The Drawbridge Model of Cryptographic Communication:

A Framework for Sociocultural Analysis of Information Security

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A Situated, Sociocultural Approach to Crypto

What can we learn about concealing communications by studying different forms of communication failure?

A Broad Definition of Cryptography: Any form of communication that uses known sources of communication failure to create reversible, nondestructive encodings that selectively limit the audience of a message.

Cryptography as Drawbridge: Information security techniques work by selectively raising and lowering the drawbridge of communication's success or failure.

Drawbridge Model of Cryptographic Communication

- Chain of islands separated by gaps. Each gap is a potential source of communication failure.
- Successful communication must bridge each gap. Failure at any stage makes further stages inaccessible.
- Different information security techniques cause communication failure at different stages. This failure must be *selective* and *reversible* (like a drawbridge).

Access

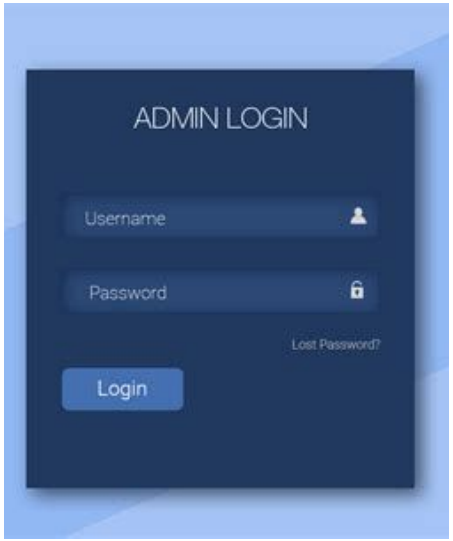
Definition

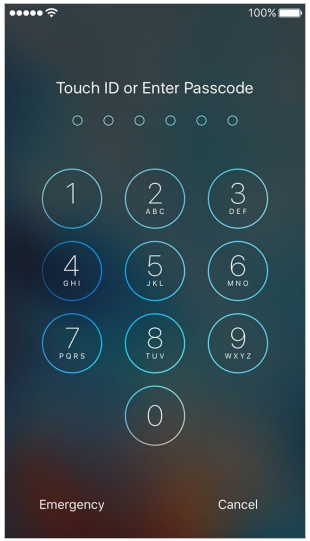
- Barrier or lack of authorization keeps you from receiving a message.
- If message is inaccessible, comm fails even if message is perfectly viable otherwise.

In Practice

- *Mundane Failure*: Barriers, Lockouts, Forgotten Passwords.
- *Security Schemes*: Keys, Envelopes, Logins, File Permissions.

Access-Based Security





	View	Edit	Create	Delete
User	☑	☑	☑	☑
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Role	☑	☑	☑	☑
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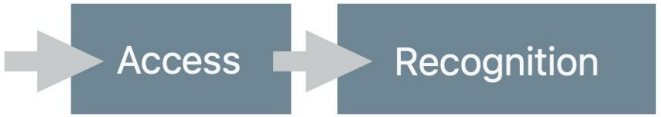
System Settings	☑	☑		
Custom User Fields	☑	☑		
Active Users	☑	☑		

Recognition



Definition

- Given Access, Recognition is the awareness that a specific message or information is present.
- Communication fails when we do not recognize that the message is there.
- The message could be perfectly viable otherwise, but communication still fails if unrecognized.

In Practice

- *Mundane Recognition Failure*: To wave, but someone doesn't see; to overlook information buried in a footnote.
- *Security Schemes*: Steganography, Invisible Ink, Digital Watermarks.

Recognition-Based Security

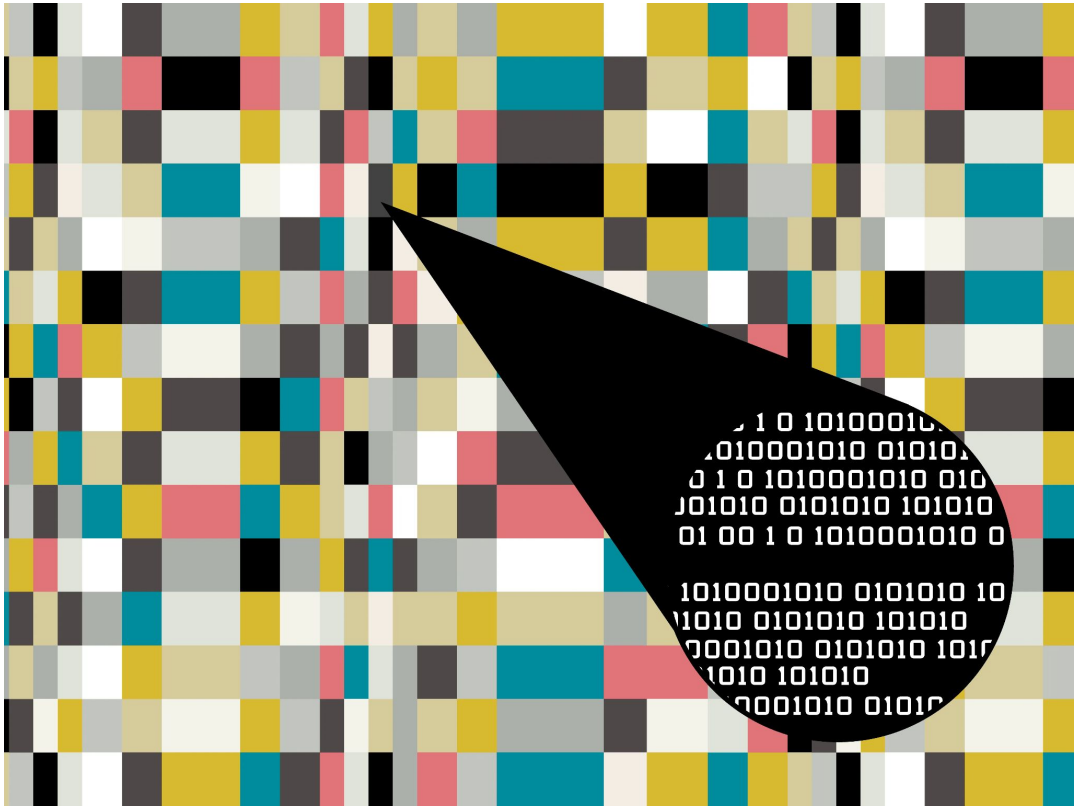


Image: Wired.

Legibility

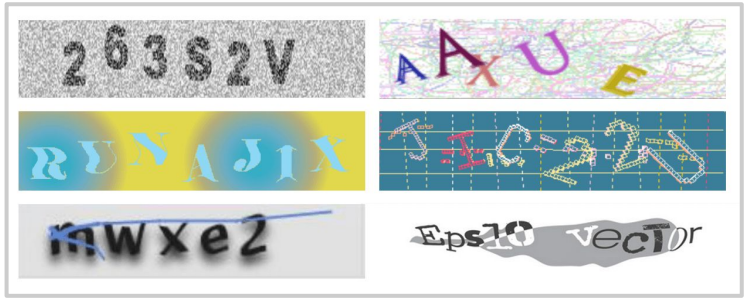
Definition

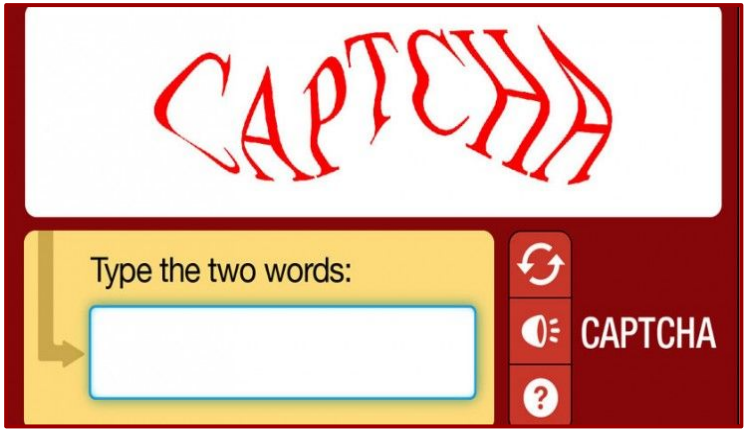
- Specific definition for this model: a *legible* message is rendered in symbols known to the user.
- “H” vs. “□”

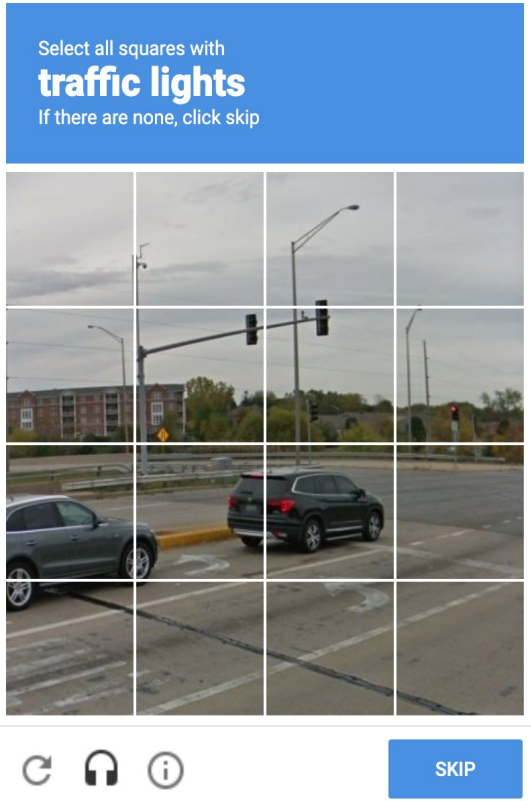
In Practice

- *Mundane Legibility Failure*: optometry exam, illegible handwriting, undeciphered ancient scripts (e.g. Linear A)
- *Security Schemes*: CAPTCHA.

Legibility-Based Security



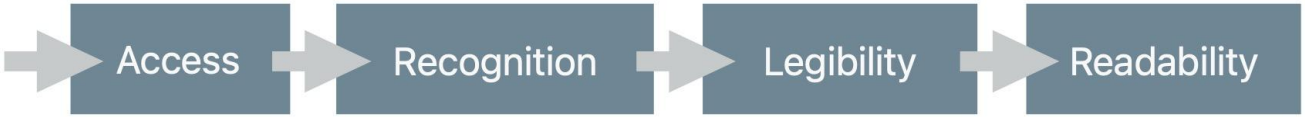




Legibility-Based Security

ZXX typefaces by Sang Mun (2013)

Readability



Definition

- Ability to recognize coherent patterns, words, syntax, in a set of known symbols.
- “HELLO” plaintext / “YDVQP” ciphertext.

In Practice

- *Types of Mundane Failure*: spelling and encoding errors, incompatible file formats, bit rot.
- *Security Schemes*: anagrams, acrostics, digital encryption of messages.

```
hQIMAw3Jn/nLK/38ARAAsSXLDhCtzUYKMptNxZImJXwhhIRm3QxfuyHjJ93ASylE
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```

Meaning

Definition

- *Success*: Shared intersubjective accord on the content expressed in a message.
- *Failure*: Mistaken apprehension, confusion, apparent nonsense.
- *Selective Mediation*: Assignment of new meaning to a specific message (Social Steganography, Marwick & Boyd).

In Practice

- *Types of Mundane Failure*: Deception, misunderstanding, false attribution.
- *Cybersecurity Threats*: Spoofing, phishing.

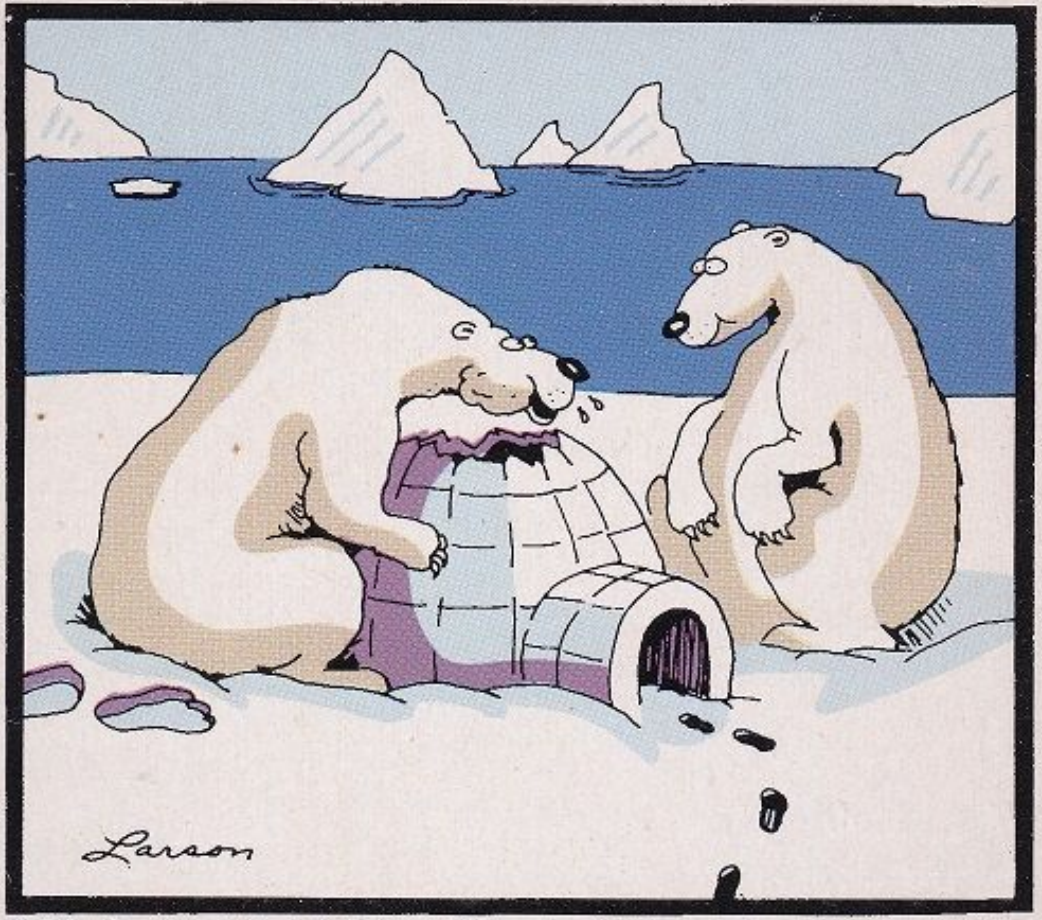
Meaning-Based Security Threats

Image: Security Magazine.

Drawbridge Model of Cryptographic Communication

Implications for AI and Cybersecurity

- Different forms of information security leverage different kinds of communication failure to selectively divide the audience of information.
- Modeling threats and vulnerabilities using the Drawbridge Model can help develop defense in depth by evaluating strength of security at each stage.
- Identifying the ways AI succeeds and fails at communication can point to opportunities for building better defenses.



"Oh hey! I just love these things! . . . Crunchy on the outside and a chewy center!"

Thank you!

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