Equitable Security: Optimizing Distribution of Nudges and Resources
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How can firms optimize the tradeoff between security nudges and levels of risk and investment for end-users, keeping fairness in mind?

Motivation & Method

We ran behavioral economics games on AMT and were able to model user security decisions with high accuracy ($R^2=0.61$).

Users make **boundedly rational cost benefit optimized security decisions** [1]. Yet, sometimes security nudges encourage users toward irrational behavior.

Users have a **limited compliance budget**. We present a **mechanism design** to mathematically select values of different system features, maximizing utility for both users and online services.

**Behavioral Economics Experimental System**

**Cost** is defined as wage-earning time loss

$$C_{2fa} = (T_{signup} + \sum T_{login}) \cdot \text{wagemturk}$$

**Utility** of 2FA is defined the $$$ savings if a hack occurred

$$U_{2fa} = P[(H) \cdot \text{Maxbank}]$$

**Rational behavior** achieved when choice utility > cost

**Firm’s Utility function:**

$$f^s(B_i, u_i) = \sum_{i=1}^{n} g(B_i, u_i) - \alpha(B_i, u_i)$$

$$f^s : (B, U)^n \rightarrow \mathbb{R}$$

**User’s Utility function:**

$$f^u : (\text{TYPE}, B, R) = g(B_i, t_i, R_i) - \alpha(B_i, t_i, R_i)$$

where $u_i$ has some $t_i \in \text{TYPE}$

**User behavior Adjustment:**

$$\text{if } \left( \sum_{d=0}^{e} \text{budget} \right) < \sum_{i=0}^{e} \text{cost}(B_i, U_i) : m_i \times t_i \times r_i$$

where budget is the users’ overall “compliance budget” across digital accounts (see Beaudent et al. 2009)

**Firm solves for optimal values** of $B_s, B_q, S_s, S_q$ and $m, r$ for some user $u_i$ for $\text{max(profit)}$

**Future work:** impose fairness constraints, simulate impact on profit & overall user security

- **Risk fairness:** all people in the system should have as equal as possible risk of a negative outcome.
- **Effort fairness:** assignment of resources / messages to minimize user variance in cost (effort).

References