Responsibility and Tangible Security: Towards a Theory of User Acceptance of Security Tokens

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pico

Pico Team

Current Members:

- **Frank Stajano (Principal Investigator)**
- David Llewellyn-Jones (Research Associate)

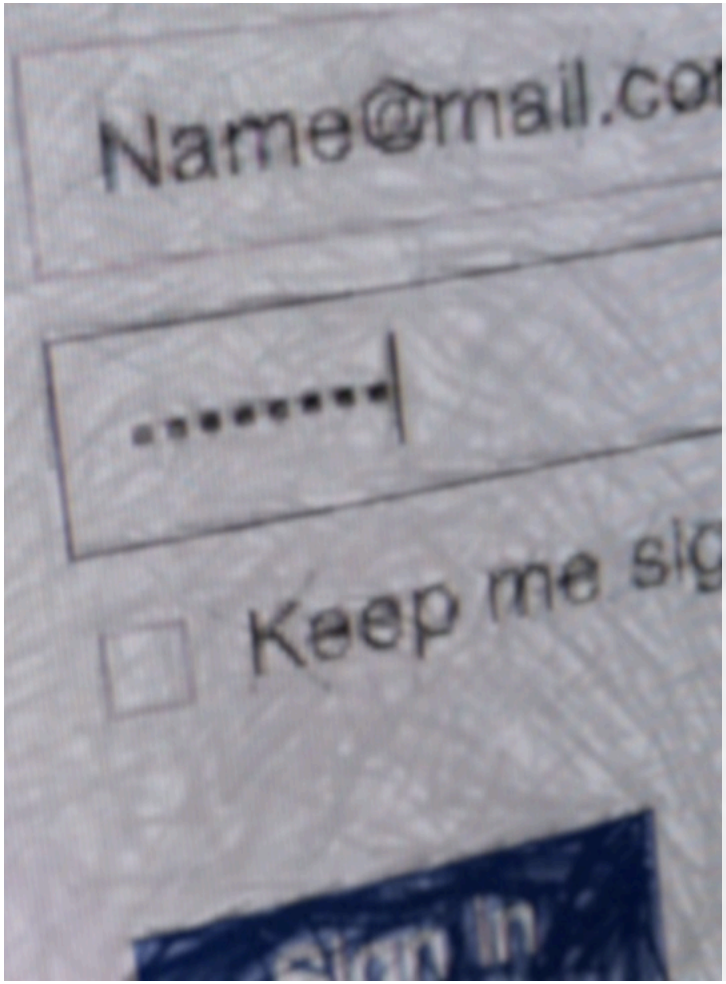
Past Members:

- Chris Warrington (now with Google)
- Quentin Safford-Fraser (now on the Endeavour Project at University of Cambridge the Computer Lab)
- Max Spencer (now at the Guardian)
- Jeunese Payne (now at Africa's Voices)
- Graeme Jenkinson (now on the CADETS project at the University of Cambridge Computer Lab)

Agenda

- **Passwords**
- **Background to Pico**
- **Approach**
- **Analysis**
- **The Grounded Theory**
- **Conclusions**

Passwords



- Coping strategies (reusing, storing, etc.)
- Alternative password types (passphrases, graphical passwords, etc.)
- Password managers
- FIDO
- Two-factor authentication
- Purely token-based schemes

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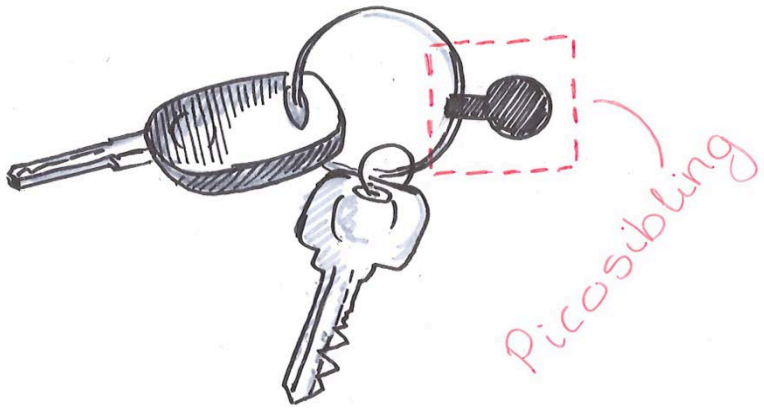
Pico (Stajano, 2011)

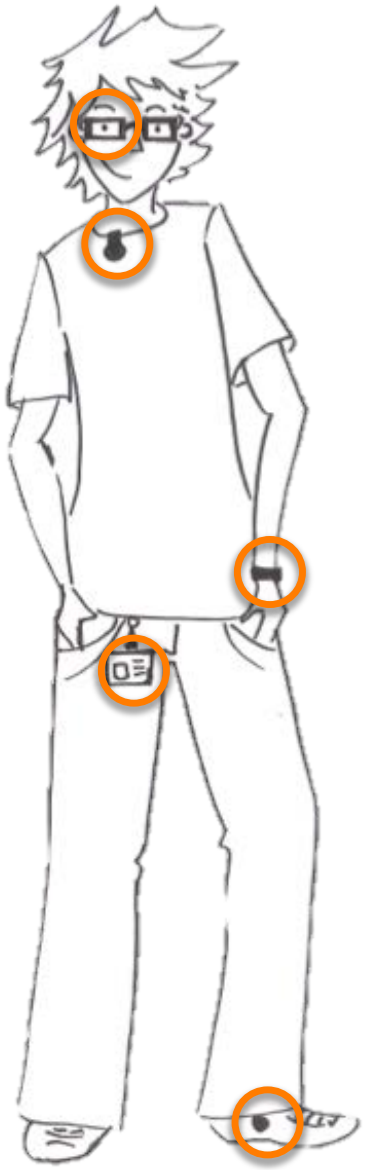
Pico = Small, dedicated device; ~~Passwords~~ → Scan a QR code

Usability benefits: Memory, Effort, Scalability

Security benefits: Continuous authentication; Resistant to guessing, phishing, and key-logging; **Theft-resistant**

Picosiblings





- It locks itself!
- Detects how close it to its **Picosiblings**
- Smaller devices you carry with you
- Collection → only need some

What explains the acceptability of a token-based authentication mechanism, such as Pico?

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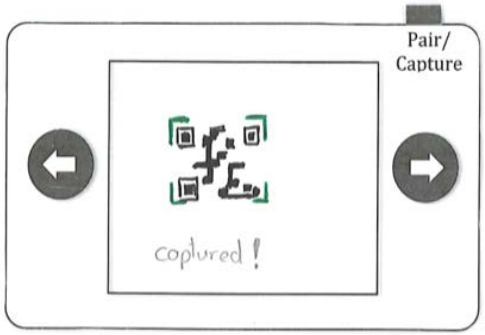
Approach: Overview

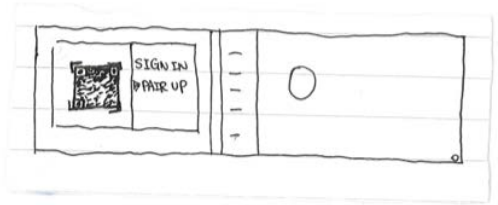
Data obtained from **semi-structured interviews** in which participants interacted with low-fidelity prototypes

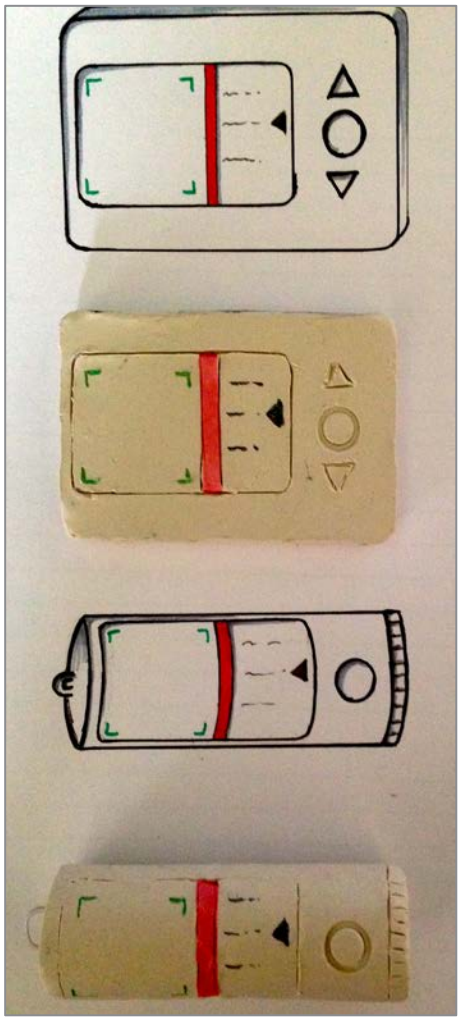
Data analysed using **Grounded Theory** (Glaser & Strauss, 1967; Strauss & Corbin, 1998)

Approach: Low Fidelity Prototypes (1)

a. Paper designs
b. Re-design
c. Plasticine
d. Polymorph







Students involved:
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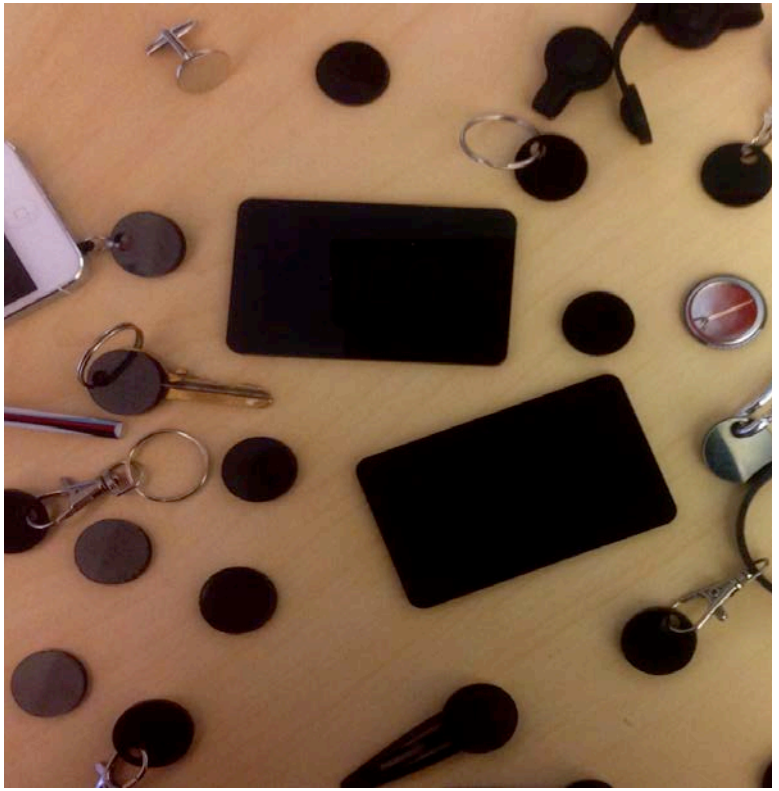
R. Dorrity, G. Liang, J. Luo,
E. J. Kay-Coles

Approach: Low Fidelity Prototypes (2)

Pilot Study of Picosiblings: Everyday and makeshift items

Main Interview Study: Uniform items and more options



Approach: Semi-Structured Interviews

- **Pilot** Phase: Open and axial coding of first 6 interviews
- **Main** Phase: Open, axial, and selective coding of 16 interviews
- **Expanding**: Testing the fit of the data in the final model from an additional 4 interviews → **20 interviews**

Approach: Participants

The range (count and percentages) of participant occupations

	Count (Percentage)
Accounting (female)	1 (5%)
Engineering (male)	1 (5%)
Military (male)	1 (5%)
Admin/Clerical (male)	1 (5%)
Publishing (female)	1 (5%)
Translating (female)	1 (5%)
Software Developer (male)	1 (5%)
Homemaker (female)	1 (5%)
Unemployed:	
Software Engineer (male)	1 (5%)
Product Designer (female)	1 (5%)
Research:	
Physics (male)	1 (5%)
Neuronal development (male)	1 (5%)
Cancer (female)	1 (5%)
No Occupation given (female)	1 (5%)
Student (undisclosed subject) (male)	1 (5%)
Education (teaching assistant) (1 male, 1 female)	2 (10%)
Post-grad student:	
Sustainable Energy (female)	1 (5%)
Computer Science (1 male; 1 female)	2 (10%)

Gender:

10 male, 10 female

Age:

20-57 years

(mean = 30.5)

Occupation:

See table

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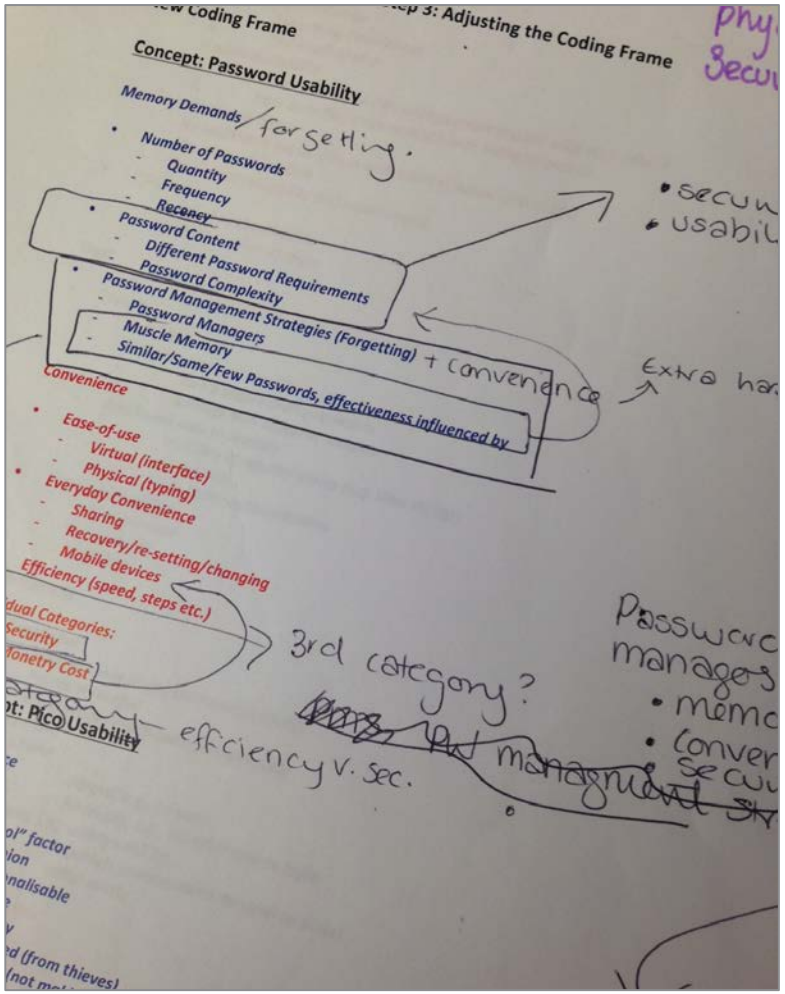
Open Coding

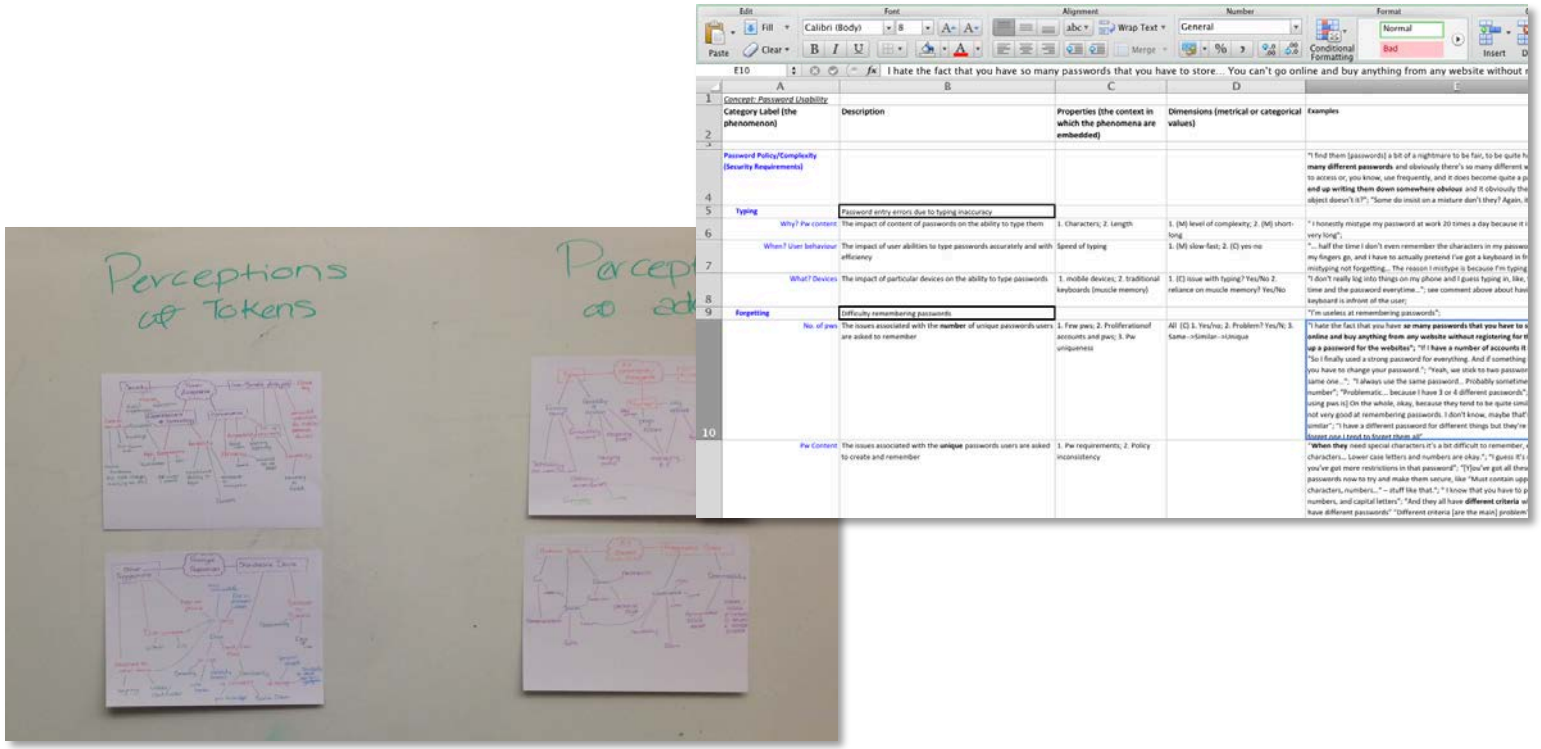


Reducing the data into codes

- Trial open-coding (interviews 1-6):
  - Double-coding
  - Blind-coding)
- Open-coding proper (interviews 1-16):
  - “Memoing”
  - Developing a coding frame

Axial Coding

Grouping codes into conceptual categories that reflect **relationships**



Axial Coding: Pico Token

Convenience

1. Efficiency (effort & time)
2. Deployment (widely adopted)
3. Something to carry (vs. dual-purpose or app)

Prototype Preferences

1. Familiarity (of concept & design)
2. Easy to carry, hold, and use (shape, size, & button functions)

Trustworthiness

1. Reliability (uninterrupted use)
2. Security (misuse, loss, & theft)

Axial Coding: Picosiblings

Hedonic Concerns

1. Self-presentation (personal style)
2. Personalisation (novelty, fun, & creativity)

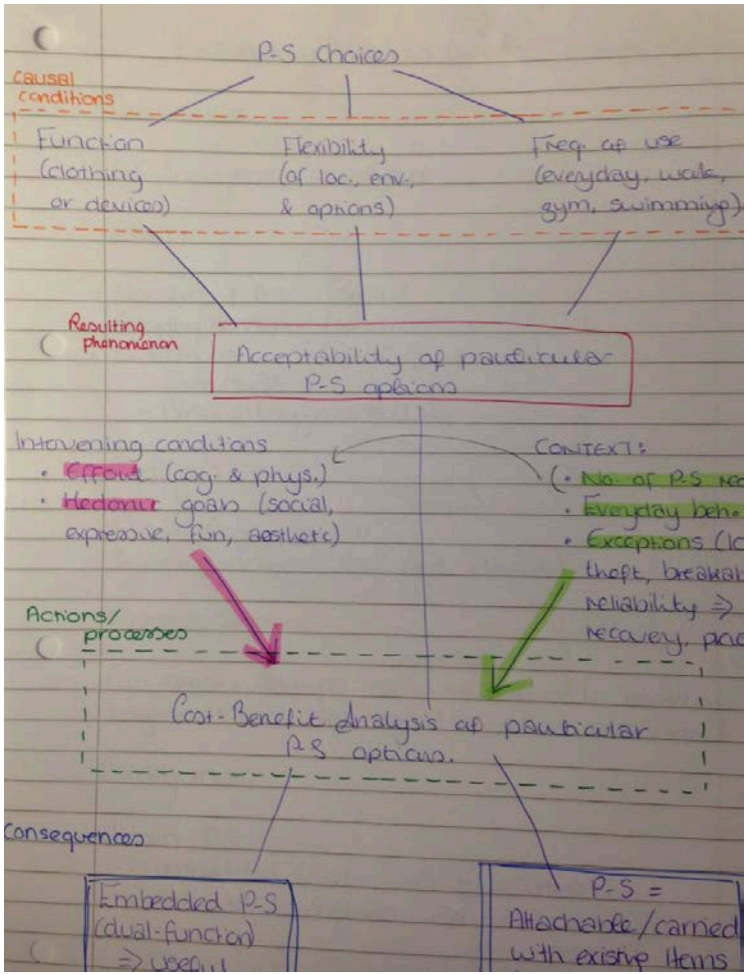
Utilitarian Concerns

1. Dual-purpose (e.g. a watch)
2. Practical Convenience (e.g. a key-ring)
3. Flexibility (e.g. a sticker)

Routine Use

1. Day-to-day (fixed or frequent)
2. Exceptions (loss & theft)

Selective Coding



Interpretation of codes in terms of an underlying **process**

- Integration of axial codes
- Refining the theory
- Developing a story line to demonstrate the theory

Selective Coding: Inconvenience

"I like the card kind of idea, kind of because you can maybe put it with other secure… with your bank card"

Selective Coding: Risk Perception

"Is there a way to do, like, a time thing on them? … I guess it just makes it even more secure … because it changes all the time"

Selective Coding: Responsibility

"The worry would be obviously if you lost one and then you went to your access point and then realised that you lost one: where would you always keep the spares?... You wouldn't want to carry too many things"

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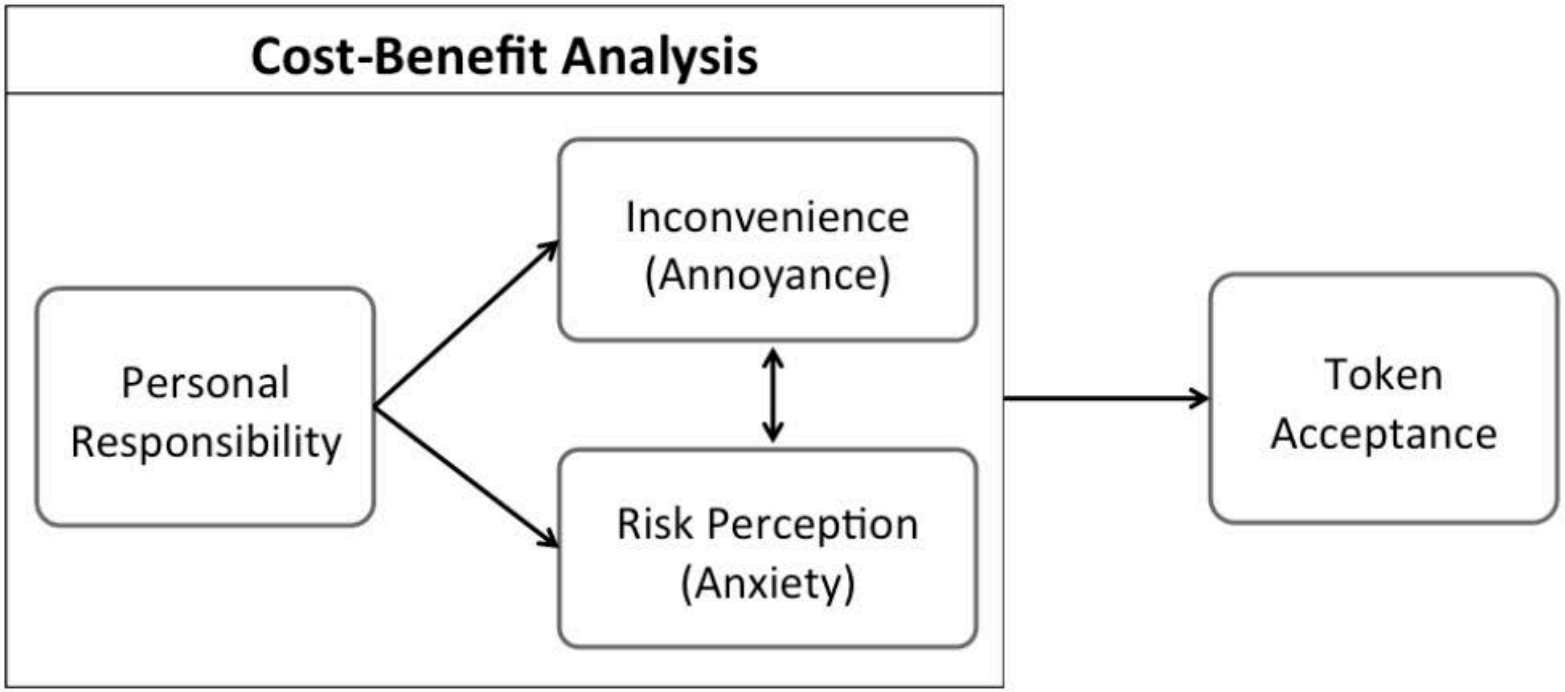
The Grounded Theory



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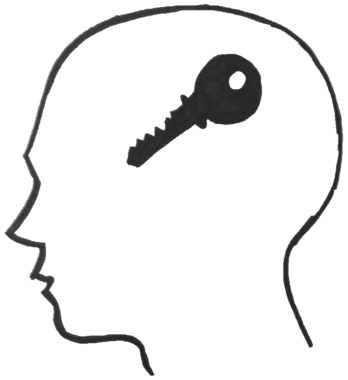
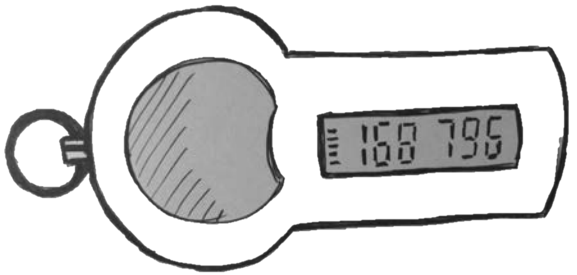
Conclusions

Passwords → Abstract



Tokens → Tangible



Tangible security increases perceived responsibility for:

a. Mitigating security risks
b. Managing physical item

= anxiety-provoking and inconvenient

Conclusions

Three key challenges:

1. Reducing annoyance (associated with inconvenience) and anxiety (associated with risk)
2. Avoiding system failures (reliability issues)
3. Aligning mental models of Pico with how it actually works

Questions?