



Hoorcollege 10

Online onderzoek & geautomatiseerd data verzamelen

Jeroen Ooge

(Credits: gebaseerd op slides Christof Van Nimwegen, Imke de Jong)



Waar zitten we in de cursus?

Methodes voor (vooral) usability engineering

HC 1: Introductie usability engineering & UX
HC 2: Usability testing & inspection
HC 3: Performance & self-reported metrics

Methodes voor (vooral) user experience

HC 4: UX & working with human participants
HC 5: Surveys & interviews
HC 6: Focus groups & diary studies
HC 7: Ethnography & case studies
HC 9: Experiments

Methodes voor dataverzameling in UX-onderzoek

HC 10: Automated data collection & online research
HC 11: Ubiquitous research & measuring the human

Opbouw van dit hoorcollege

Deel 1: online onderzoek

Deel 2: geautomatiseerd data verzamelen

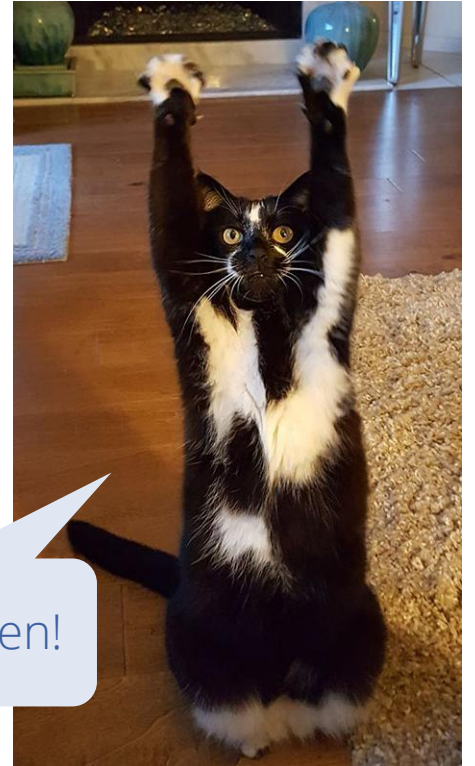
Deel 3: geautomatiseerd UEUX-onderzoek

Literatuur:

Lazar et al.: H10, H12, H14

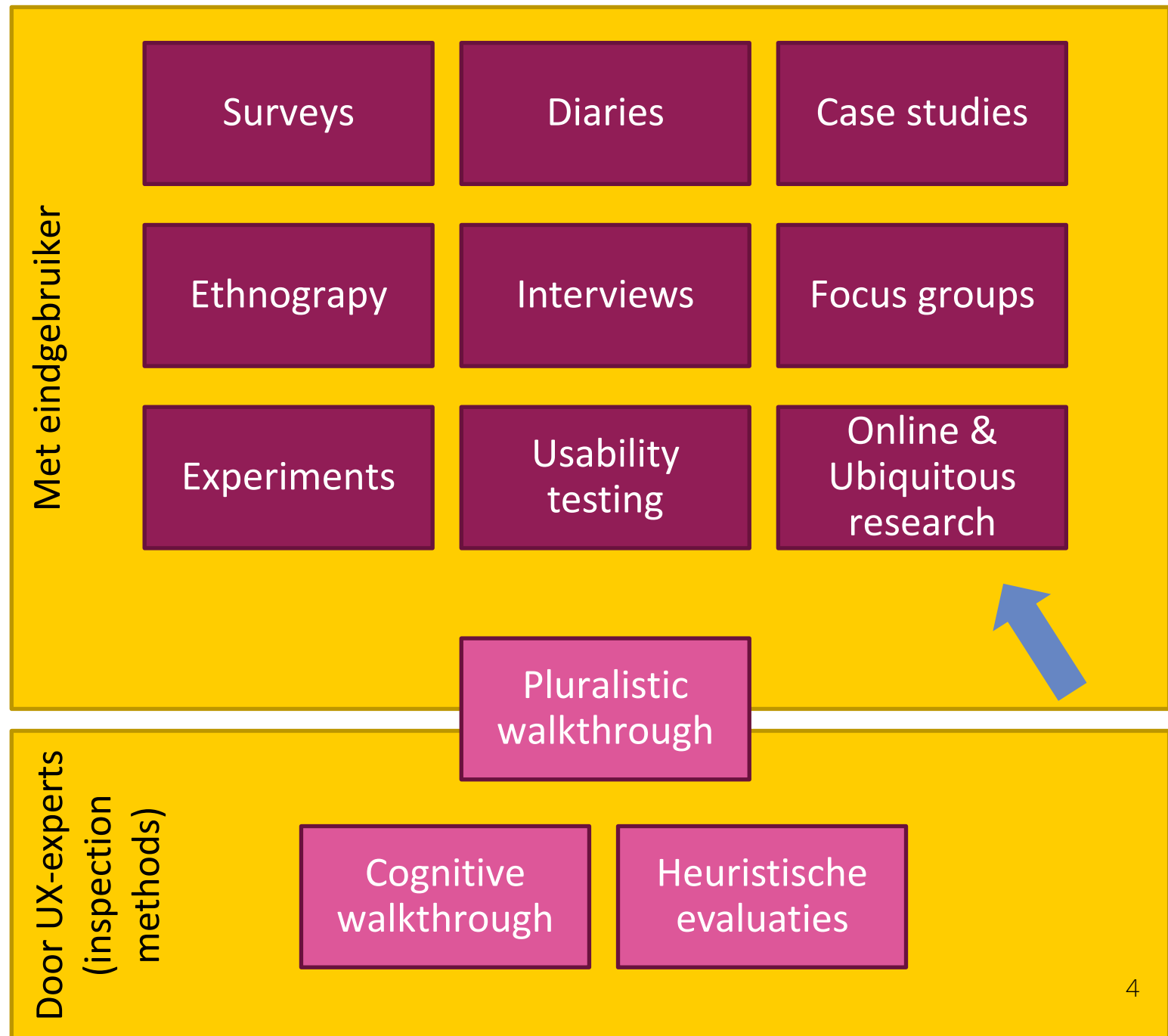
 *Column Jie Li*

Stel vrrrragen!



Methoden in dit vak

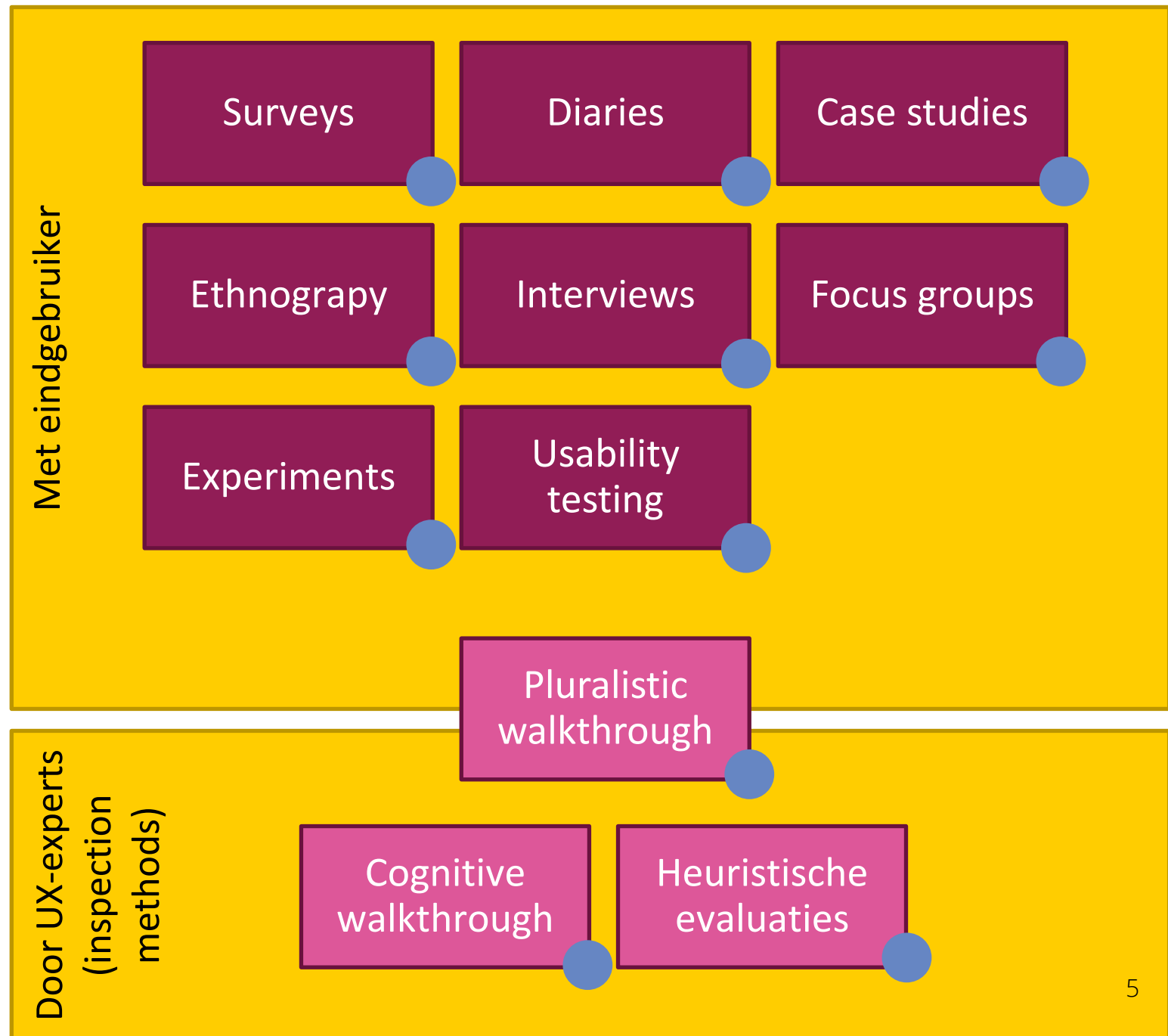
zie hoorcollege 1



Methoden in dit vak

zie hoorcollege 1

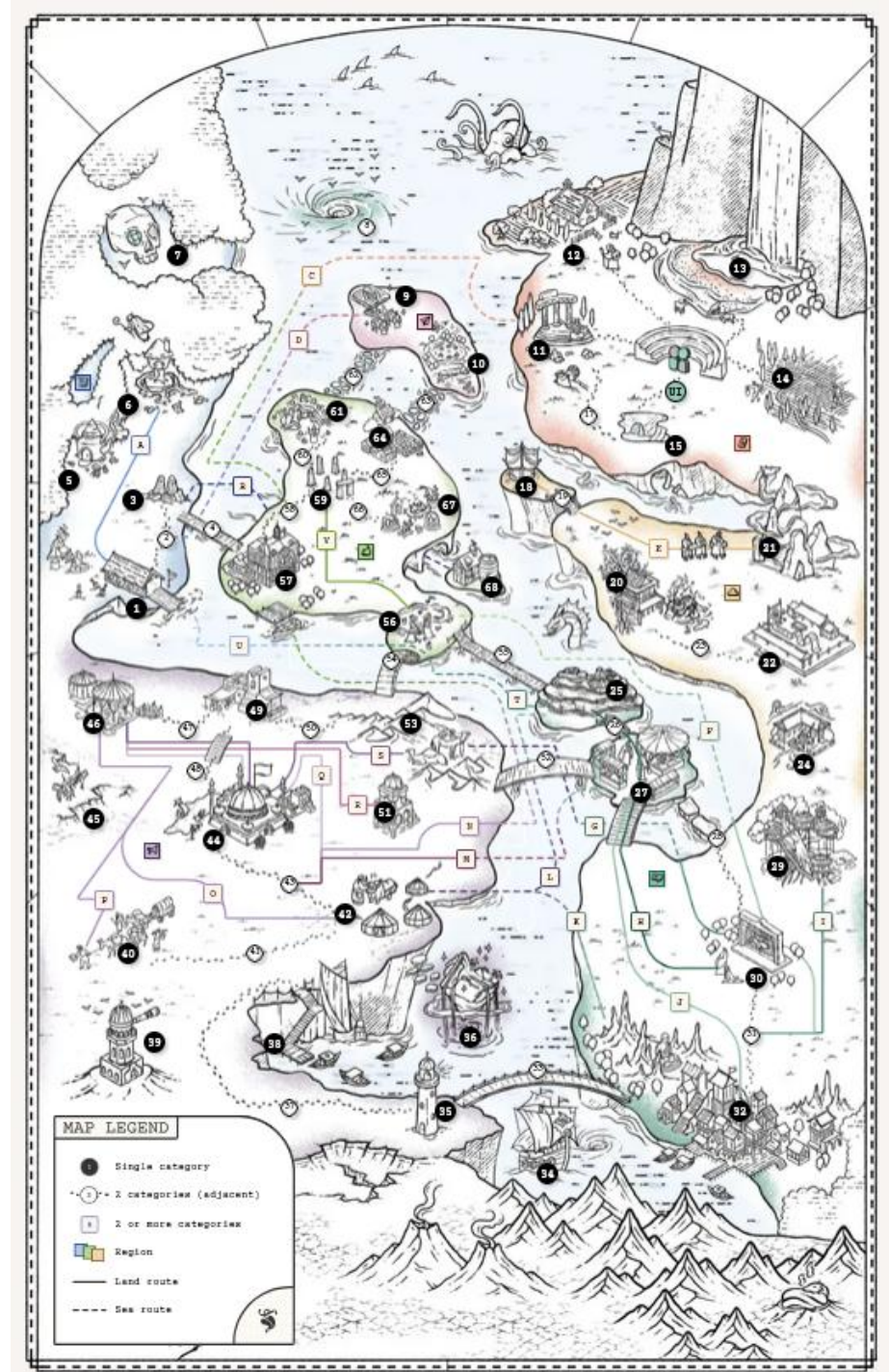
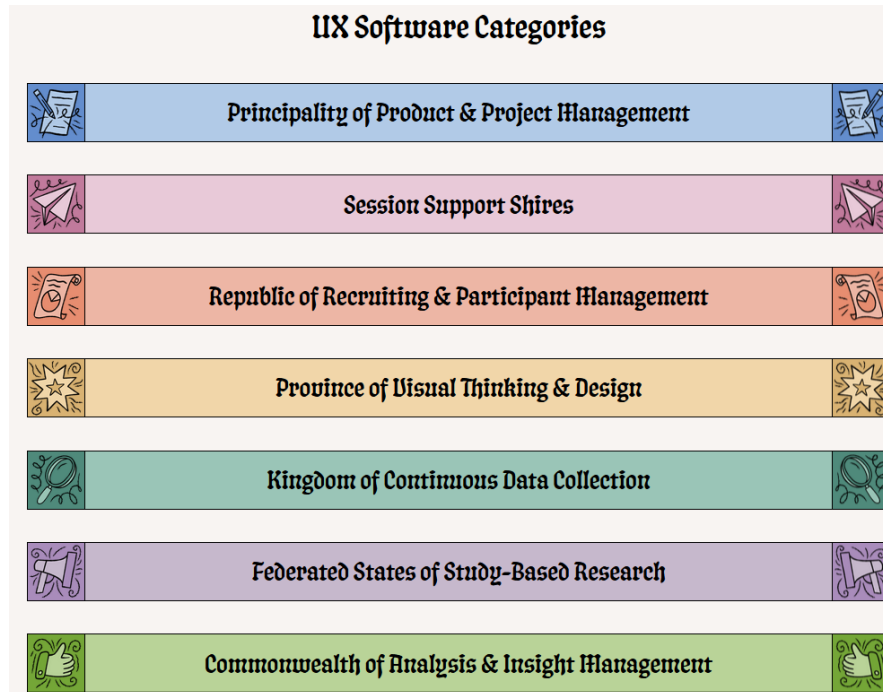
Mogelijkheid voor online
& ubiquitous research ●

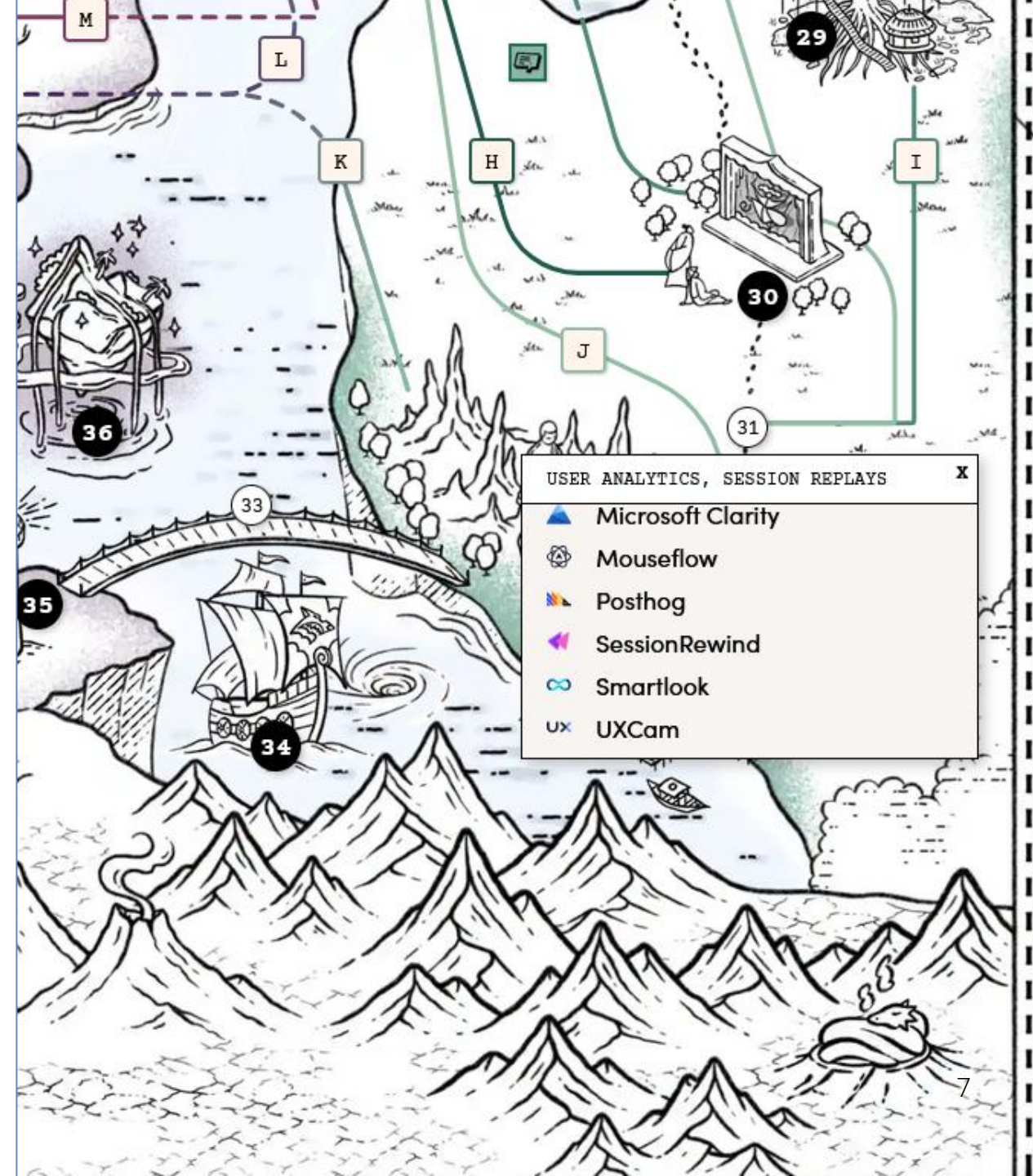
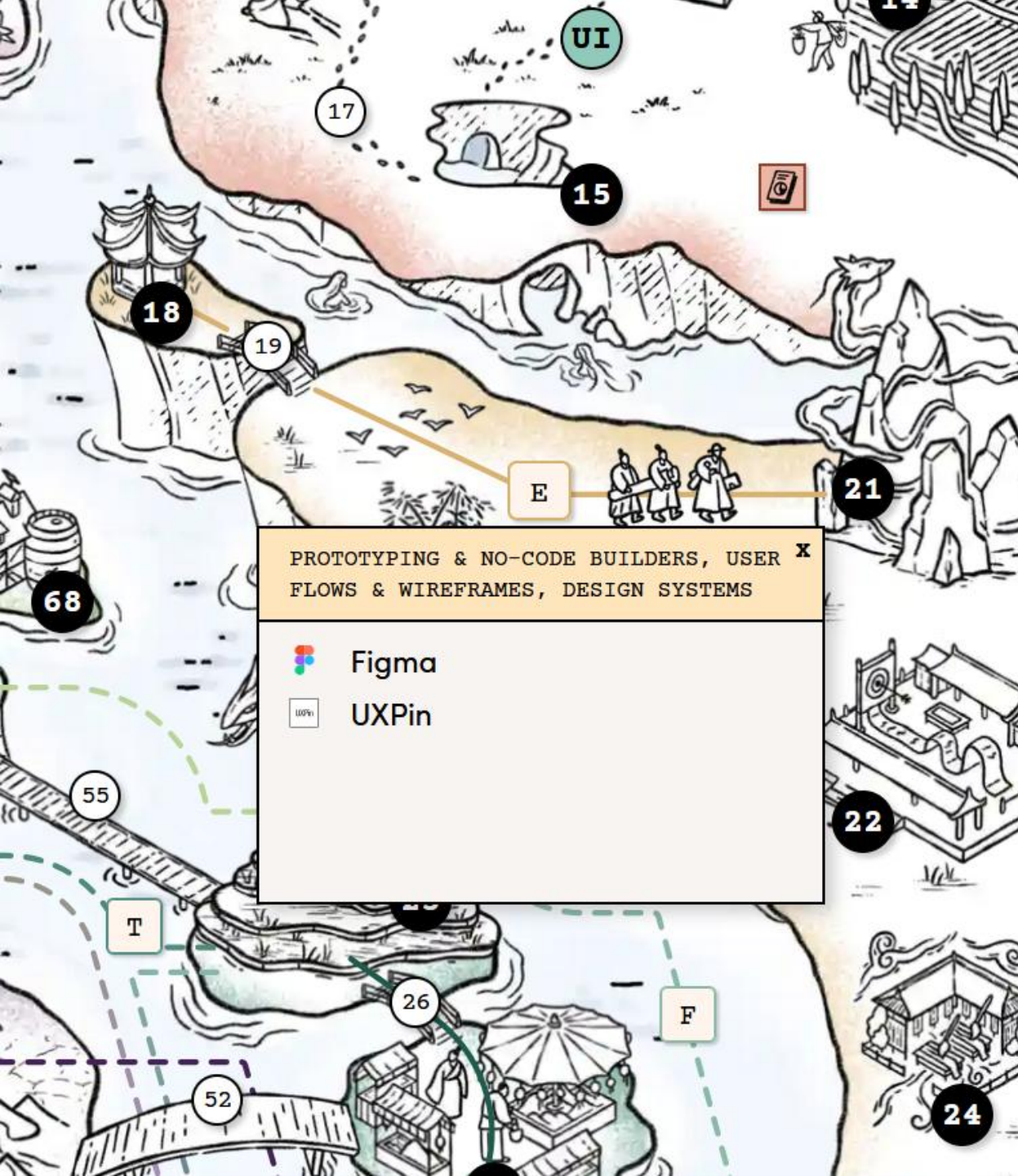


Er bestaan erg veel tools voor online UX-onderzoek

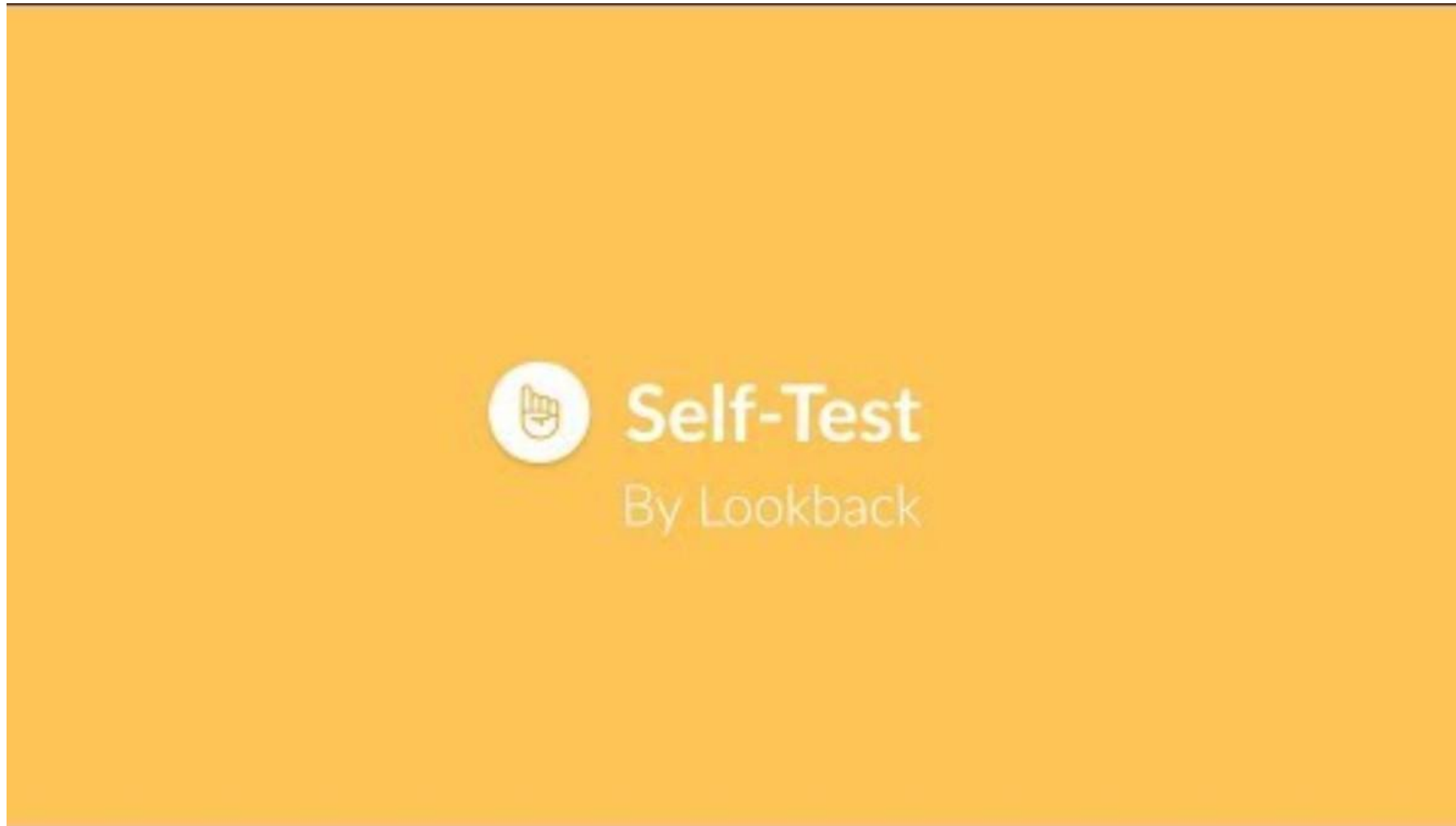
vb. The UX Tools Map omvat 800+ tools:

<https://www.userinterviews.com/ux-research-tools-map>





Online onderzoek zonder moderator



Voor- en nadelen van online onderzoek zonder moderator

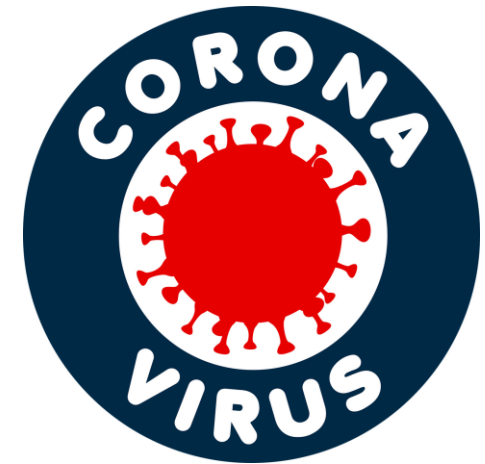
- Deelnemers kunnen minder gefocust zijn
 - Geen hulp bij technische problemen
 - Vervolg vragen stellen is onmogelijk
 - Deelnemers beantwoorden minder vragen
-
- Goedkoper en sneller uit te voeren
 - Timide deelnemers voelen zich comfortabeler



<https://www.youtube.com/watch?v=fbTKAHiWtFw>

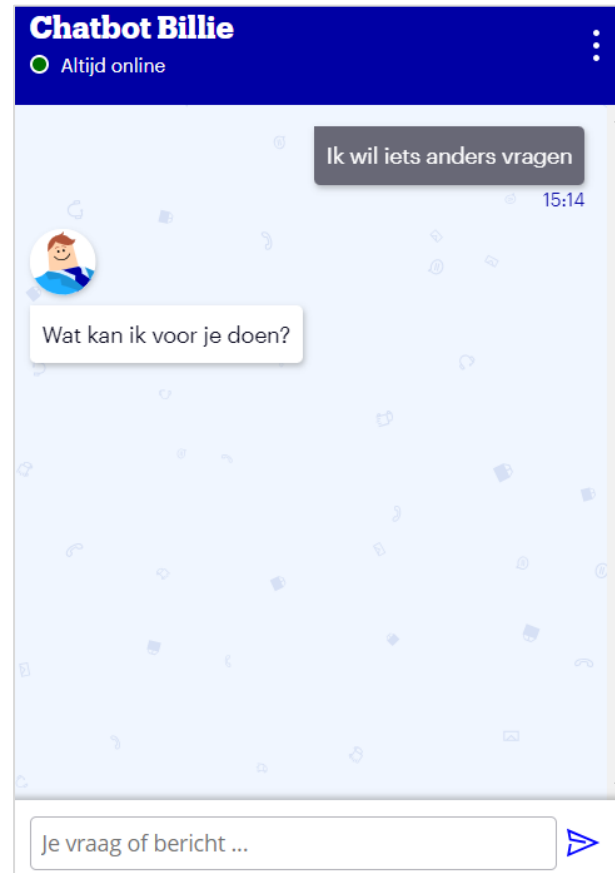
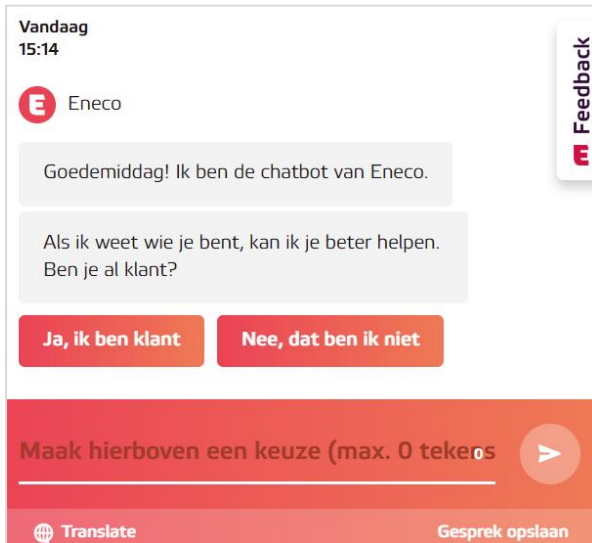
Khayyatkhooshnevis, P. et al. (2022). Comparison of Moderated and Unmoderated Remote Usability Sessions for Web-Based Simulation Software: A Randomized Controlled Trial. https://doi.org/10.1007/978-3-031-05311-5_16

Wanneer doe je UX-onderzoek in persoon en wanneer online?



Wanneer doe je UX-onderzoek in persoon en wanneer online?

← *waarschijnlijk online*



waarschijnlijk in persoon →



Uitdagingen bij online onderzoek

- Typisch weinig of onvolledige respons
- Denk na over wat je meet (bv. tijd is niet altijd gepast)
- Check of de data aan kwaliteitseisen voldoet (bv. controlevraag om aandacht te testen)

Tip: Doe kleine offline studies om resultaten te bevestigen

Opbouw van dit hoorcollege

Deel 1: online onderzoek

Deel 2: geautomatiseerd data verzamelen

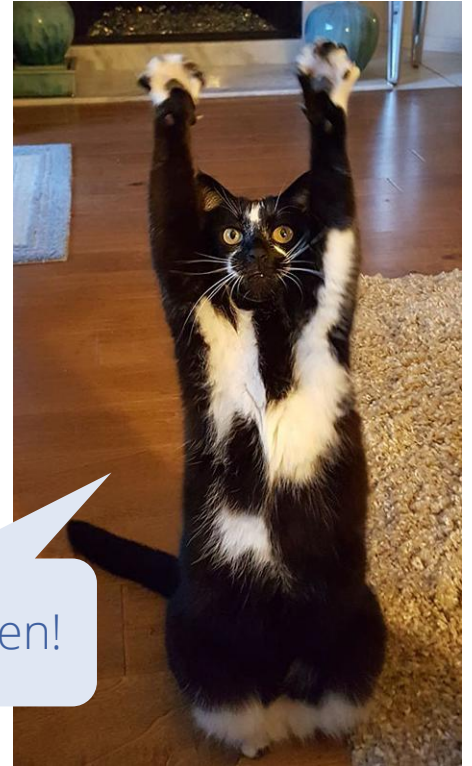
Deel 3: geautomatiseerd UEUX-onderzoek

Literatuur:

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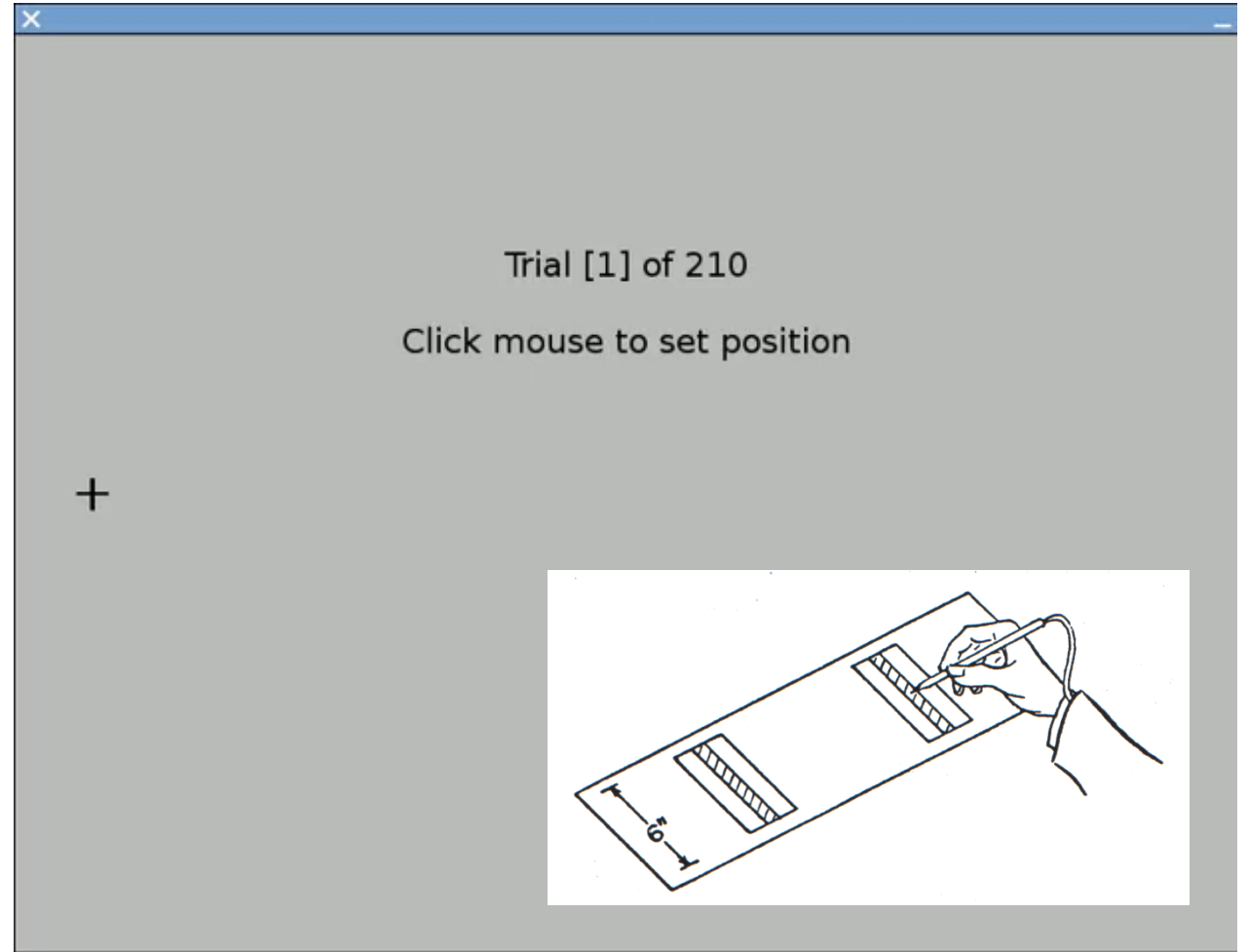
 *Column Jie Li*

Stel vrrrragen!

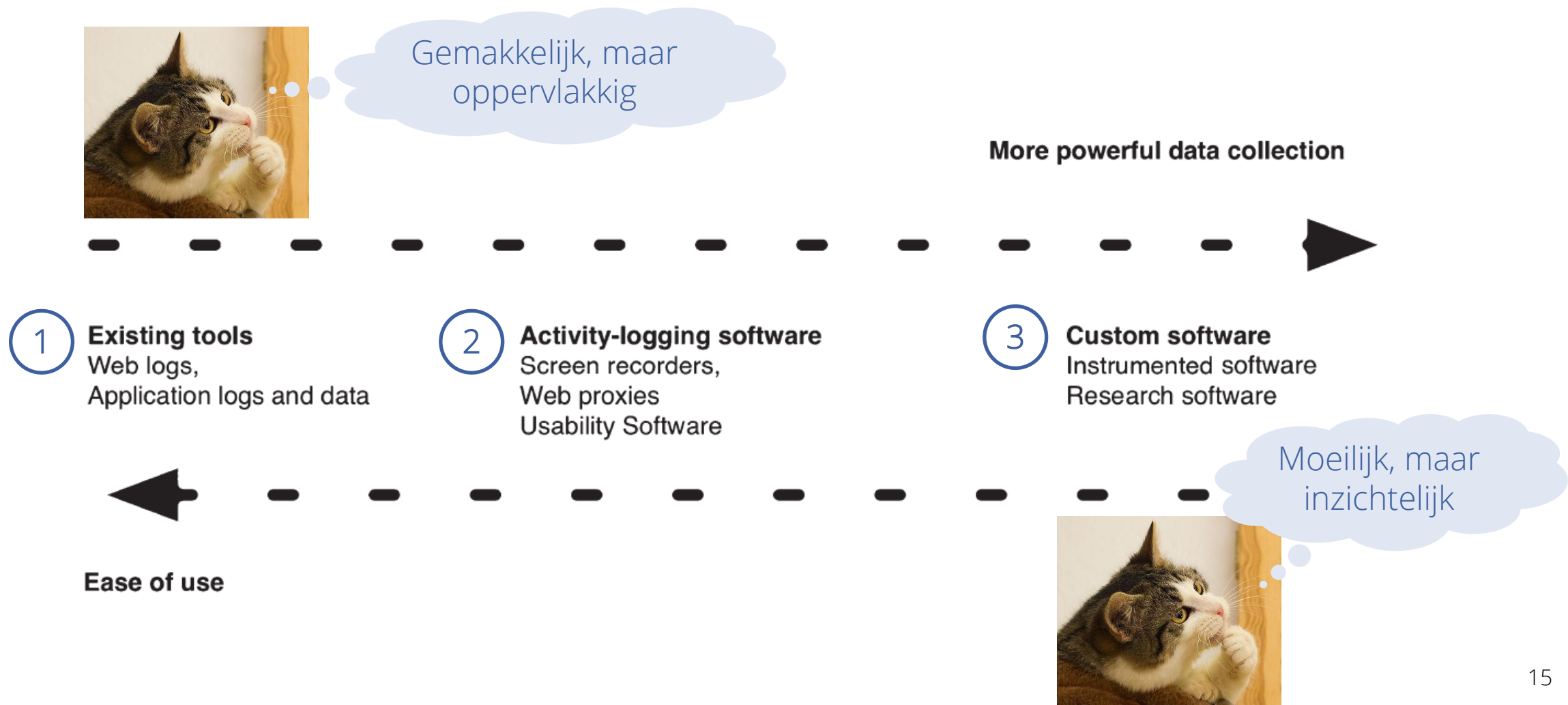


Waarom geautomatiseerd data verzamelen in UX-onderzoek?

- Gedetailleerd meten van interacties in natuurlijke omgevingen
- Manueel verzamelde data kan inconsistent zijn (bv. de reactiesnelheid van onderzoekers vertekent tijdsmetingen)



Afwegingen bij geautomatiseerd data verzamelen



Manieren om geautomatiseerd data te verzamelen



Gemakkelijk, maar oppervlakkig

More powerful data collection

1 **Existing tools**
Web logs,
Application logs and data

2 **Activity-logging software**
Screen recorders,
Web proxies
Usability Software

3 **Custom software**
Instrumented software
Research software

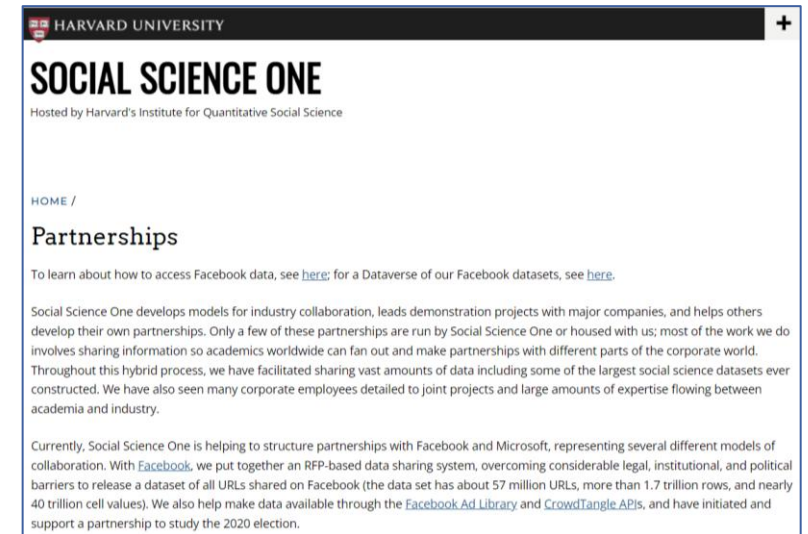
Ease of use

Bestaande software: data opgeslagen in applicaties

Mensen laten sporen na over hoe ze applicaties gebruiken, bv. informatie organiseren:

- Mappenstructuren
- Indeling van het bureaublad
- E-mailprogramma's
- Favoriete websites

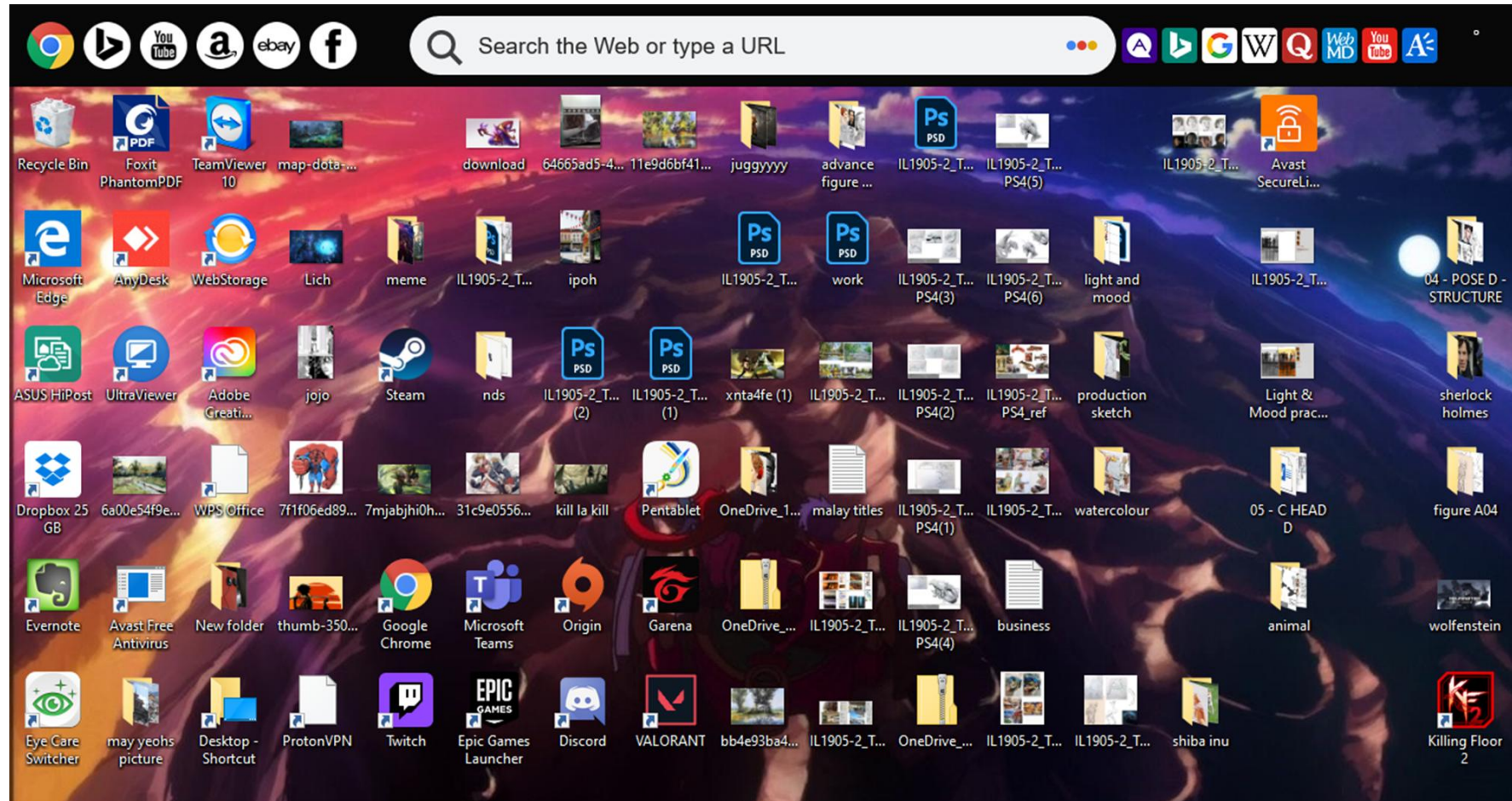
Data over gebruik van sociale media



Vb. het bureaublad van Jeroen



Vb. het bureaublad van iemand anders



Bestaande software: logbestanden

Alle acties die personen uitvoeren in een applicatie worden opgeslagen:

- UID
- Timestamp
- Uitgevoerde actie
- Foutmeldingen
- Gebruikte browser
- ...

```
- <Trial number="2" circular="false" metronome="false" completed="true" practice="true"
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Height=864}" MT="-1" A="256" W="64" axis="180" angle="177.2935" ae_1d="275" dx_1d="9"
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Y=0,0527516195664718}" taskAxisCrossings="1" movementDirectionChanges="1"
orthogonalDirectionChanges="0" movementVariability="5.5117" movementError="7.9352"
movementOffset="-7.7614">
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<move index="8" point="{X=760, Y=578, Time=1436}" />
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```

Microsoft Office Alerts				
Number of events: 1,491				
Level	Date and Time	Source	Event ID	Task Category
Information	1/5/2022 10:17:22 AM	Microsoft Office 16 Alerts	300	None
Information	1/5/2022 9:42:22 AM	Microsoft Office 16 Alerts	300	None
Information	1/4/2022 3:40:40 PM	Microsoft Office 16 Alerts	300	None
Information	1/3/2022 12:51:42 PM	Microsoft Office 16 Alerts	300	None
Information	1/3/2022 9:50:05 AM	Microsoft Office 16 Alerts	300	None
Information	1/3/2022 9:47:25 AM	Microsoft Office 16 Alerts	300	None
Information	12/20/2021 11:25:26 AM	Microsoft Office 16 Alerts	300	None
Information	12/16/2021 5:07:39 PM	Microsoft Office 16 Alerts	300	None
Information	12/16/2021 3:29:20 PM	Microsoft Office 16 Alerts	300	None
Information	12/16/2021 8:52:39 AM	Microsoft Office 16 Alerts	300	None
Information	12/15/2021 7:56:40 PM	Microsoft Office 16 Alerts	300	None
Information	12/15/2021 2:46:38 PM	Microsoft Office 16 Alerts	300	None
Information	12/15/2021 1:40:46 PM	Microsoft Office 16 Alerts	300	None
Information	12/15/2021 1:40:28 PM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 5:35:57 PM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 11:34:24 AM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 11:34:12 AM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 11:30:42 AM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 10:59:28 AM	Microsoft Office 16 Alerts	300	None
Information	12/14/2021 10:52:12 AM	Microsoft Office 16 Alerts	300	None

Event 300, Microsoft Office 16 Alerts	
General	Details
Microsoft Outlook We saved a draft of this message for you. Want to keep it? IP: 301434	

```
10.55.10.14 - - [13/Jul/2007:13:42:10 -0400] "GET /homepage/classes/spring07/686/index.html HTTP/1.1" 200 8623
10.55.10.14 - - [13/Jul/2007:13:48:32 -0400] "GET /homepage/classes/spring07/686/schedule.html HTTP/1.1" 200 16095
10.55.10.14 - - [13/Jul/2007:13:48:33 -0400] "GET /homepage/classes/spring07/686/readings.html HTTP/1.1" 200 14652
```

Vb. logbestanden op websites

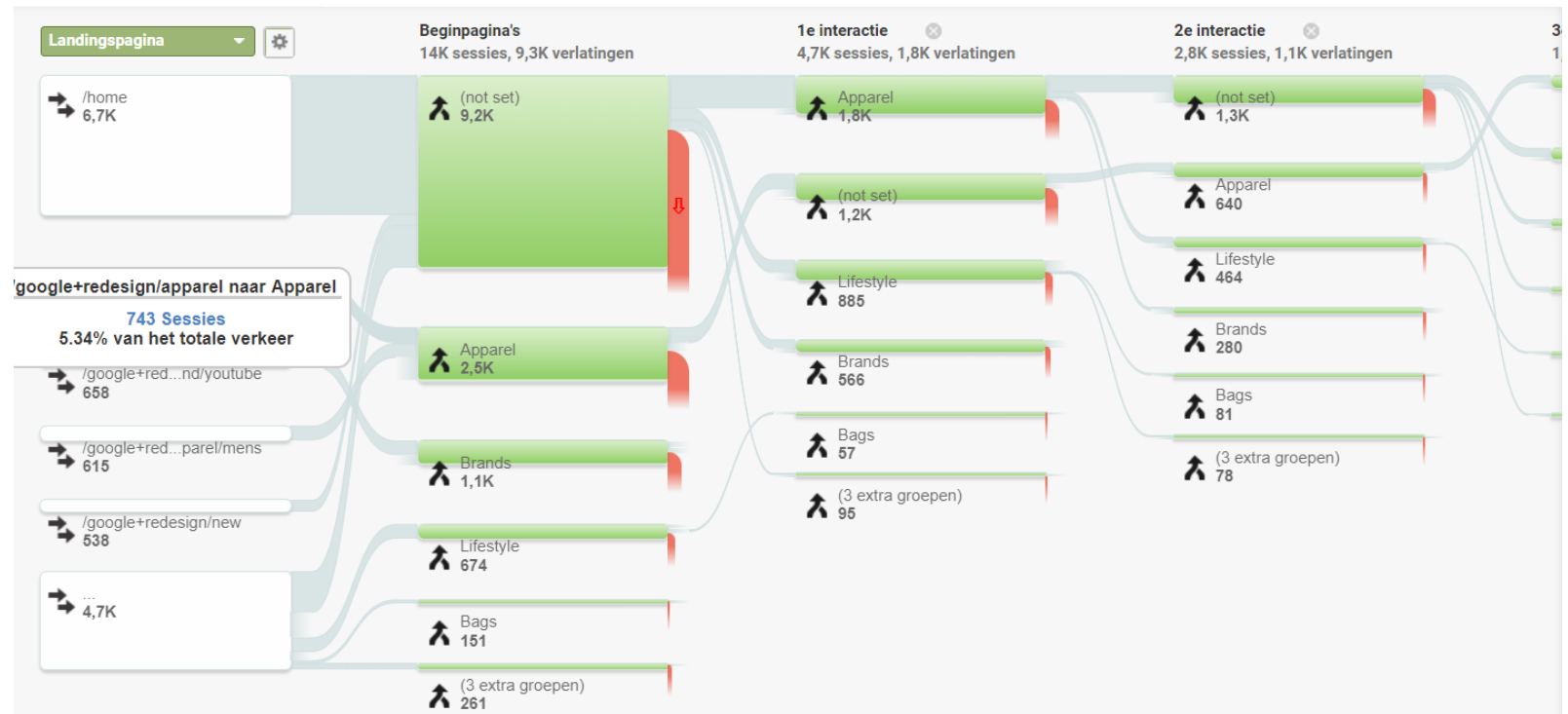
- Welke pagina's worden het vaakst bezocht?
- Waar haken bezoekers af? Bv. tijdens check-out
- Vanaf welke (externe) webpagina komen bezoekers?

Mogelijk usability-inzicht:
pagina's waar bezoekers problemen ondervinden

<https://neilpatel.com/blog/how-marketing-funnels-work>



Google Analytics



Bestaande software: uitdagingen

Beperkte inzichten zonder extra data:

- Je bent afhankelijk van wat standaard wordt gelogd
- Logbestanden kunnen “fout” zijn, vb. ander IP-adres bij VPN-gebruik, niet toestaan cookies ...

Privacyvraagstukken

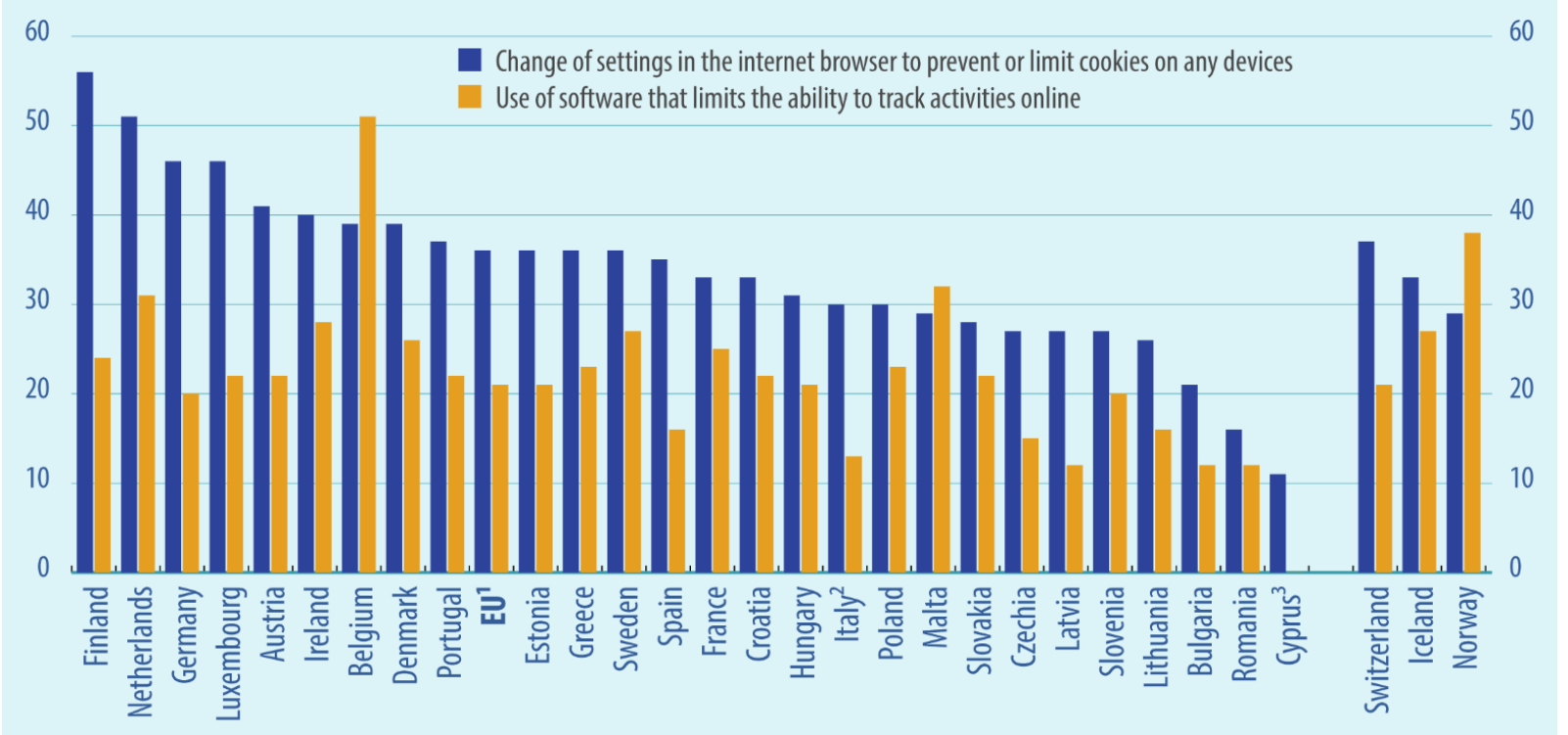
Bestaande software: cookies

Veel mensen blokkeren cookies, dus logbestanden kunnen incompleet zijn



Use of software to limit online tracking and browser settings to prevent or limit cookies, 2021

(% of individuals who used internet in the last 3 months)



¹EU aggregate: estimated

²2020 data

³2021 data for the use of software that limits the ability to track activities online is close to zero

ec.europa.eu/eurostat

Bestaande software: privacy

“Google Analytics is used by 83.7% of all the websites whose traffic analysis tool we know. This is 53.0% of all websites.”

<https://w3techs.com/technologies/details/ta-googleanalytics>



14 januari 2022 14:23

Laatste update: 46 minuten geleden

100 NUijj-reacties

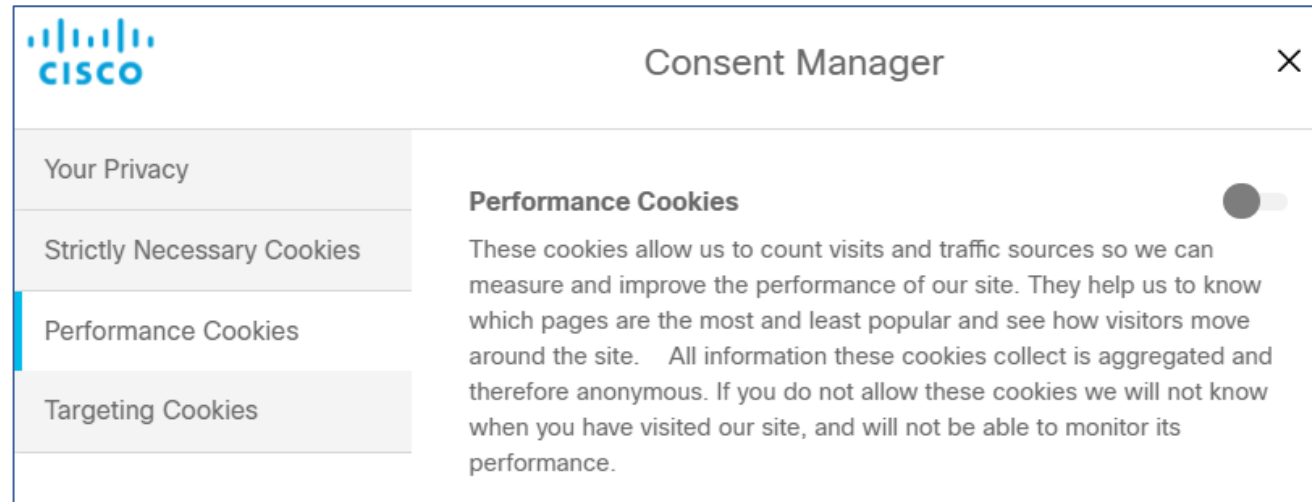
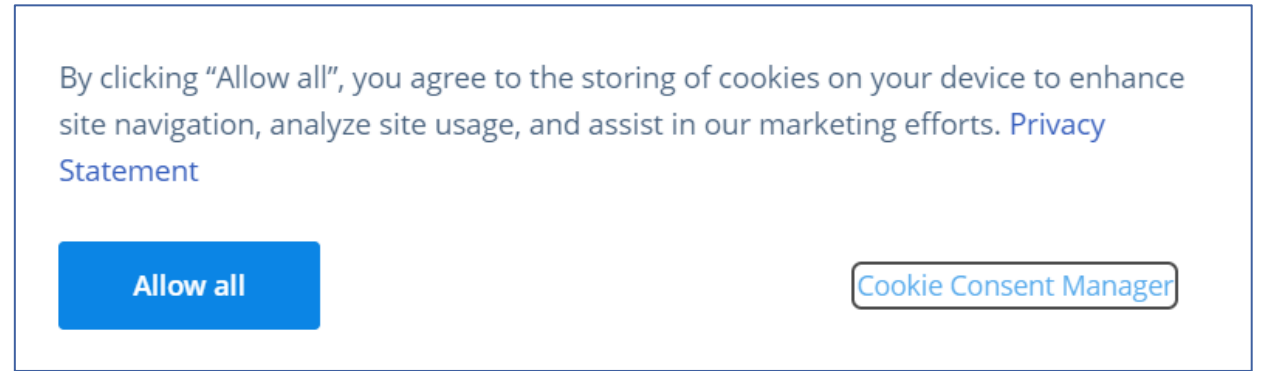


Google Analytics is binnenkort mogelijk niet meer toegestaan in Nederland, waarschuwt de Autoriteit Persoonsgegevens (AP) op zijn website. De toezichthouder zegt vrijdag tegen NU.nl op het moment onderzoek te doen naar twee klachten over het gebruik van de statistiekendienst van Google in Nederland.

<https://www.nu.nl/tech/6178229/google-analytics-binnenkort-mogelijk-niet-meer-toegestaan-wegens-privacywet.html>

Bestaande software: privacy

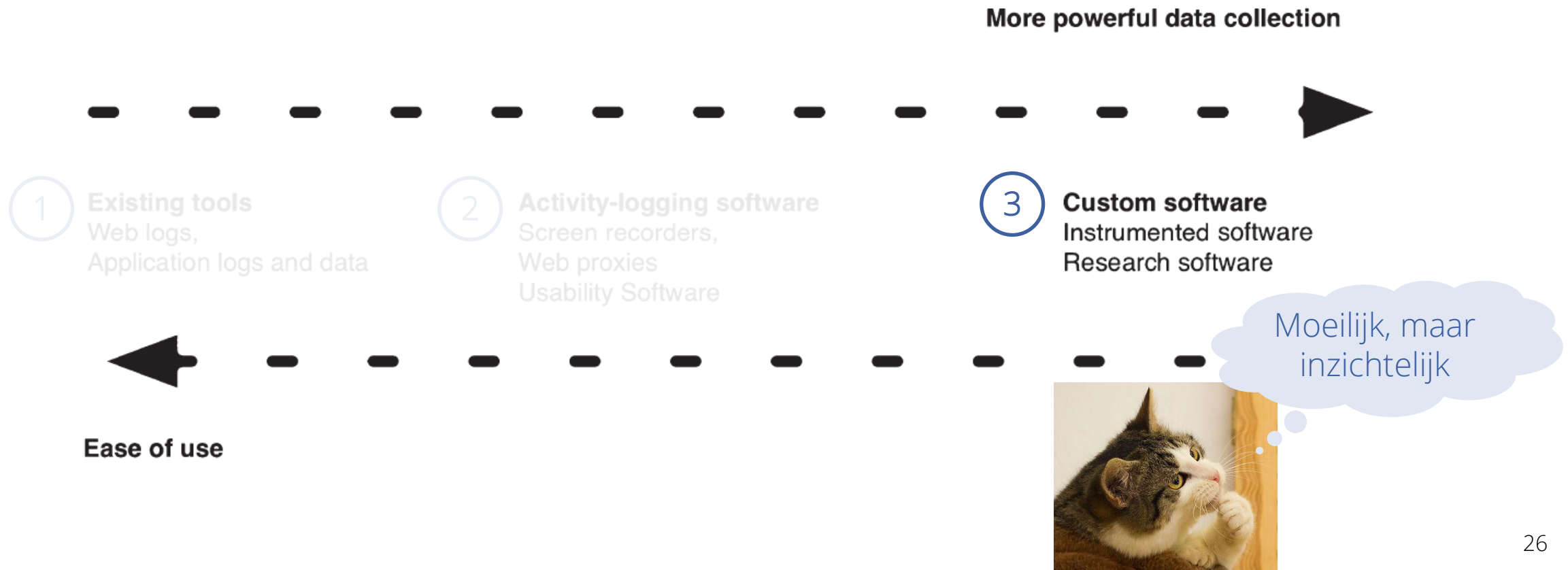
- Gebruik alleen logdata bij toestemming
- Verwijder logdata die individuele personen kan identificeren
- Bewaar logbestanden niet onnodig lang



Er rijzen vaak vragen bij de huidige aanpak om "toestemming" te geven



Manieren om geautomatiseerd data te verzamelen



Zelfgemaakte software

Instrumented software: loggingsoftware bouwen voor bestaande applicaties

Research software: applicaties met loggingfunctionaliteiten bouwen speciaal voor het onderzoek



Zelfgemaakte software: research software

Fitts Law Experiment

Participant ID

Device

Mouse

Trackpad

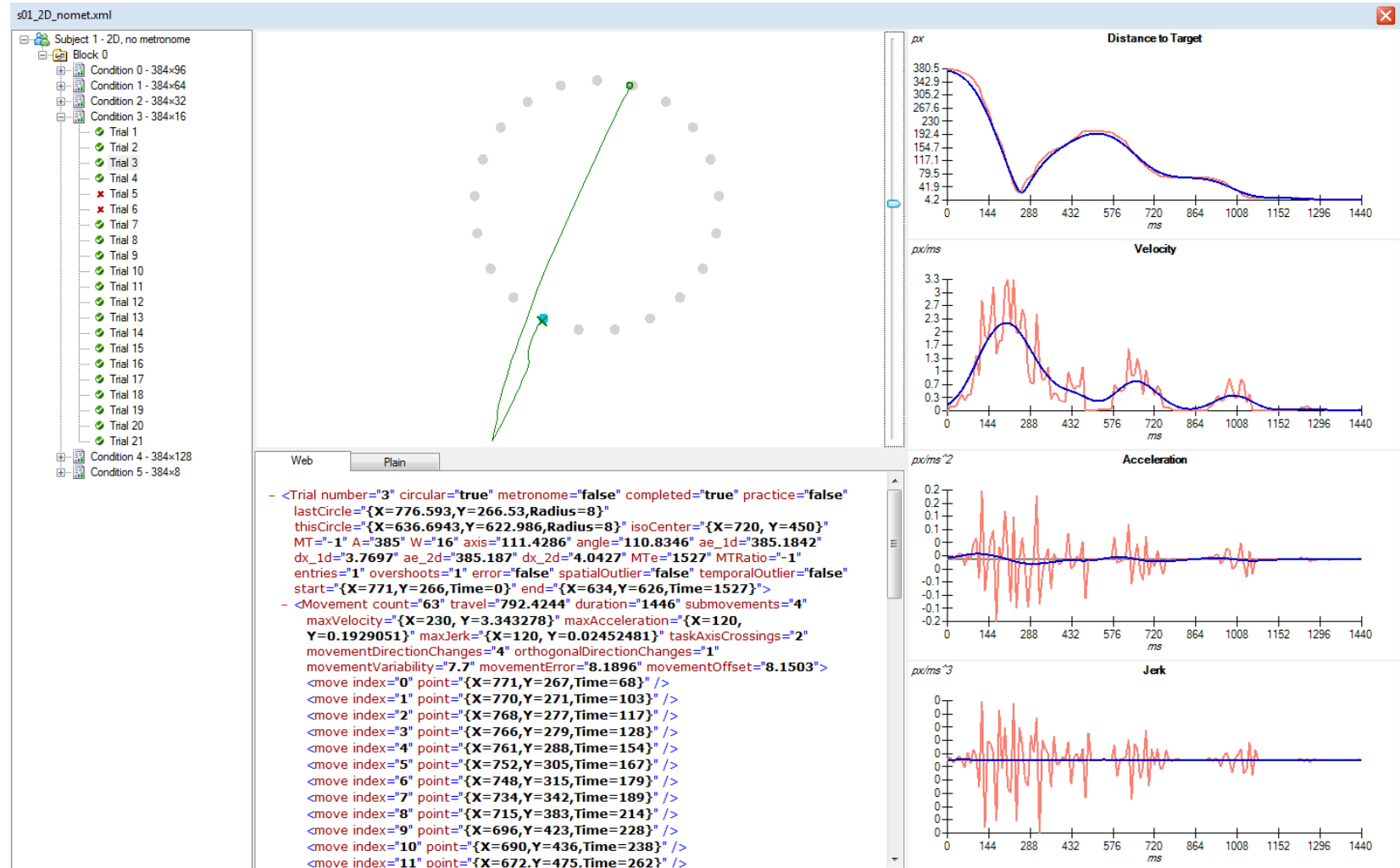
Touchscreen

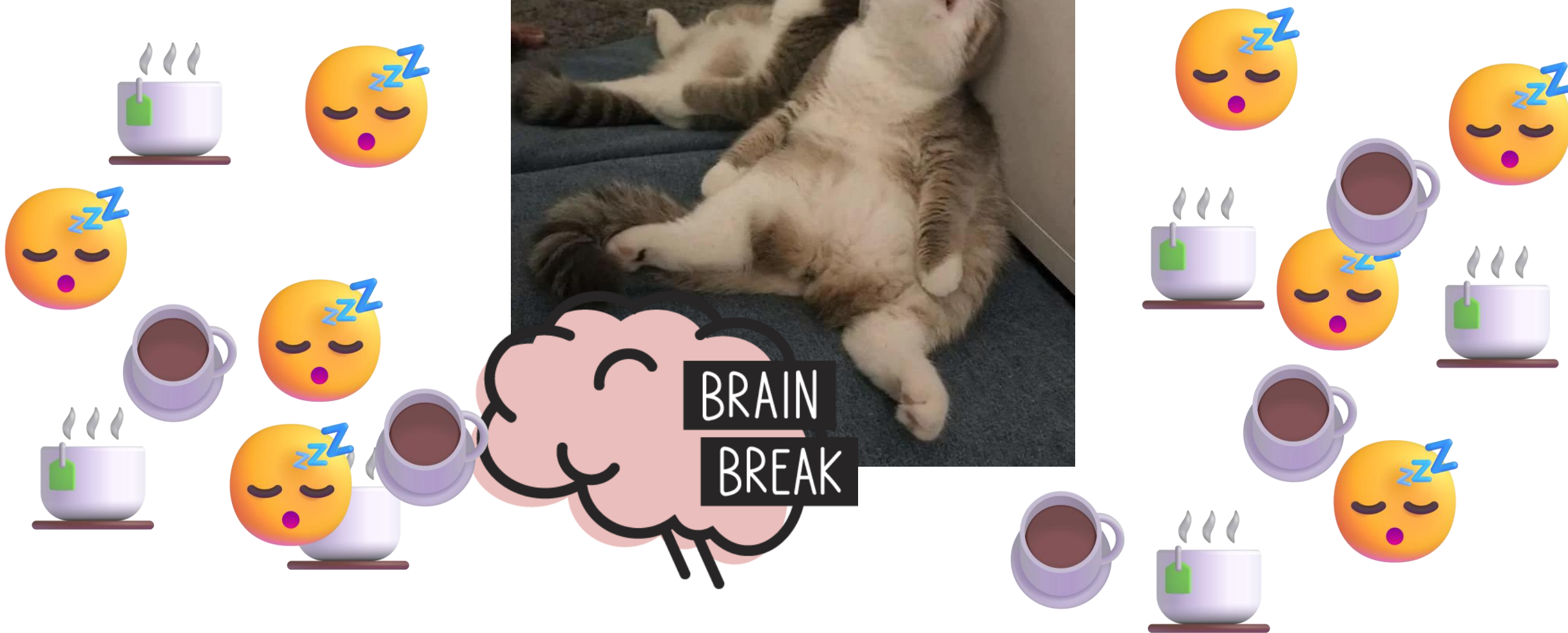
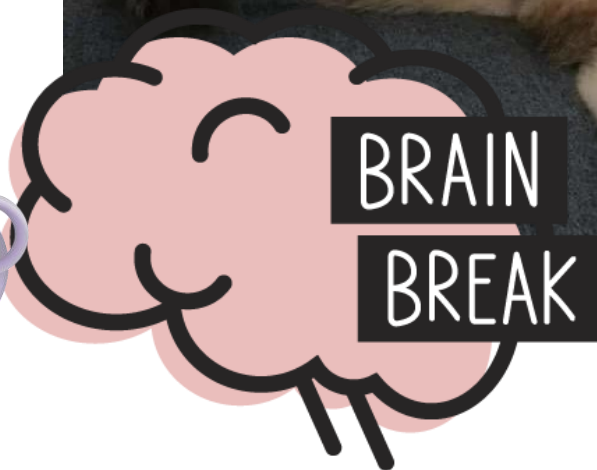
Widths: 20px, 40px, 60px

Amplitudes: 150px, 300px, 600px

Replication: 15

Continue





Manieren om geautomatiseerd data te verzamelen



Misschien is dit een goede consensus?

More powerful data collection

1 Existing tools
Web logs,
Application logs and data

2 Activity-logging software
Screen recorders,
Web proxies
Usability Software

3 Custom software
Instrumented software
Research software

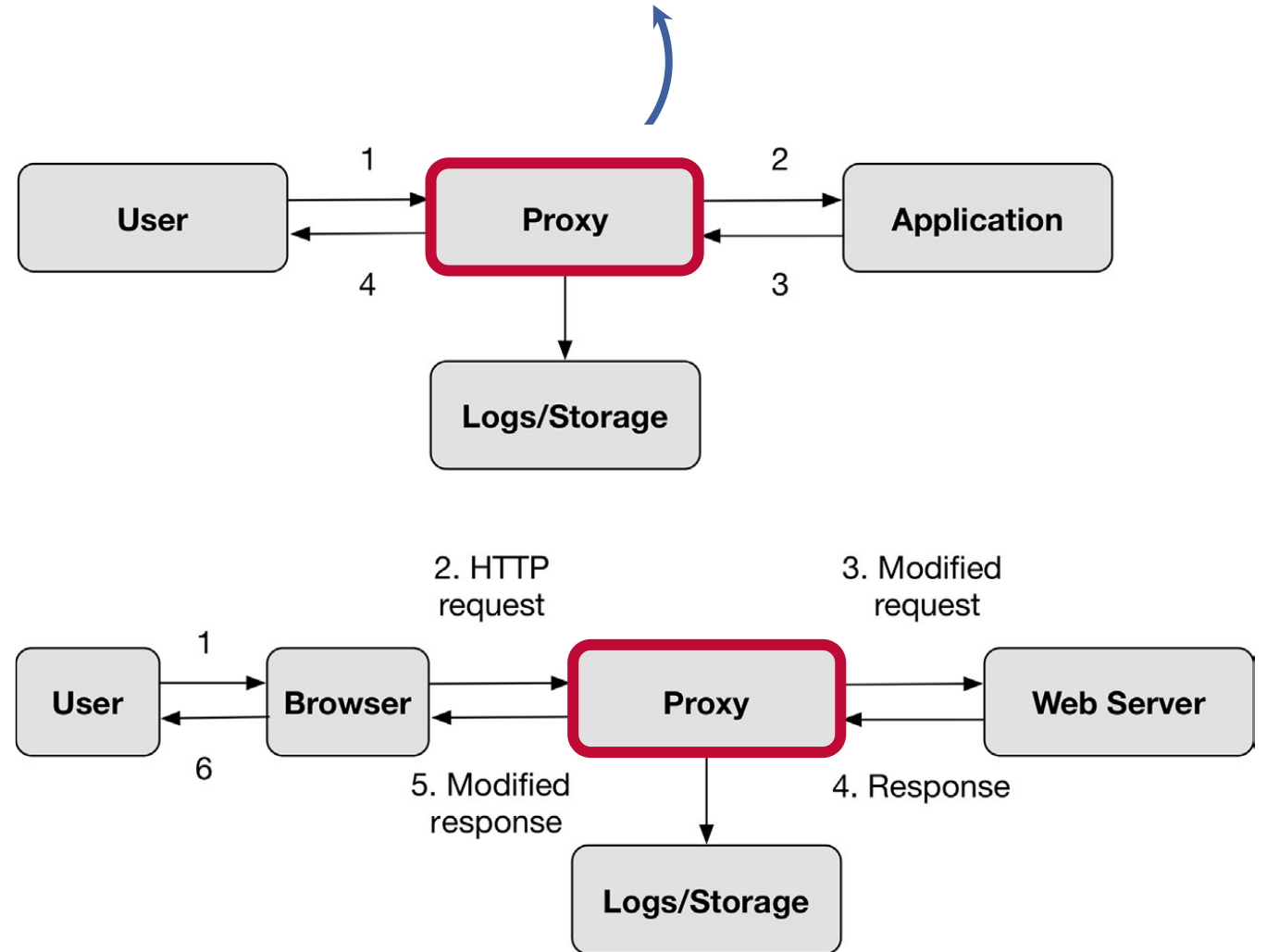
Ease of use

Software om activiteiten te loggen

Software die in meerdere applicaties gebruikt kan worden en acties logt zoals:

- toetsaanslagen
- muisklikken en –bewegingen
- overgang tussen programma's
- sluiten van vensters
- geluids- en beeldopnames
- ...

Een proxy onderschept acties van gebruikers om data te loggen



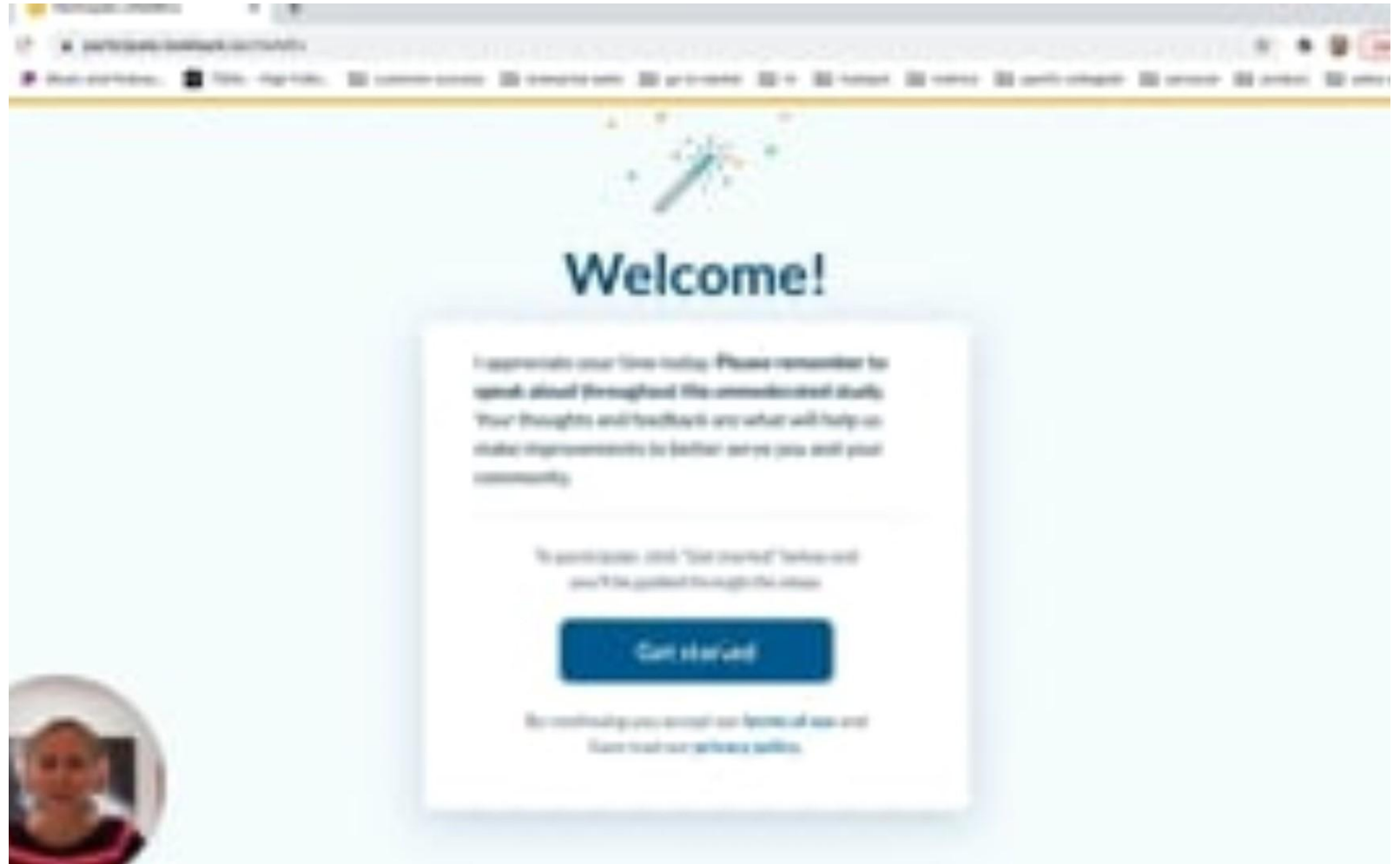
**Vb. software om
activiteiten in een
team te loggen**



Vb. software om activiteiten in studies te loggen

Niet alleen logbestanden, maar daadwerkelijk zien wat deelnemers doen

Nuttig voor asynchrone gebruikersstudies



Software om activiteiten te loggen: goed of slecht?

👁️ *Spyware*: activiteiten zoals toetsaanslagen registreren om data te stelen

😊 *Onderzoek*: vb. muisbewegingen van mensen met een fysieke beperking bestuderen om interfaces gebruiksvriendelijker te maken

Software legt soms restricties op om misbruik te vermijden

Restrictions are in place which will prevent you from allowing fields with potentially sensitive personal information. These fields will always be suppressed by the Hotjar script, even if they are allowed.

Keystroke data will **never** be recorded or sent to our servers and is **always** suppressed for:

- **Longer numbers, such as credit card and phone numbers:** If a user enters 9 or more digits in sequence, Hotjar assumes that this is a Credit Card or Phone number so the data is suppressed. Although credit card numbers can be detected through an algorithm, we purposely chose to use a more basic method since an algorithm could fail to suppress a credit card number with an accidental typo.
- **Email Addresses:** If a user enters what appears to be an email address, the data is suppressed.
- **Fields of a specific HTML Type:** Any fields using one of the following HTML types - password, email
- **Input fields with specific Names or IDs:** Any input fields with an HTML Name or ID attribute equal to one of the following - username, name, firstname, surname, lastname, familyname, fullname, email, phone, ,cell, cellphone, telephone, tel, postcode, postalcode, zip, zipcode, mobile, address, ssn, security, securitynum, socialsec, socialsecuritynumber, socsec, ppsn, nationalinsurancenum, nin, dob,dateofbirth, password, pass, adgangskode, authpw, contrasena, contrasenya, contrasinal, cyfrinair, contraseña, fjalëkalim, focalfaire, IP, creditcard, cc, ccnum, ccname, ccnumber, ccexpiry, ccexp, ccexpmonth, ccexpyear, cccvc, cccvv, cctype, cvc, cvv. For names and IDs, case and the symbols "-" and "_" are ignored.

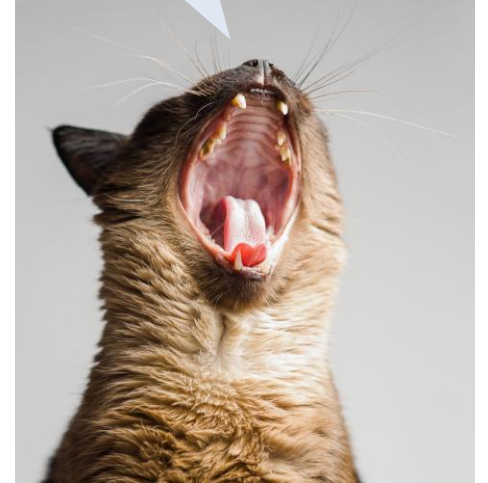
Manieren om geautomatiseerd data te verzamelen: hybride aanpak

Combineer verschillende soorten data, bv.:

- Logbestanden en video's
- Logbestanden en interviews

Krijg inzicht in *hoe* en *waarom* mensen bepaalde acties uitvoeren in applicaties

Triangulatie!



Voordat je data geautomatiseerd gaat verzamelen of gebruiken ...

Denk na over de fijnmazigheid van de te loggen data:

- *Hoge resolutie* = log alle “low-level” interacties
- *Lage resolutie* = log alleen bepaalde “high-level” interacties

Denk na over wat je nodig hebt, maar ook over wat je *niet* nodig hebt en log alleen waarin je geïnteresseerd bent

Hou steeds je **onderzoeksvraag** in gedachten

Voorbeeld: soms zijn grote hoeveelheden logdata niet erg nuttig

Verzamel alleen grote hoeveelheden data als dat nuttig is



30 mei 2020 11:21

Laatste update: 30 mei 2020 12:06



Europese wetenschappers zijn ontevreden over de data die Facebook aanlevert om te onderzoeken hoe nepnieuws zich op het sociale medium verspreidt, zeggen zij in gesprek met de [NOS](#).

Data opschonen:

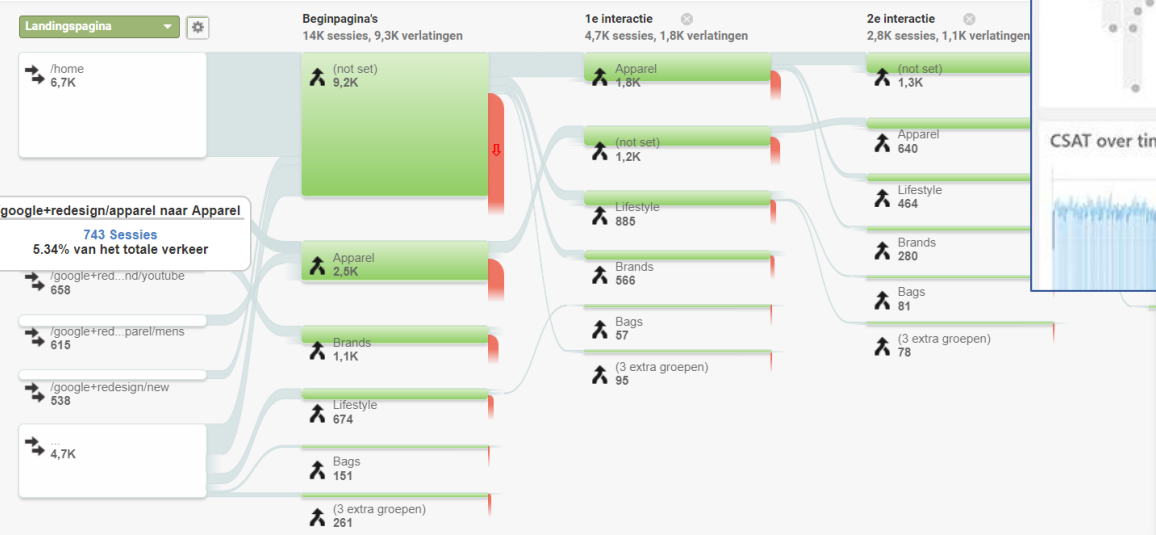
- Overbodige data en fouten verwijderen
- Ontbrekende data identificeren
- Data hercoderen

Parsing: data in logbestanden omzetten naar een formaat dat analysetools kunnen inlezen

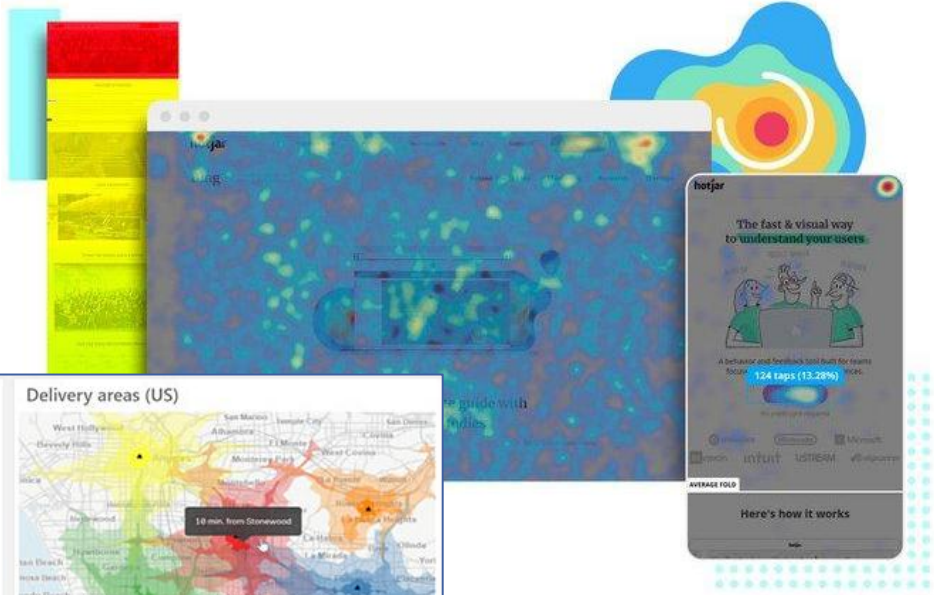
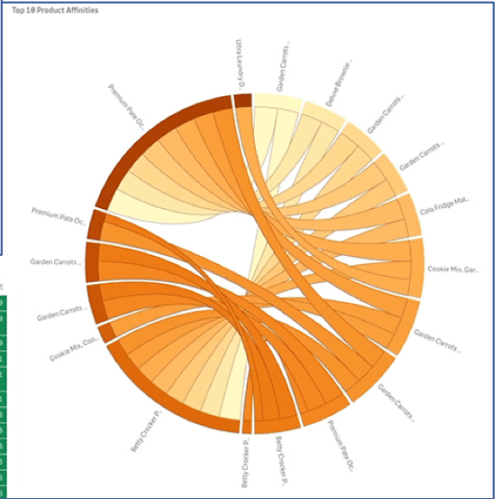


Logbestanden analyseren: visualisatie is belangrijk

Visual analytics: interactief complexe visualisaties van grote hoeveelheden data verkennen



Product Name	Q	antecedent	Q	consequent	Q	Support	Confidence	Lift
Cookie Mix	PRD0900215	PRD0900173	PRD0900129	PRD0900129	1,82%	0,47	6,40	6,40
Premium Pate Ocean Whitefish Recipe Cat Food	PRD0900215	PRD0900173	PRD0900129	PRD0900129	1,82%	0,47	6,40	6,40
Ultra Laundry Detergent	PRD0900215	PRD0900173	PRD0900129	PRD0900129	1,82%	0,47	6,40	6,40
Cookie Mix	PRD0900215	PRD0900173	PRD0900295	PRD0900295	1,82%	0,46	6,41	6,41
Premium Pate Ocean Whitefish Recipe Cat Food	PRD0900215	PRD0900173	PRD0900295	PRD0900295	1,82%	0,46	6,41	6,41
Ultra Laundry Detergent	PRD0900215	PRD0900173	PRD0900295	PRD0900295	1,82%	0,46	6,41	6,41
Cookie Mix	PRD0900215	PRD0900121	PRD0900295	PRD0900295	1,97%	0,45	6,16	6,16
Garden Carrots & Brown Rice	PRD0900215	PRD0900121	PRD0900295	PRD0900295	1,97%	0,45	6,16	6,16
Ultra Laundry Detergent	PRD0900215	PRD0900121	PRD0900295	PRD0900295	1,97%	0,45	6,16	6,16
Cookie Mix	PRD0900215	PRD0900121	PRD0900129	PRD0900129	1,97%	0,44	6,11	6,11
Garden Carrots & Brown Rice	PRD0900215	PRD0900121	PRD0900129	PRD0900129	1,97%	0,44	6,11	6,11
Ultra Laundry Detergent	PRD0900215	PRD0900121	PRD0900129	PRD0900129	1,97%	0,44	6,11	6,11



Waarom geen (of niet alleen) geautomatiseerd data verzamelen in UX-onderzoek?

- Soms onmogelijk als je bestaande applicaties onderzoekt
- Vaak weinig achtergrondinformatie over de data, vb. wat er gebeurde tijdens de interactie
- Opzet en analyse kan veel tijd kosten
- Privacyproblemen en uitdagingen bij de analyse

Opbouw van dit hoorcollege

Deel 1: online onderzoek

Deel 2: geautomatiseerd data verzamelen

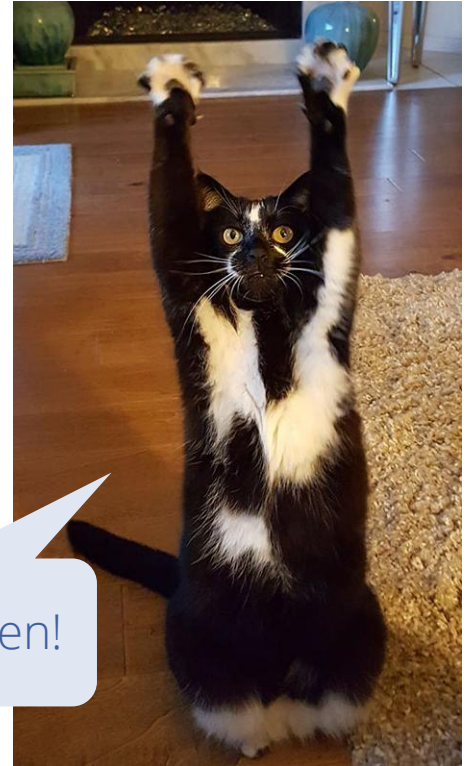
Deel 3: geautomatiseerd UEUX-onderzoek

Literatuur:

Lazar et al.: H10, H12, H14

 *Column Jie Li*

Stel vrrrragen!



Usability engineering

Algemene methode: testpersonen representatieve taken laten voltooien in representatieve contexten

- Usability inspection = interface-experten als testpersonen
- Usability testing = eindgebruikers als testpersonen
- Geautomatiseerde testen = geen testpersonen



Geautomatiseerd usability testen

Software evalueert zonder menselijke tussenkomst de usability van interfaces op basis van ontwerprichtlijnen die gebaseerd zijn op:

- Empirisch onderzoek
- Algemeen aanvaarde ontwerpprincipes
- Ervaring van usability-experten



Zie heuristische
evaluaties in
hoorcollege 2

Vb. geautomatiseerd toegankelijkheid testen

zie hoorcollege 2

*Web Content Accessibility
Guidelines voor websites*

How to Meet WCAG (Quick Reference)

A customizable quick reference to Web Content Accessibility Guidelines (WCAG) 2 requirements (success criteria) and techniques.

[Show About & How to Use](#)

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1.4.4 Resize Text

Selected Filters: **WCAG 2.1:** all success criteria and all techniques.

[Clear filters](#)

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Principle 1 – Perceivable

Information and user interface components must be presentable to users in ways they can perceive.

Guideline 1.1 – Text Alternatives

Provide text alternatives for any non-text content so that it can be changed into other forms people need, such as large print, braille, speech, symbols or simpler language.

1.1.1 Non-text Content — Level A

All non-text content that is presented to the user has a text alternative that serves the equivalent purpose, except for the situations listed below. [Show full description](#)

[Show techniques and failures for 1.1.1](#)

[Understanding 1.1.1](#)

[SHARE](#) | [BACK TO TOP](#)

Guideline 1.2 – Time-based Media

Provide alternatives for time-based media.

1.2.1 Audio-only and Video-only (Prerecorded) — Level A

For prerecorded audio-only and prerecorded video-only media, the following are true, except when the audio or video is a media alternative for text and is clearly labeled as such: [Show full description](#)

[Show techniques and failures for 1.2.1](#)

[Understanding 1.2.1](#)

[SHARE](#) | [BACK TO TOP](#)

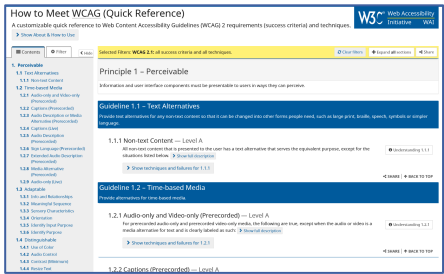
1.2.2 Captions (Prerecorded) — Level A

44

Vb. geautomatiseerd toegankelijkheid testen



rapport met
testresultaten



Resource: <http://jeroenooge.com> Date: 11/03/2024 15:34 Guidelines WCAG 2.1 Analysis level: AA Technologies: HTML, CSS

Operable

User interface components and navigation must be operable.

Guideline	Level	Result	Problems	Warnings	Not reviewed
2.1-Keyboard Accessible			0	1	2
2.1.1 - Keyboard	A	!		1	1
2.1.2 - No Keyboard Trap	A	?			1
2.2-Enough Time			0	0	1
2.2.1 - Timing Adjustable	A	?			1
2.2.2 - Pause, Stop, Hide	A	?			1
2.3-Seizures			0	0	1
2.3.1 - Three Flashes or Below Threshold	A	?			1
2.4-Navigable			0	5	4
2.4.1 - Bypass Blocks	A	?			1
2.4.2 - Page Titled	A	!		1	
2.4.3 - Focus Order	A	?			1
2.4.4 - Link Purpose (In Context)	A	✓			
2.4.5 - Multiple Ways	AA	?			1
2.4.6 - Headings and Labels	AA	!		4	
2.4.7 - Focus Visible	AA	?			1



0 Problems automatically detected
No automatic problems

A human review is needed regarding warnings and non-checked criteria in order to ensure an adequate accessibility level



16 Warnings
in 4 success criteria
A human review is necessary

- Perceivable 10
- Operable 6
- Understandable 0
- Robust 0



21 Not reviewed
in 21 success criteria
Fully manual review

- Perceivable 7
- Operable 8
- Understandable 5
- Robust 1

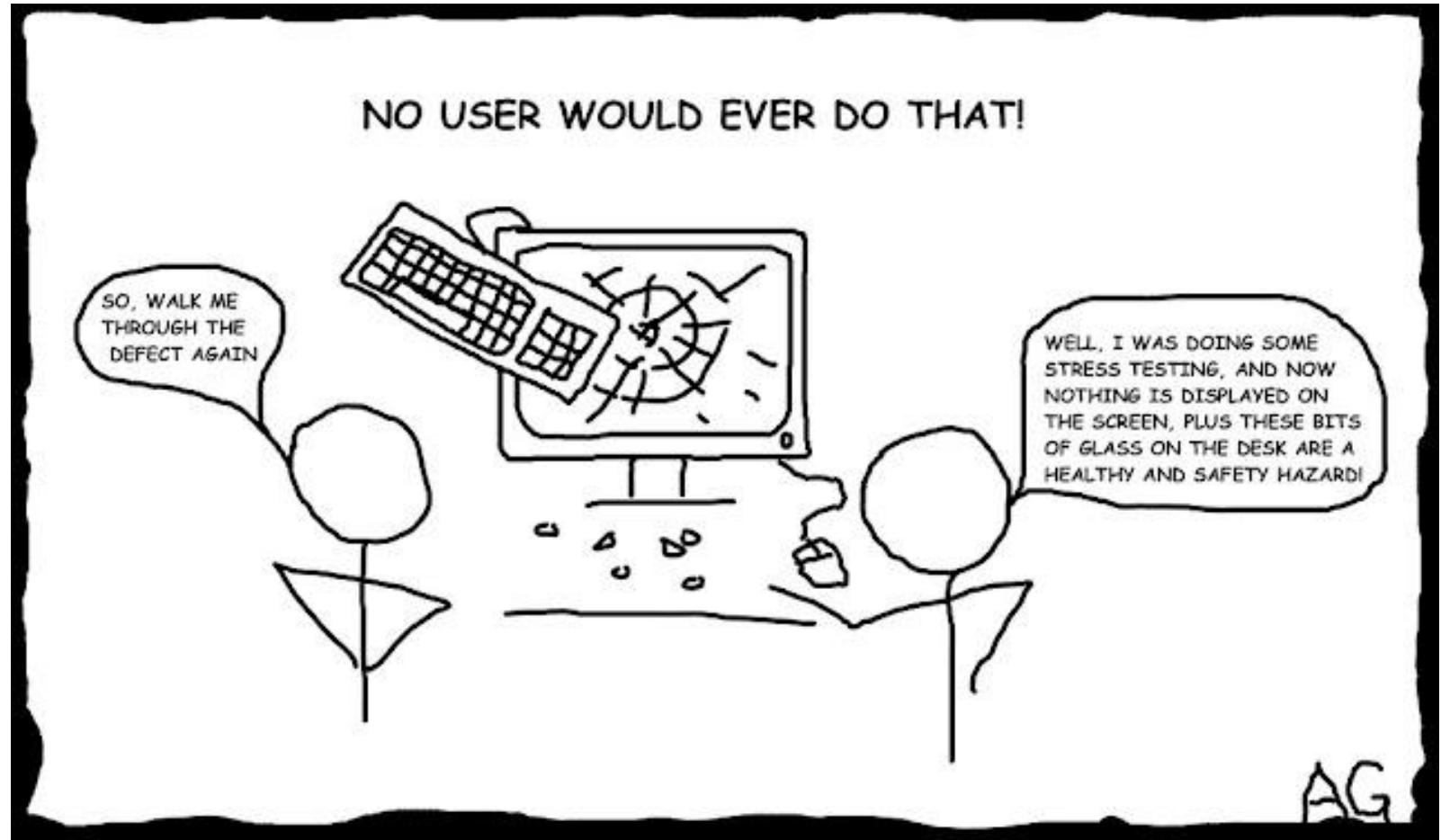
Voordelen van geautomatiseerd usability testen

- Goedkoper/sneller dan usability evalueren met mensen
- Levert consistente resultaten op
- Kan gemakkelijk ingezet worden in verschillende stadia van het ontwerpproces
- Geeft snel een algemeen beeld van de aanwezigheid van bepaalde features op bv. duizenden webpagina's

Nadelen van geautomatiseerd usability testen

- Geven geen inzicht in hoe mensen interageren met interfaces
- Volledig afhankelijk van de kwaliteit van de gebruikte richtlijnen

Conclusie: goede aanvulling, maar geen vervanging voor testen met mensen!

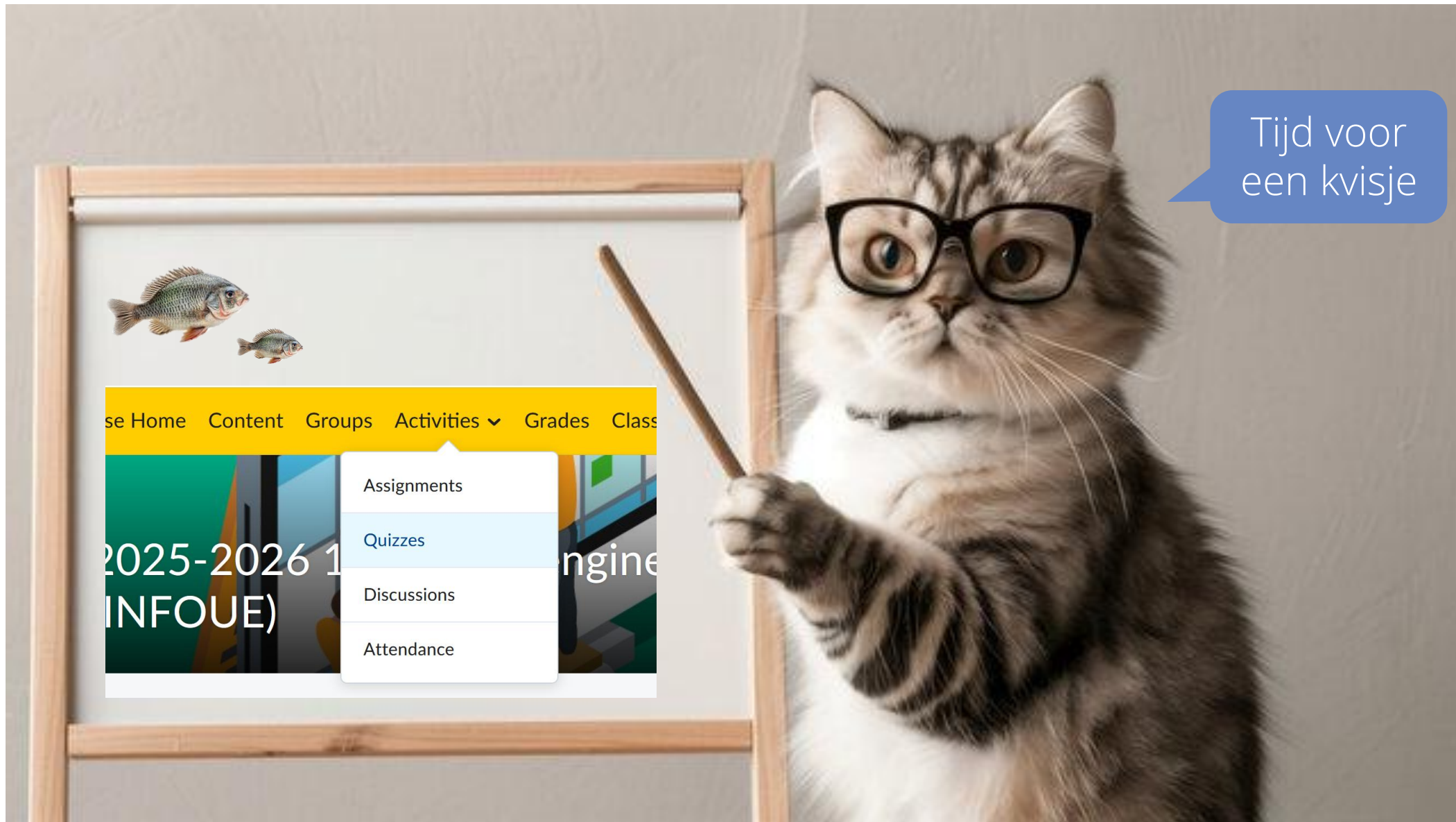


Het gaat al heel de tijd
over automatisering.
Moeten we dan niet
ook over GenAI praten?

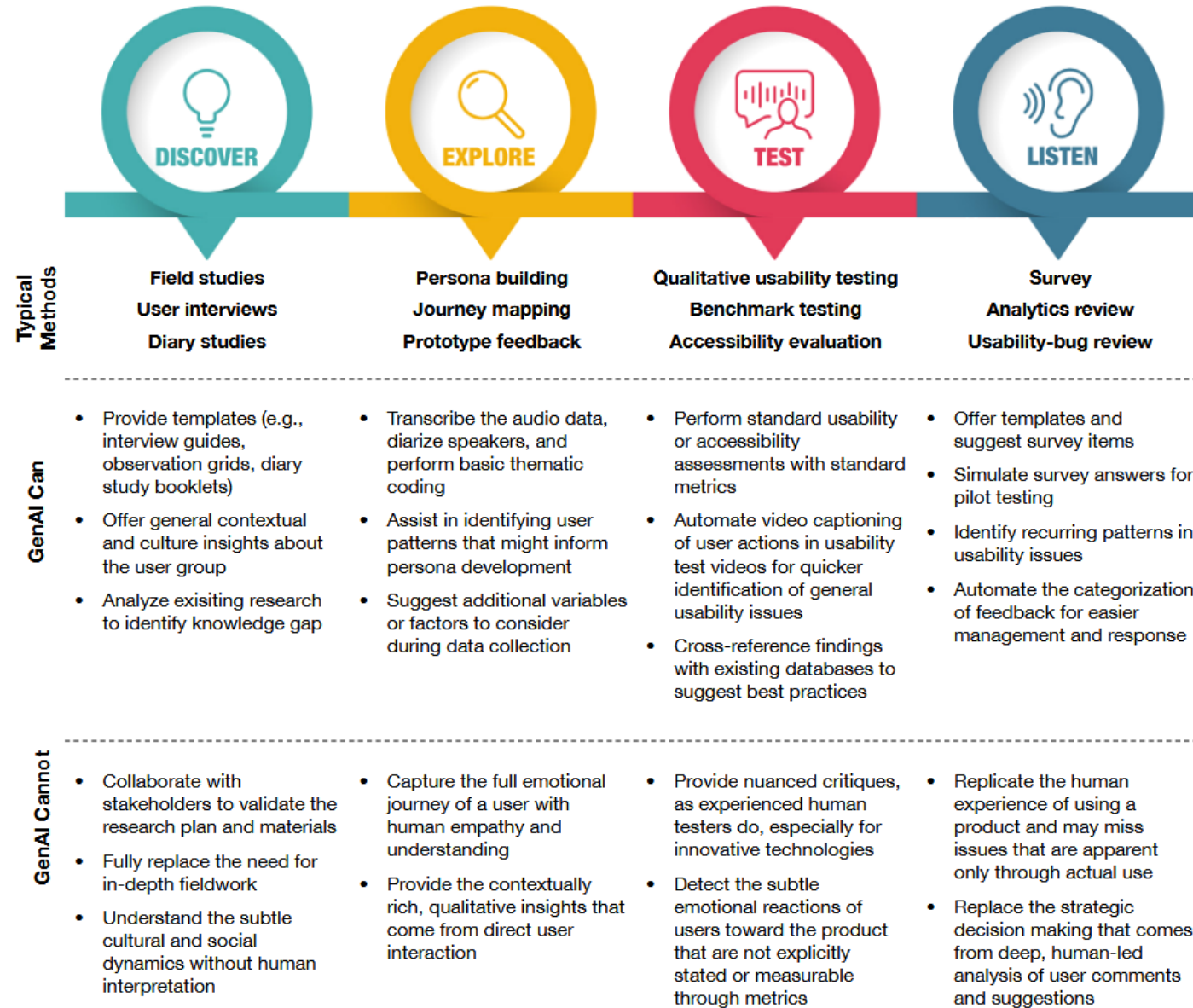


Goed dan ...





GenAI voor UX-onderzoek



Synthetische deelnemers met GenAI creëren? 🤔

“synthetic user data often provides only summary answers, leaving out context-rich, unexpected responses linked to the personal and emotional experiences of unique users” – Jie Li



Real User Interview

Interviewer: *And did you finish all seven parts of that course?*

Real user: *So, to be honest, I didn't finish all the courses I did up to the third course, but because I have completed the first course successfully, I got a certification on the fundamentals (...) But in every course, if you successfully complete a course with the required pass mark, you get a certification for that. So I didn't complete all seven. I completed three. I got the certification for the first one, the first course.*

Synthetic User Interview

Interviewer: *Did you complete all of these courses that you mentioned?*

Synthetic user: *Yes, I completed all the courses I mentioned. Each of them played a significant role in broadening my knowledge and skill set in UX research and design. Completing these courses was not just about acquiring certificates but truly understanding and integrating the learnings into my work. The insights and practical skills gained from these courses have been instrumental in enhancing my approach to UX projects, allowing me to apply new methodologies and improve the user experience in the products I work on.*

GenAI gebruiken voor usability testing? 🤔

“ChatGPT’s findability performance matched or exceeded the best participants. ChatGPT had almost perfect task completion scores, while the mean successful task completion rate across the ten tasks for participants was about 50%.”

Task	Description	Correct Path
1	Where would you go to find out if you can pay your taxes with PayPal?	Pay > PAY BY > Debit or Credit Card
2	Where would you go to find information about the form you would need if you were a worker that had Income and Social Security withheld?	Forms & Instructions > POPULAR FORMS & INSTRUCTIONS
3	Where would you go if you were expecting a tax refund and had not yet received it?	Refunds > Where's my refund
4	Where would you go to get more information on possible consequences for not paying your taxes?	Pay > POPULAR > Penalties
5	Where would you go to find out if your electric vehicle could save you any money on your taxes?	Credits & Deductions > POPULAR > Clean Energy and Vehicle Credits
6	Where would you go to learn about how to file taxes for an LLC?	File > INFORMATION FOR... > Businesses & Self-employed
7	Where would you go to learn how to update your address?	File > FILING FOR INDIVIDUALS > Update your Information
8	Where would you go to learn about how children can reduce your taxes?	Credits & Deductions > POPULAR > Child Tax Credit
9	Where would you go to find information on how much you can contribute to your 401(k)?	Credits & Deductions > POPULAR > Retirement plans
10	Where would you go to find information on past-due child support that may impact your refund?	Refunds > Reduced Refunds

Methodes voor (vooral) usability engineering

HC 1: Introductie usability engineering & UX
HC 2: Usability testing & inspection
HC 3: Performance & self-reported metrics

Methodes voor (vooral) user experience

HC 4: UX & working with human participants
HC 5: Surveys & interviews
HC 6: Focus groups & diary studies
HC 7: Ethnography & case studies
HC 9: Experiments

Methodes voor dataverzameling in UX-onderzoek

HC 10: Automated data collection & online research
HC 11: Ubiquitous research & measuring the human

Volgende keer...

*Werkcollege - Opdracht 2:
update vooruitgang en
implementatie*

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Zo meteen...

*Werkcollege - Opdracht 2:
onderzoeksvraag
formuleren, literatuurstudie
en implementatie*

Niet verdwalen op
weg naar Dalton, hè





**Universiteit
Utrecht**

Sharing science,
shaping tomorrow