuasive Design".** In: Proc. 4th International Conference on Persuasive Technology. 2009.

[12] Intraction Design Foundation. **Intraction Design Foundation.** 2025. URL: https://www.interaction-design.org/.

[13] David Harborth and Sebastian Pape. **"Examining Technology Use Factors of Privacy-Enhancing Technologies: The Role of Perceived Anonymity and Trust".** In: 2018.

[14] David Harborth and Sebastian Pape. **"How Privacy Concerns and Trust and Risk Beliefs Influence Users' Intentions to Use Privacy-Enhancing Technologies-the Case of Tor".** In: 2019.

[15] David Harborth, Sebastian Pape, and Kai Rannenberg. **"Explaining the Technology Use Behavior of Privacy-Enhancing Technologies: The Case of Tor and Jondonym".** In: 2020.

Recommended Reading

[16] Franziska Herbert et al. **"A World Full of Privacy and Security (Mis) Conceptions? Findings of a Representative Survey in 12 Countries".** In: Proc. ACM Conference on Human Factors in Computing Systems (CHI). 2023.

[17] Věra Jourová. **"Keynote Speech by Commissioner Věra Jourová".** In: Proc. General Data Protection Regulation Conference. 2018.

[18] Ioannis Krontiris et al. **"Privacy-Abcs as a Case for Studying the Adoption of Pets by Users and Service Providers".** In: Proc. 3rd Privacy Technologies and Policy. 2016.

[19] Linda Naeun Lee et al. **"A Usability Evaluation of Tor Launcher".** In: 2017.

[20] Bin Liu et al. **"Follow My Recommendations: A Personalized Privacy Assistant for Mobile App Permissions".** In: Proc. 12th Symposium on Usable Privacy and Security (SOUPS). 2016.

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Recommended Reading

[21] Christian Matt and Philipp Peckelsen. **"Sweet Idleness, but Why? How Cognitive Factors and Personality Traits Affect Privacy-Protective Behavior".** In: Proc. 49th Hawaii International Conference on System Sciences (HICSS). 2016.

[22] Maryam Mehrnezhad, Kovila Coopamootoo, and Ehsan Toreini. **"How Can and Would People Protect From Online Tracking?"** In: 2022.

[23] Moses Namara et al. **"Emotional and Practical Considerations Towards the Adoption and Abandonment of VPNs as a Privacy-Enhancing Technology".** In: 2020.

[24] Erica Racine et al. **"What Are Pets for Privacy Experts and Non-experts".** In: Proc. Symposium on Usable Privacy and Security. 2020.

[25] Joseph Reagle and Lorrie Faith Cranor. **"The Platform for Privacy Preferences".** In: 1999.

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Recommended Reading

[26] Karen Renaud, Melanie Volkamer, and Arne Renkema-Padmos. **"Why Doesn't Jane Protect Her Privacy?"** In: Proc. 14th International Symposium om Privacy Enhancing Technologies. 2014.

[27] Shirin Shams, Sebastian Reinke, and Delphine Reinhardt. **"Left Alone Facing a Difficult Choice: An Expert Analysis of Websites Promoting Selected Privacy-Enhancing Technologies".** In: Proceedings of the 29th Nordic Conference on Secure IT Systems (NordSec). 2024.

[28] Helen Sharp, Jennifer Preece, and Yvonne Rogers. **Interaction Design: Beyond Human-Computer Interaction.** 5th. Hoboken, NJ: John Wiley & Sons, 2019. ISBN: 9781119547316.

[29] Peter Story et al. **"Awareness, Adoption, and Misconceptions of Web Privacy Tools".** In: 2021.

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