



# STEGANOGRAPHY RESEARCH

BY GUARDIAN PROJECT



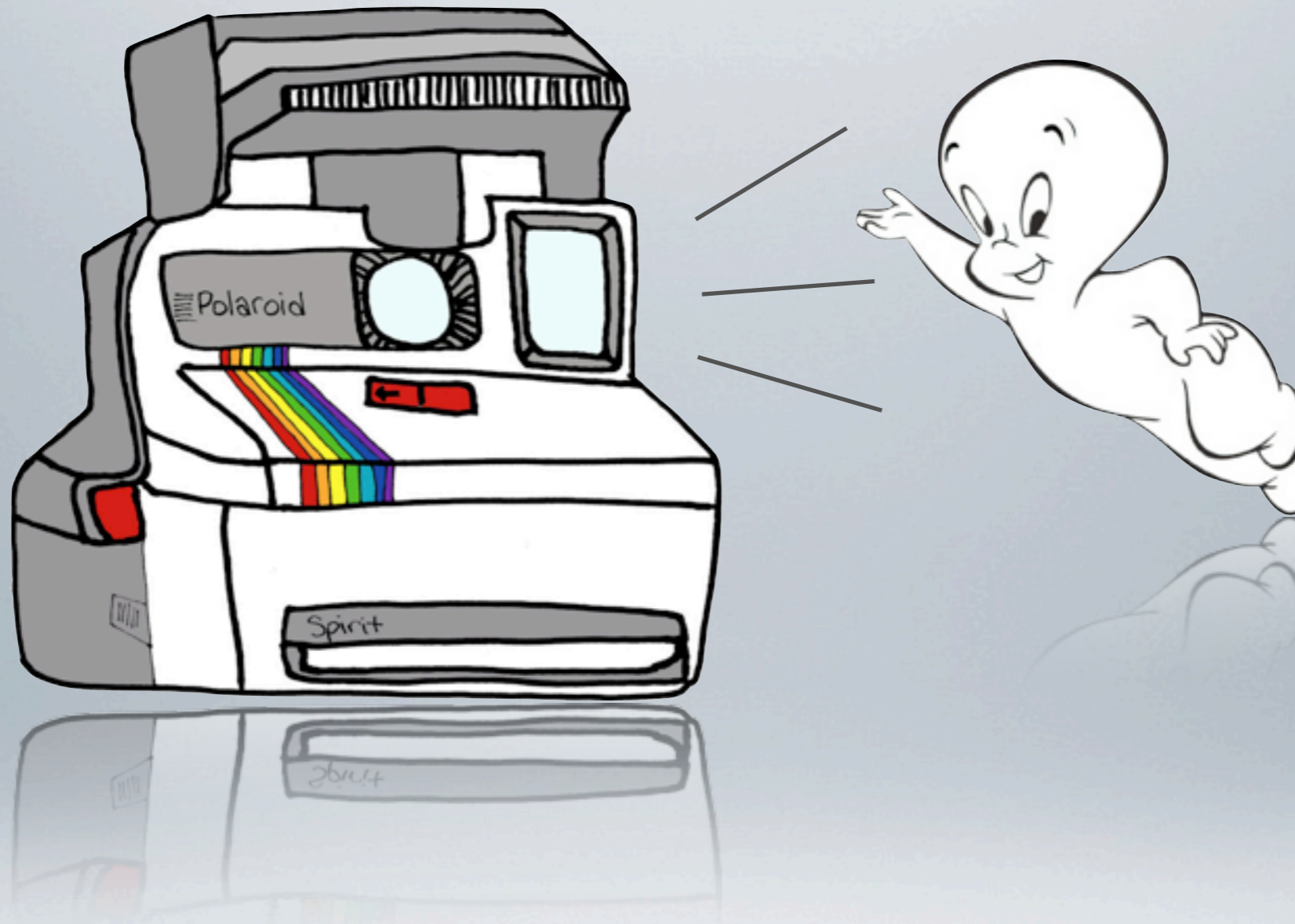
Guardian Project is a research and development effort powered by technology-focused activists, concerned citizen users, and open-source security software hackers. We build open source tools based on real-world experience and feedback. Our process is transparent, inclusive and responsible.





# STEGANOGRAPHY

The practice of embedding secret messages into a piece of media so that no one, apart from the sender and intended recipient, know that the secret message exists.



# MODERN IMAGE STEGO

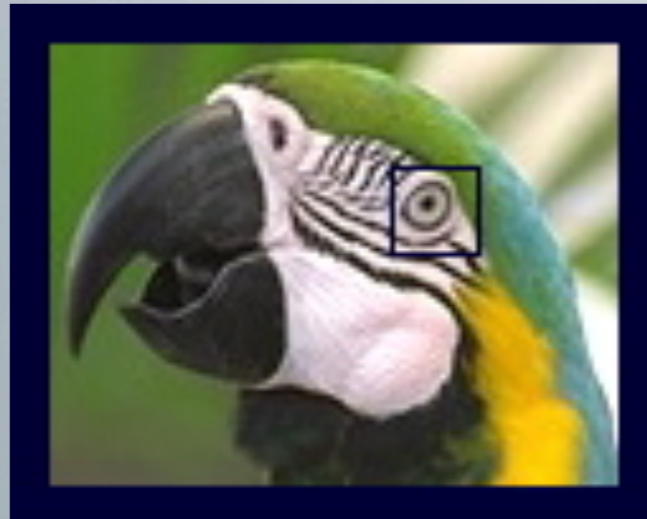
The secret message in an image, or ghost in the machine, must:

1. Have the original image appear, to the trained human eye, **unedited**.
2. Have the bytes of the image appear, to a trained analyst, **undistorted** so much so as to arouse suspicion.
3. Have the complete message be **recoverable** no matter how it is transmitted.



# MODERN PROBLEMS

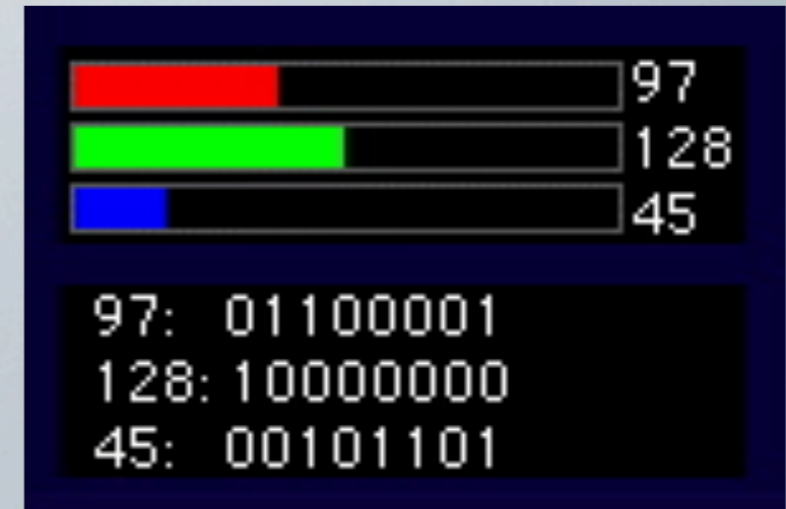
What was cutting edge a couple of years ago, no longer is.



Parrot



Pixels



Red-Green-Blue values

# LEAST-SIGNIFICANT-BIT STEGO

Problems with making slight alterations to certain parts of an image:

1. **Distortion:** Forensic analysts are now accustomed to this trick. The footprint of an image treated this way can be obvious to a professional, so it can be found-out.
2. **Unrecoverable:** This tactic requires that the image never deviate in its size or quantization. This happens across most modern image-sharing medium, such as social networks & MMS.



# FUTURE SOLUTIONS

An app that manipulates the image at the "compressed domain," at the quantization tables of the jpeg, and embeds the secret message as a DCT coefficient in the chrominance channel of each 8x8 pixel block of the image



# SOCIAL MEDIA INTEGRITY

The quantization stego method purportedly resists certain transformations to the image. However, this is as long as the image itself is not re-quantized by another actor, which could be the case with certain web and mobile services like Facebook. This approach already is popular in the use of watermarking copyrighted material.



# APPLICATION LANDSCAPE

Apps available on a variety of mobile platforms.





# IMAGE STEGANOGRAPHY

Landscape Analysis of Existing Tools on Different Platforms.





# ANDROID

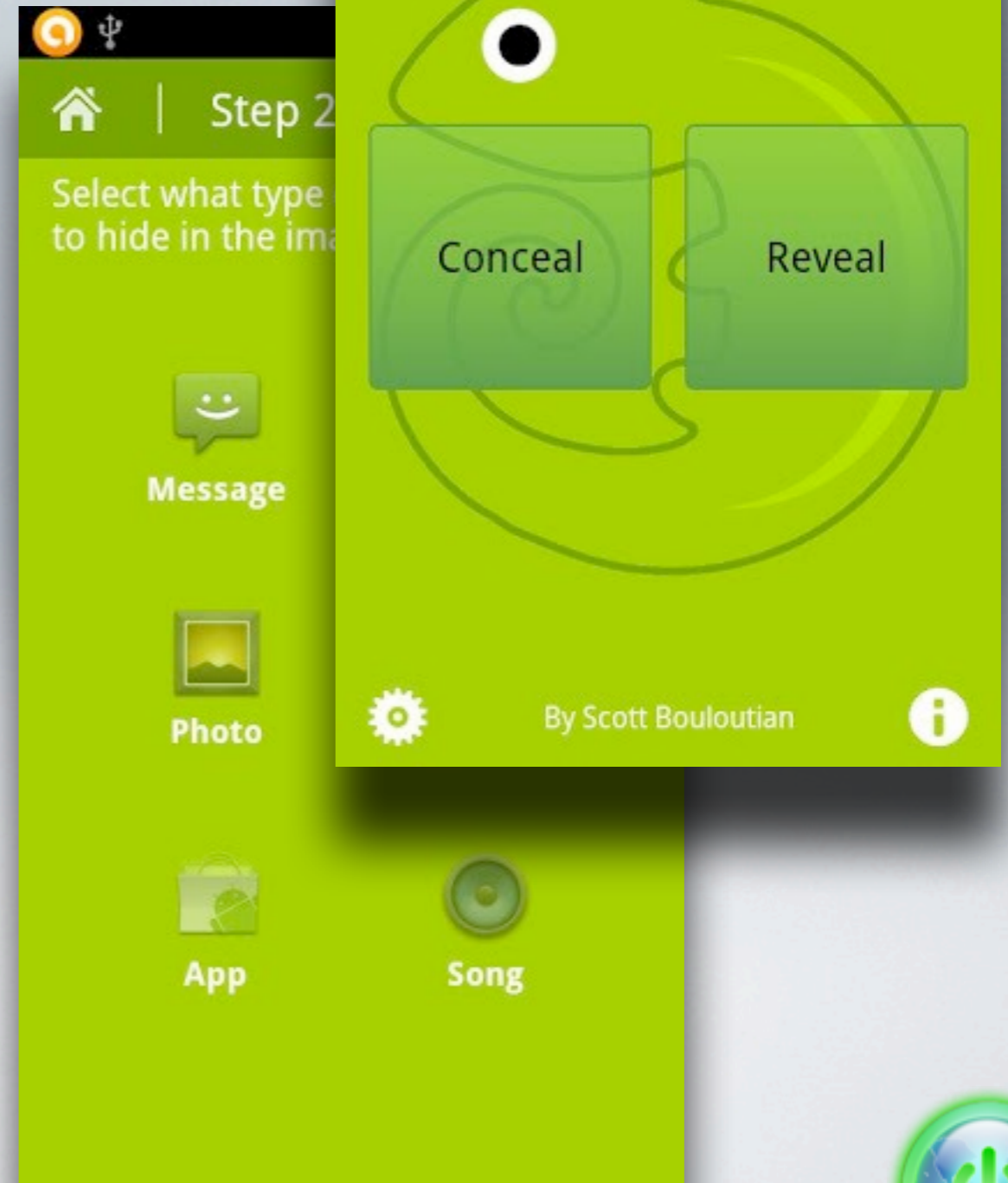
Apps available publicly all over the world for download, installation and easy use.



# CRYPISIS

Images store music, apps, contact info, and other pictures

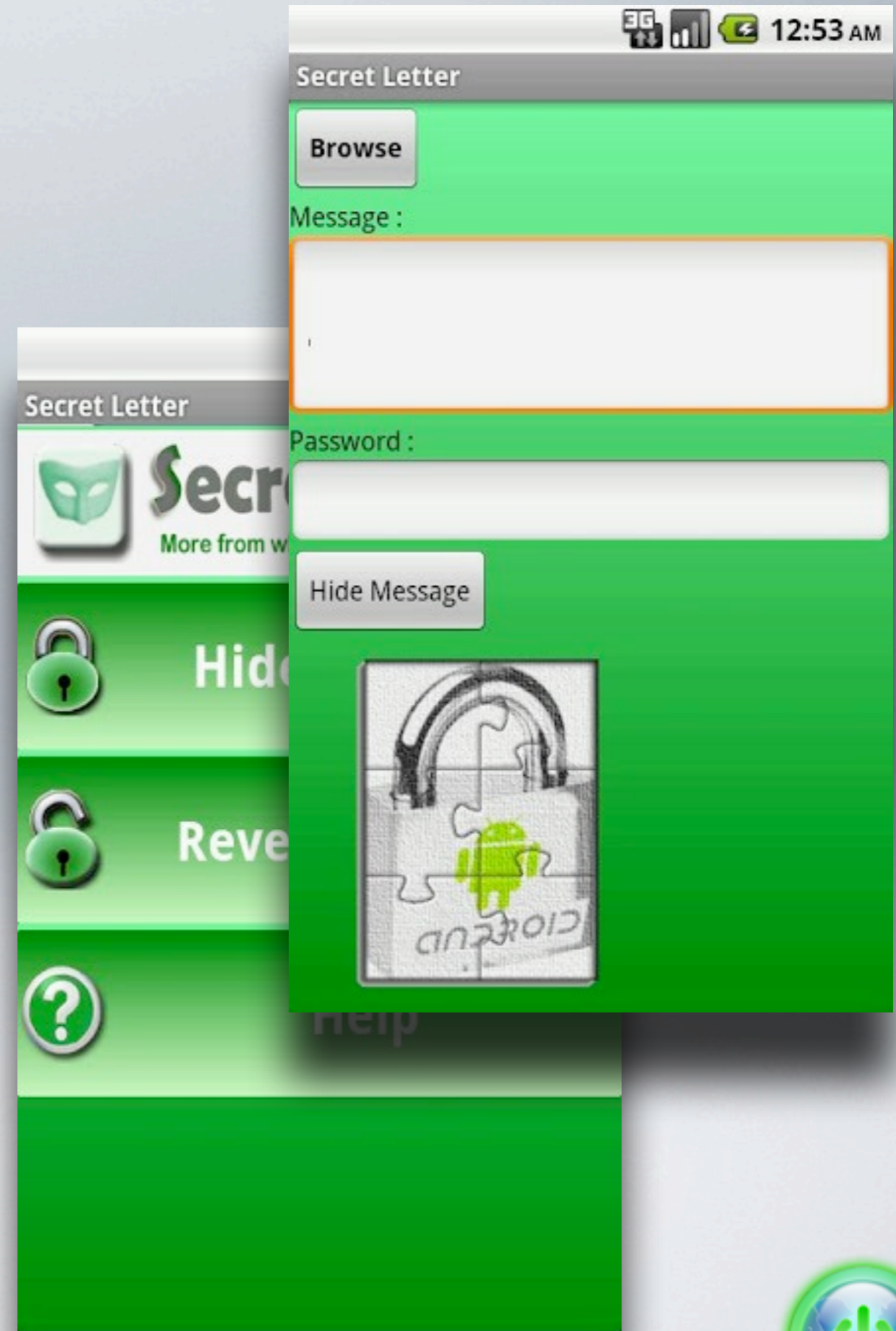
- Usability
  - Clean and Straightforward. Saves to pre-labeled gallery.
- Technical
  - Message has 998,784 character limit. Files are saved large.
- Accessibility
  - Developer site
    - <https://sites.google.com/site/scottbouloutian/>
  - Free App - Trial
    - [https://play.google.com/store/apps/details?id=com.bouloutian.crypsis\\_free](https://play.google.com/store/apps/details?id=com.bouloutian.crypsis_free)
  - \$1.99 App
    - <https://play.google.com/store/apps/details?id=com.bouloutian.crypsis>



# SECRET LETTER

Images store text

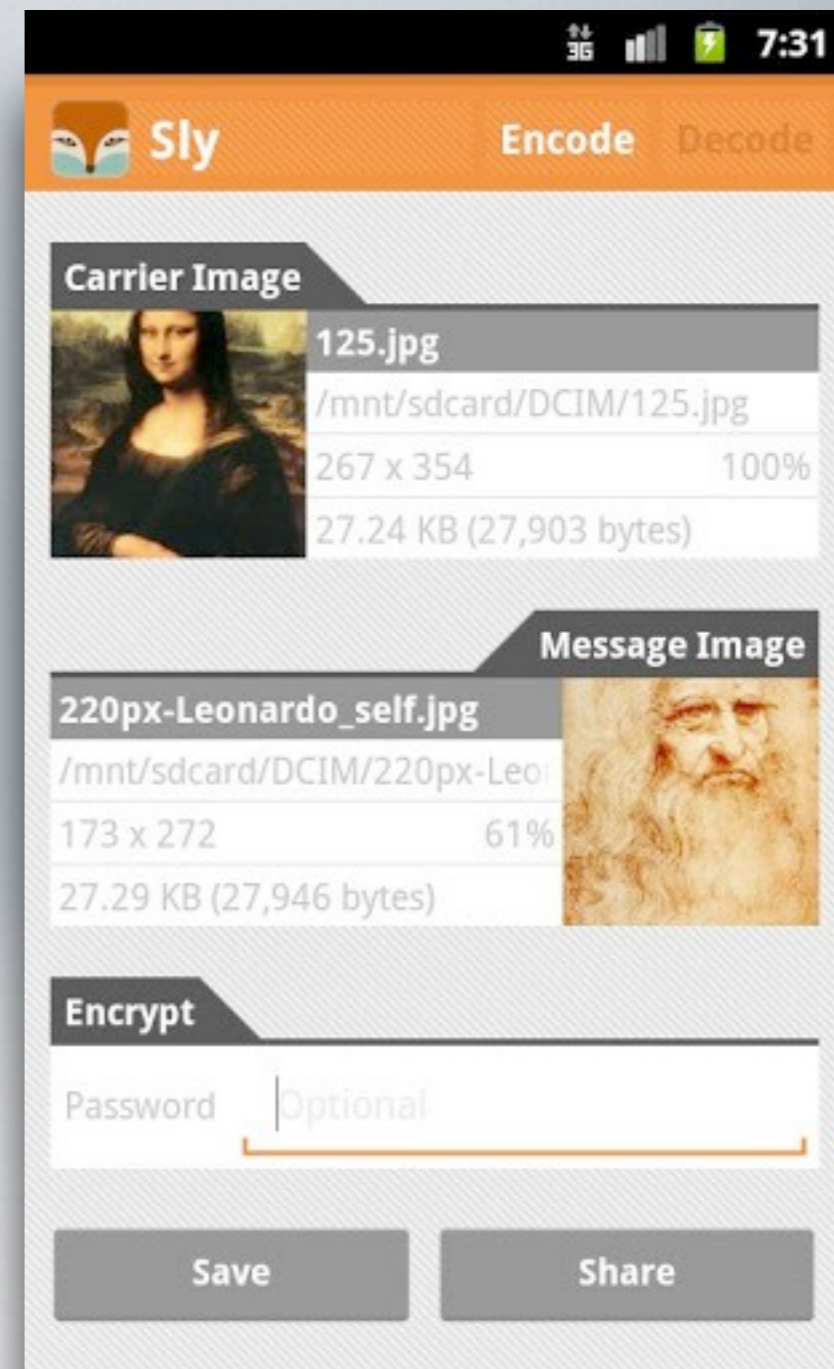
- Usability
  - Confusing to add a picture. Text message of unknown length. Saves to new "Secret Message" folder in Gallery. Does not give option to view this folder.
- Technical
  - Facebook: Decrypts but into gibberish
- Accessibility
  - Developer email
    - ivanalum88@gmail.com
  - Free App
    - <https://play.google.com/store/apps/details?id=steganodroid.iu>



# SLY

Images store text or images and  
can be encrypted with a  
password

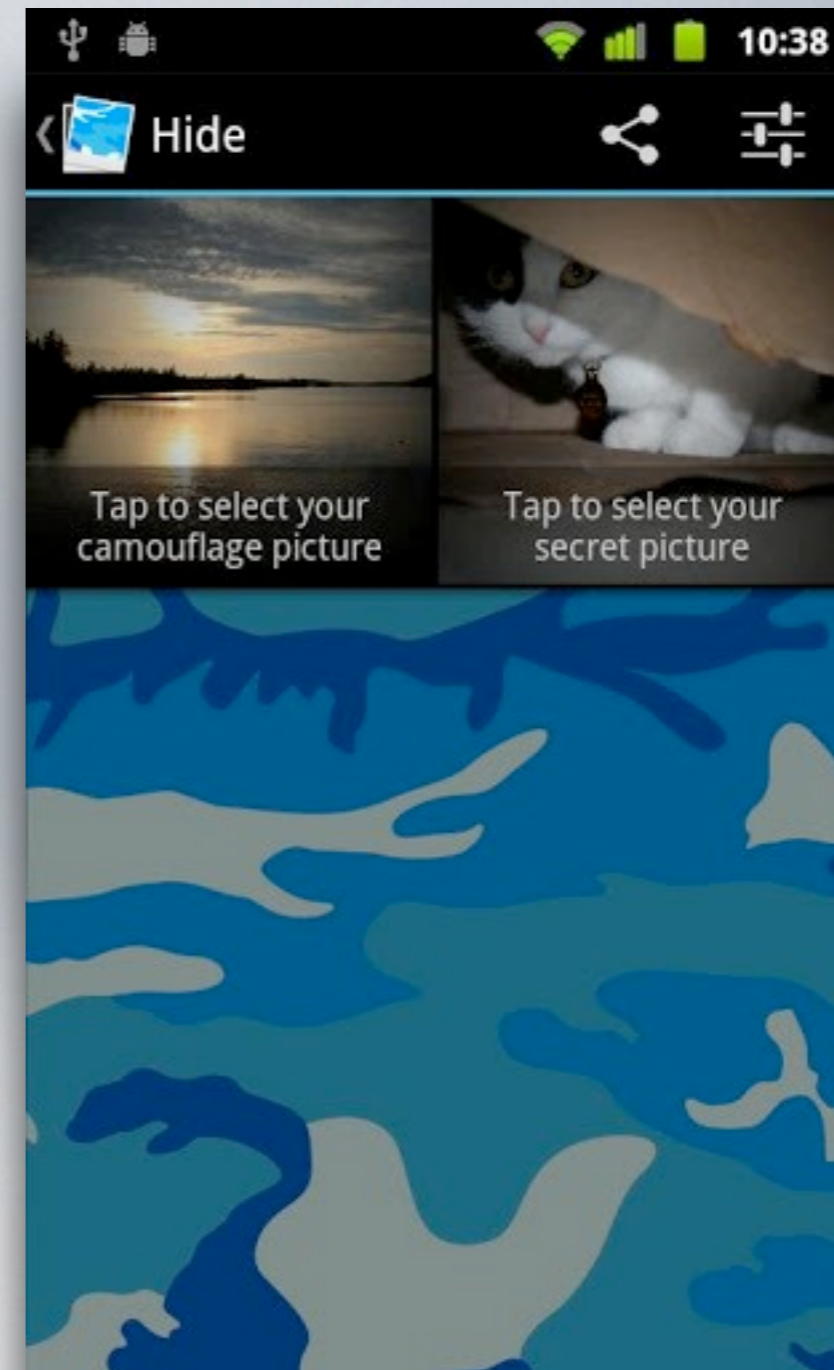
- Usability
  - Sleek UI but doesn't seem to encode properly. Massive distortion (i.e. stretching) to the picture.
- Technical
  - Uses LSB digital image steganography which will be affected by altering the image in any way
- Accessibility
  - Developer
    - <http://alexbrowndev.com/>  
[alex.m.brown22@gmail.com](mailto:alex.m.brown22@gmail.com)
  - Free App
    - <https://play.google.com/store/apps/details?id=org.alexmbrown.sly>



# CAMOPIC

## Pictures in Pictures

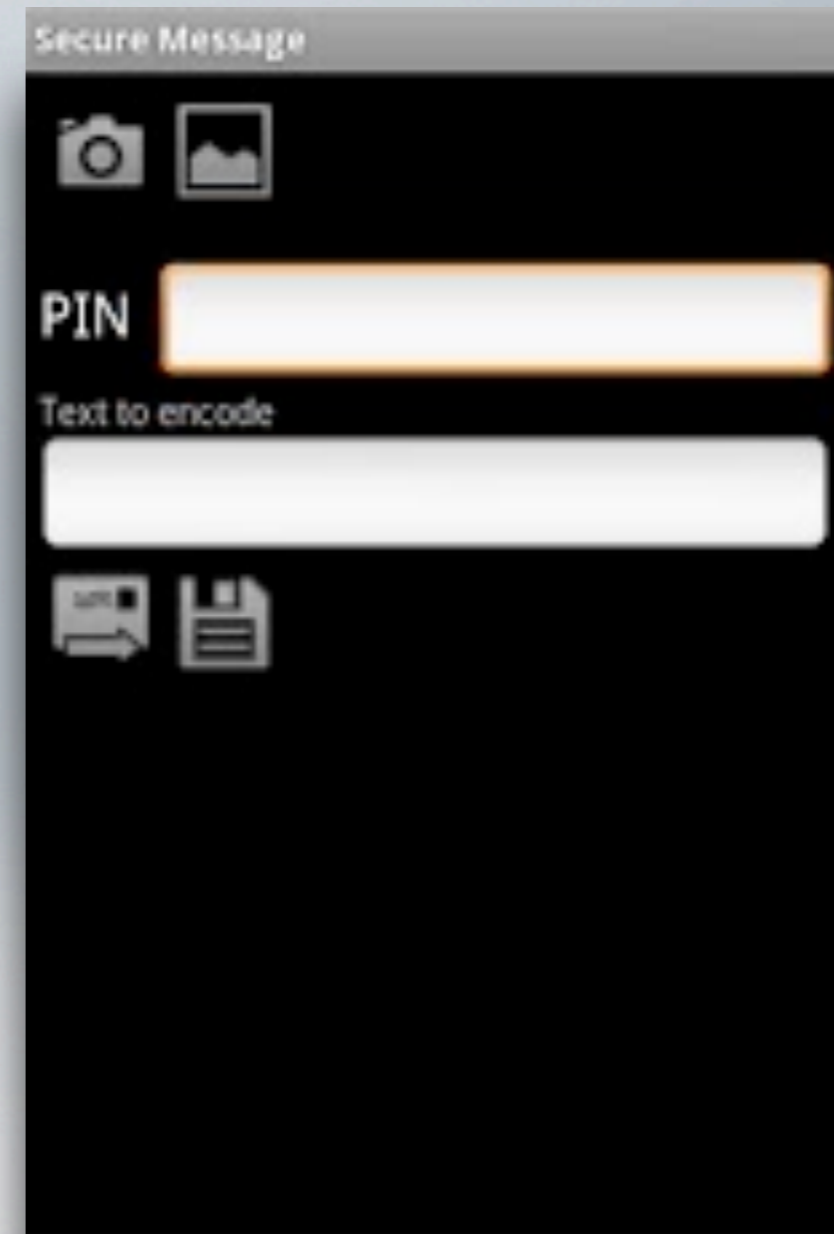
- Usability
  - Tap an image to flip it over and reveal the hidden picture behind it.
  - Users can preset sharing options
- Technical
  - Crops pictures square. and doesn't offer open option from dropbox
- Accessibility
  - Developer site
    - <http://blog.repl.ca>
  - Code
    - <https://github.com/jbowes>
  - Free App
    - <https://play.google.com/store/apps/details?id=ca.repl.camopic>



# SECUREMESSAGE

## Pictures in Pictures

- Usability
- Technical
  - From dev: The next version will make the necessary modifications to overcome the limitation placed by Facebook
- Accessibility
  - Developer site
    - <http://www.amishpirate.com>
  - \$.99 App
    - <https://play.google.com/store/apps/details?id=com.amishpirate.securemessage>





# IOS

Apps available publicly all over the world for download, installation and easy use.



# CONCEALMENT

## Pictures in Pictures

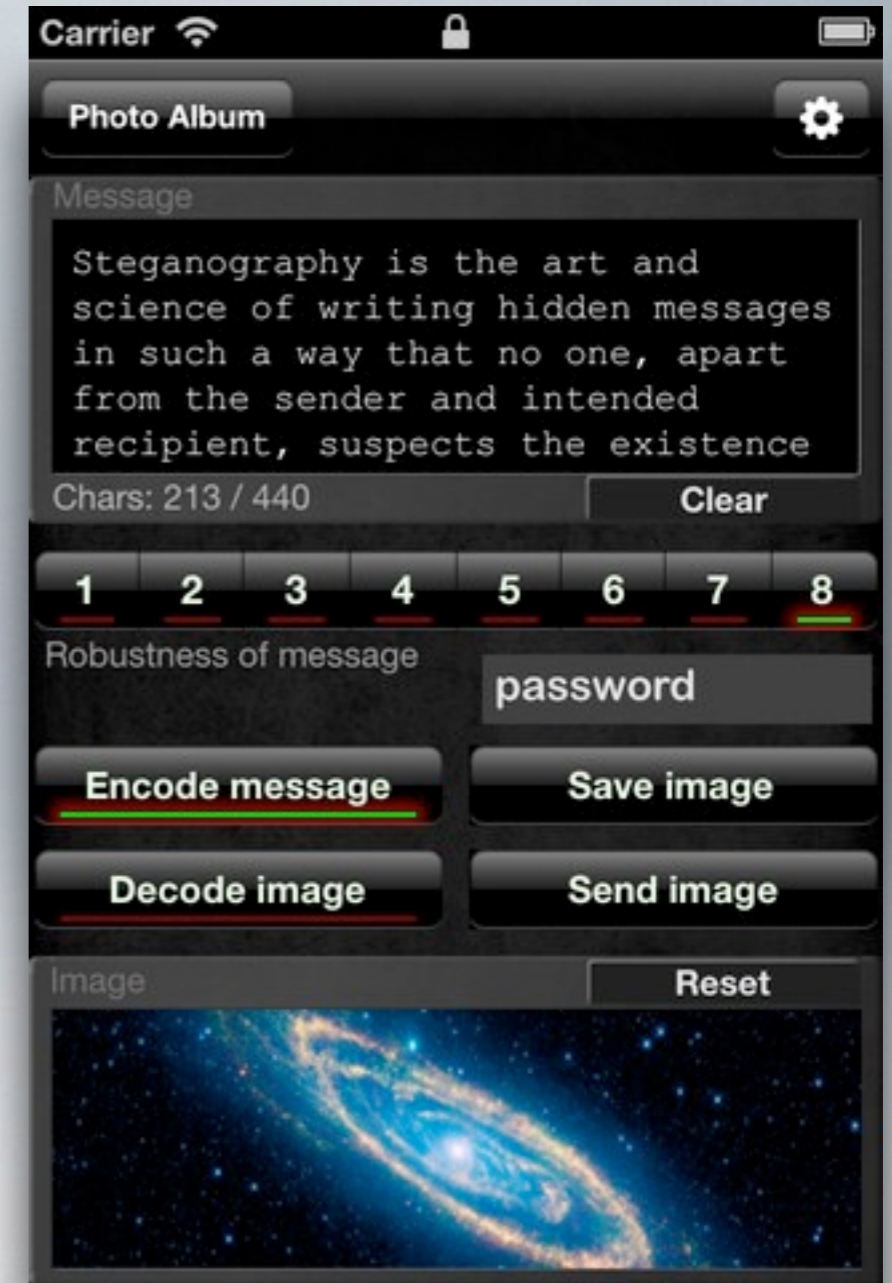
- Usability
  - Plain interface.
- Technical
  - Can hide a message any length and up to 6 images
  - From the dev: Ability to scramble your message in case of interception"? & iMessage compatibility
- Accessibility
  - Developer site
    - <http://www.davidberroaproductions.webs.com>
  - App
    - Free or \$1.99



# STEGANOGRAPHIA

## Text in Pictures

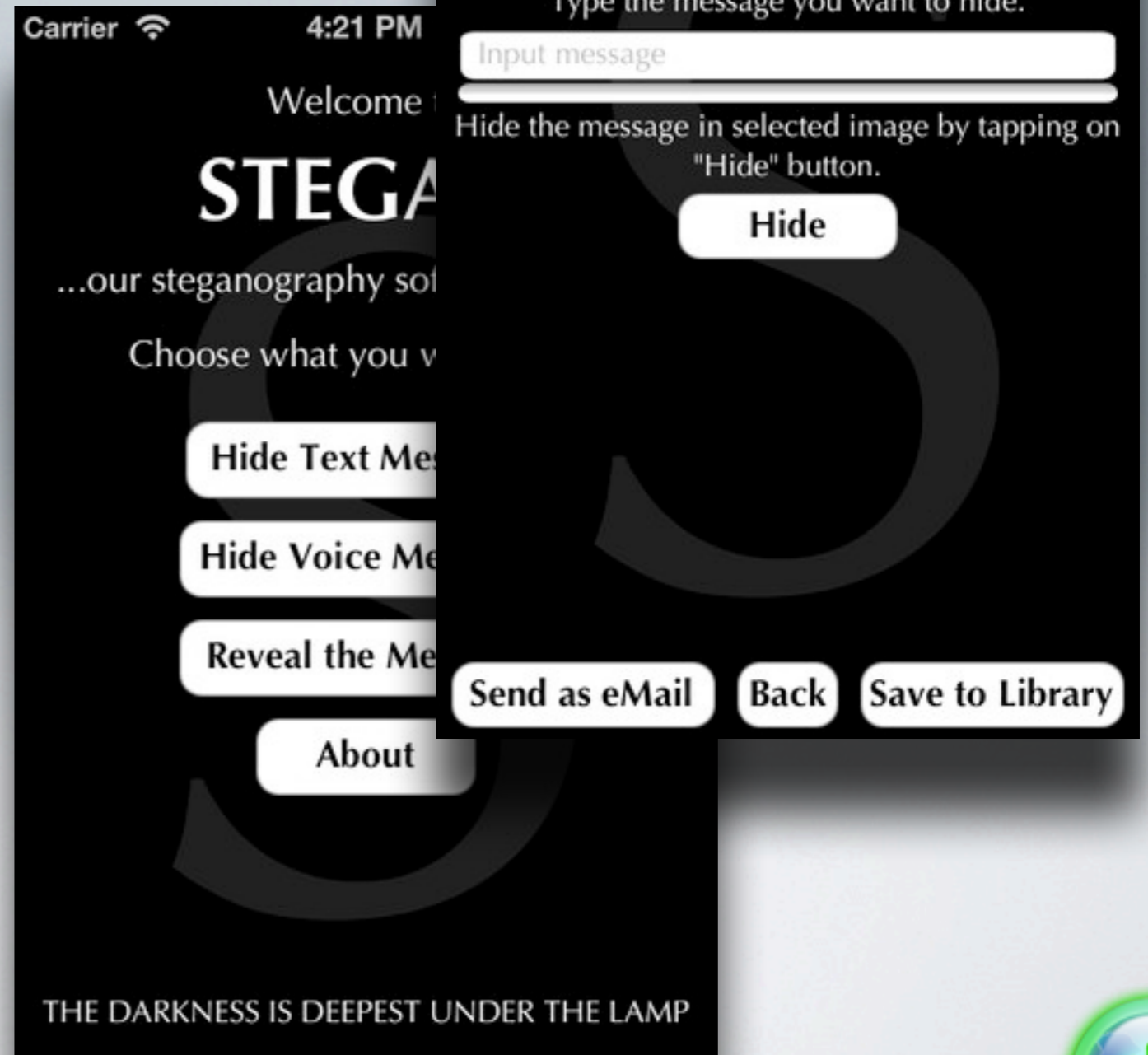
- Usability
  - Complicated interface.
- Technical
  - ASCII text in JPEG Images
  - From dev: The algorithm has 8 levels of robustness (1st level is less robust) so the message is still decodable even if the image is recompressed (such as occurs for the images published on Facebook or Twitter).
- Accessibility
  - Developer site
    - Luigi Orso - <http://steganographia.lodevelop.it/>
  - Free App
    - <https://itunes.apple.com/us/app/steganographia/id537627497?mt=8>



# STEGAIS

## Text and Audio in Pictures

- Usability
  - -
- Technical
  - Audio and Text
- Accessibility
  - Developer site
    - <http://stegais.com/>
  - Free App
    - <https://itunes.apple.com/us/app/stegais/id543862770?mt=>
    - Updated: Nov 08, 2012



A large, solid yellow heart is centered in the upper half of the slide.

# SYMBIAN

# NOKIA

Apps available publicly all over the world for download, installation and easy use.



# HIDDEN

## Pictures in Pictures

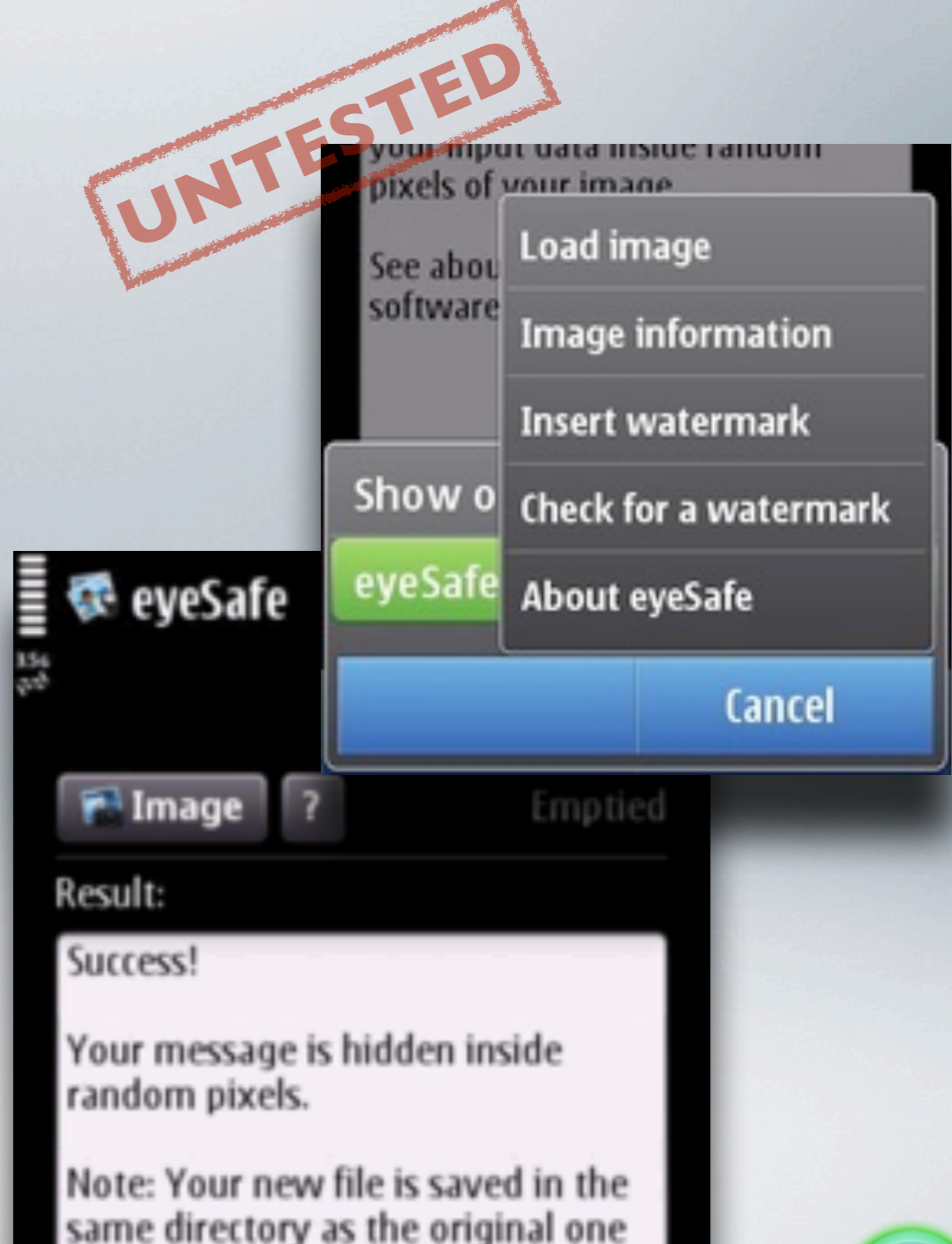
- Usability
  - *Not tested*
  - Saves images with hidden text
- Technical
  - Hides message of up to 500 characters to image
  - Send image via MMS
- Accessibility
  - Free App
    - <http://store.ovi.com/content/227938?clickSource=search&pos=1>



# EYESAFE

## Pictures in Pictures

- Usability
  - *Not tested*
- Technical
  - Advanced DSP ie invisible watermarking
- Accessibility
  - Free App
    - <http://store.oivi.com/content/100622?clickSource=search&pos=2>





# BLACKBERRY

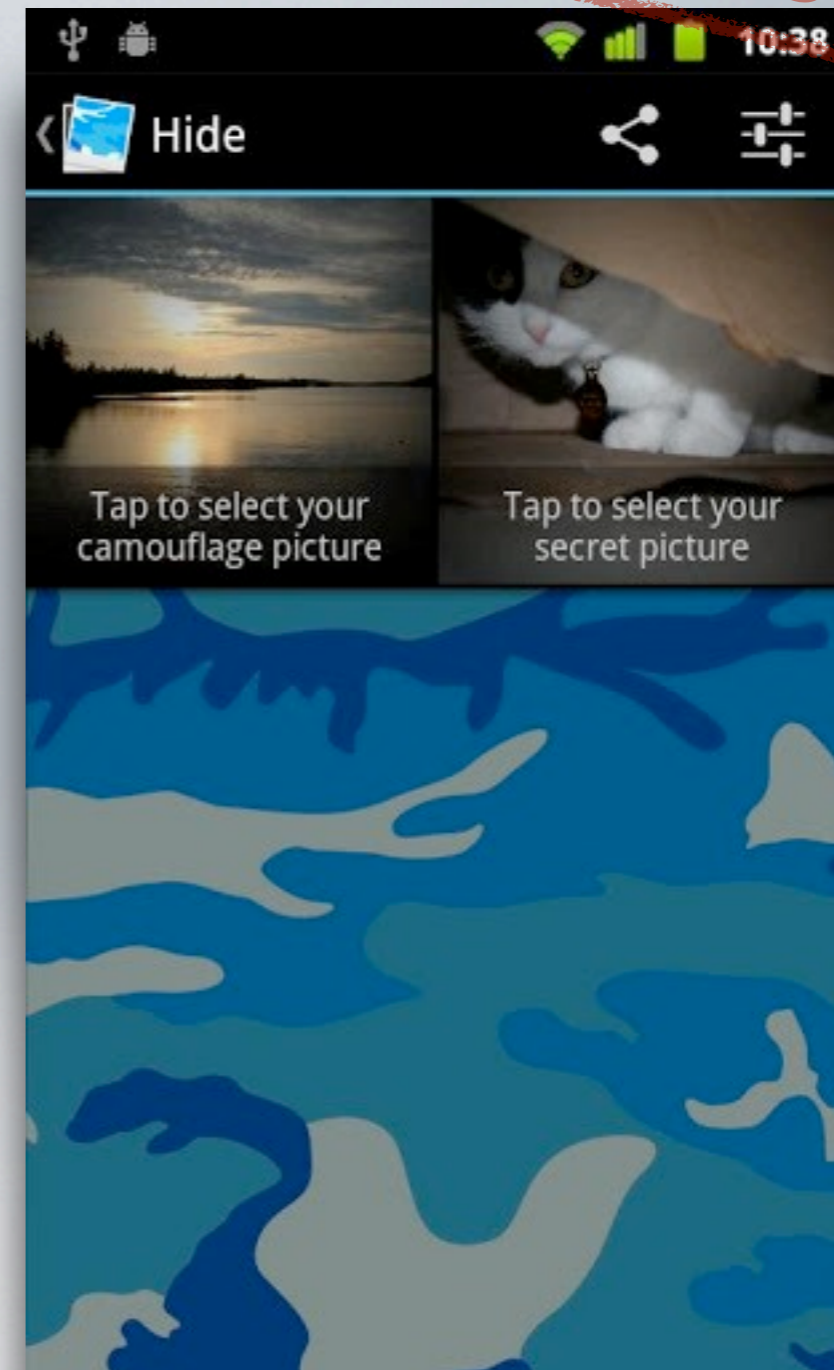
Apps available publicly all over the world for download, installation and easy use.



# CAMOPIC

## Pictures in Pictures

- Usability
  - Tap an image to flip it over and reveal the hidden picture behind it.
  - Users can preset sharing options
- Technical
  - Crops pictures square. and doesn't offer open option from dropbox
  - From dev: gmail & SMS compatible
- Accessibility
  - Developer site
    - <http://blog.repl.ca>
  - Developer Contact
    - [jbowes@repl.ca](mailto:jbowes@repl.ca)
  - \$.99 App
    - <https://appworld.blackberry.com/webstore/content/107992/?lang=en>
    - Last release: April 30, 2012



UNTESTED





# WINDOWS

Apps available publicly all over the world for download, installation and easy use.

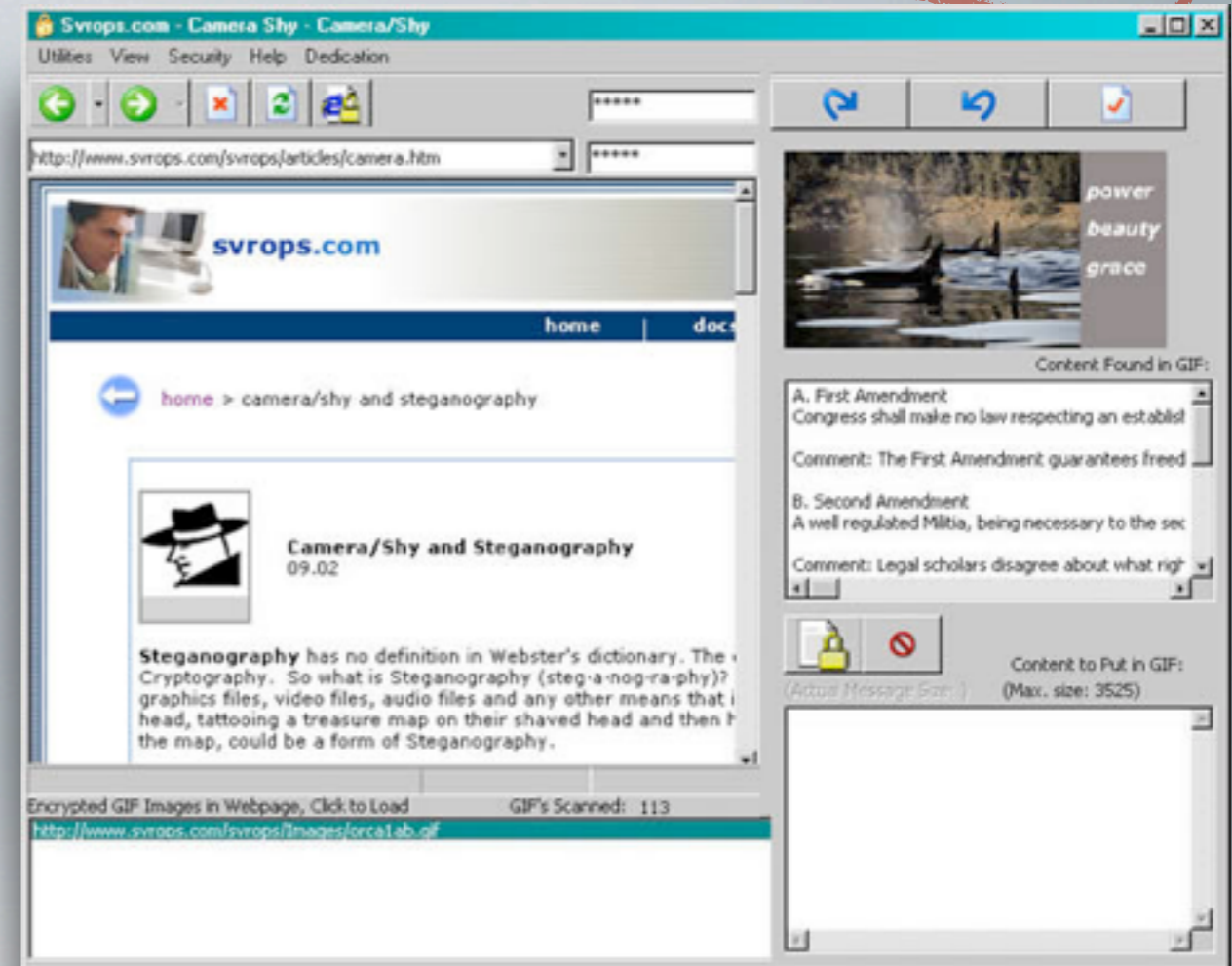


# CAMERASHY

UNTESTED

## Pictures in Pictures

- Usability
  - Automatically scans for and delivers decrypted content straight from the Web. It is a stand-alone, Internet Explorer-based browser.
- Technical
  - Language: Delphi/Kylix
  - From dev: Leaves no trace on user's system & has enhanced security
  - AVG identifies this as a virus
- Accessibility
  - License
    - GNU General Public License version 2.0 (GPLv2)
    - Last Update: 2009-07-16
  - Developer site
    - <http://sourceforge.net/projects/camerashy/files/>
    - <http://www.hacktivismo.com/about/>





# TESTING

Checking Apps Against Our Criteria:

Images (1) appear **unedited**, (2) appear **undistorted** and (3) are **recoverable**.



# (I) IMAGE APPEARS UNEDITED



Many of the apps produced rendering errors, warped in some way. Otherwise, images did not appear edited in any of the apps.



## (2) IMAGE APPEARS UNDISTORTED



*Trained analysts have not yet been engaged  
analyze whether distortion has occurred.*



# (3) APP EXCHANGE RECOVERABILITY

Tool	Recoverable*
Dropbox	Yes
Facebook	No
Flickr	Yes
Picassa	Camopic, Stegais
Instagram	No
Twitter App	Stegais

\*Only tested on Android & iOS





# GUARDIAN

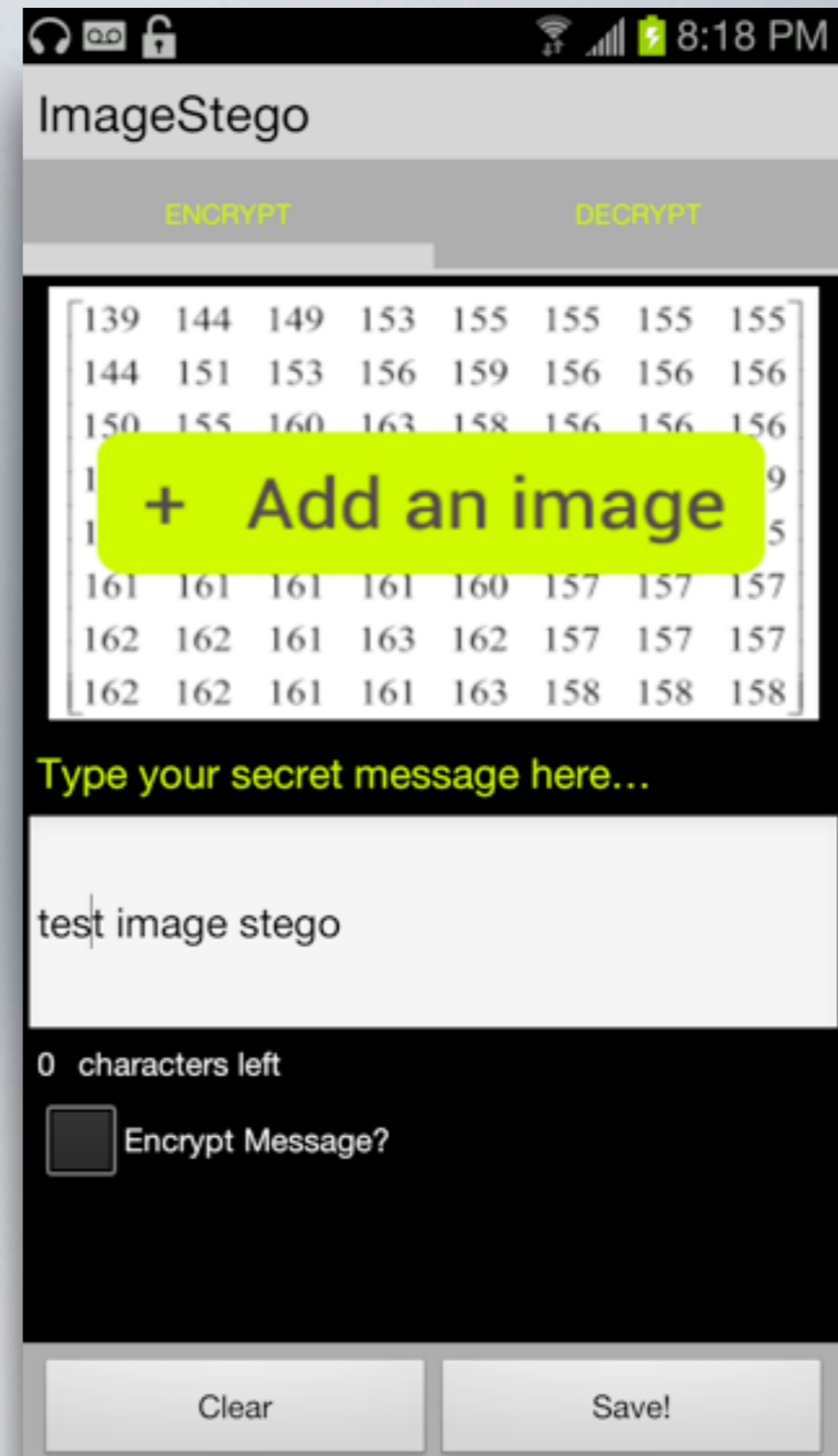
Initial experiments to show proof of concept.



# IMAGESTEGO

## GPG Encrypted Text in an Image

- Usability
  - Straightforward.
- Technical
  - Exploring options
    - PGP key lookup: requires data connectivity & possibly a telling move on an open network.
    - Proxy: Request can be proxies over Tor but data would still be required.
    - GPG-for-Android: Could be required but doesn't exist yet
- Accessibility
  - FOSS
    - <https://github.com/guardianproject/ImageStego/downloads>

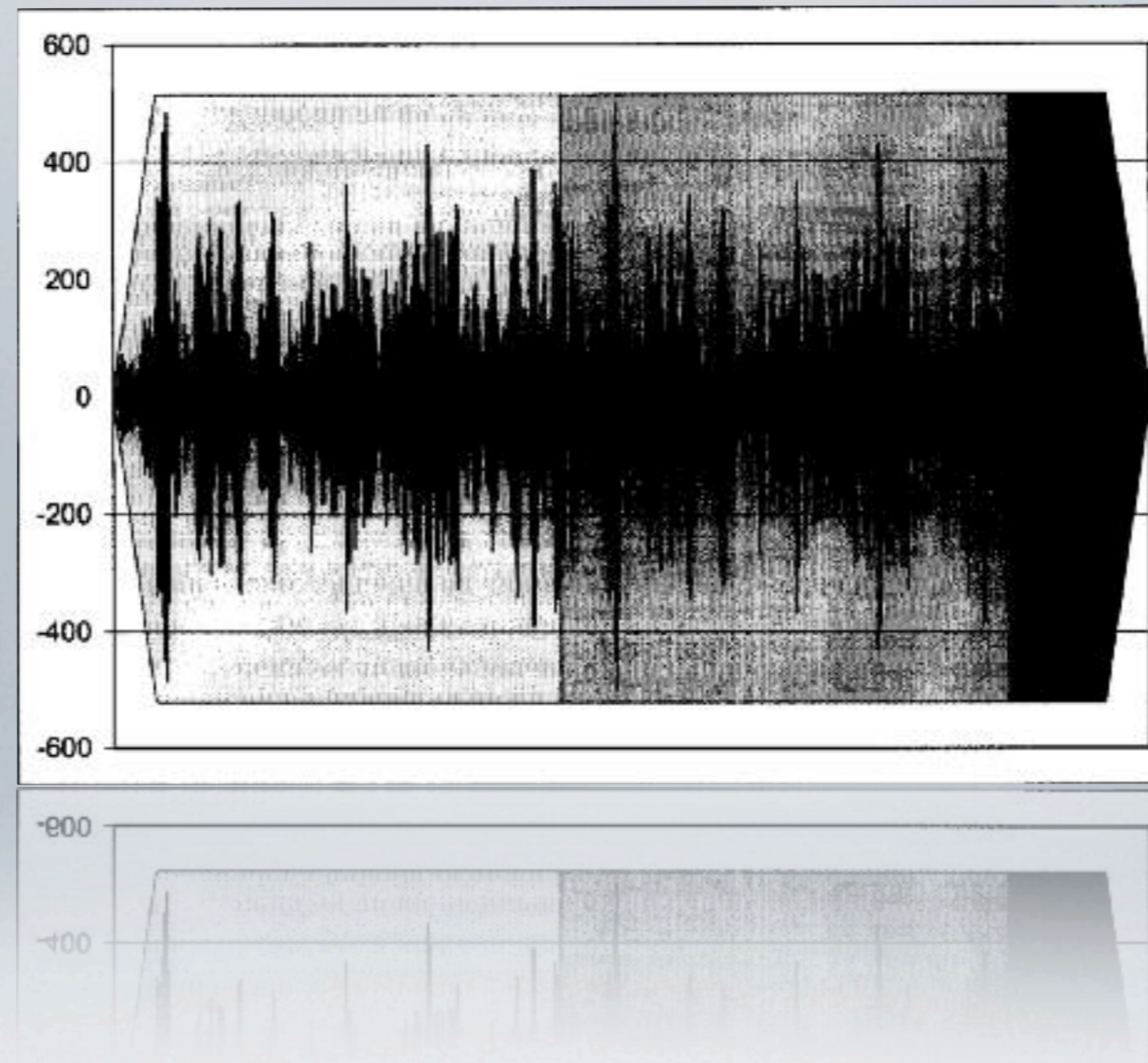


# QR ANIME

## Animated Image Data Transmission

- Usability
  - A video showing a series of QR codes plays to transmit data.
  - Functional on QR code readers that allow “bulk scan mode”
- Technical
  - Exploring integrity & maximum bitrate transfer that’s reasonable for average user.
- Accessibility
  - FOSS
    - <https://github.com/n8fr8/qranime>
    - <http://openideals.org/2012/02/10/qranime-aka-blipverts-aka-snowcrash/>





# AUDIO STEGANOGRAPHY

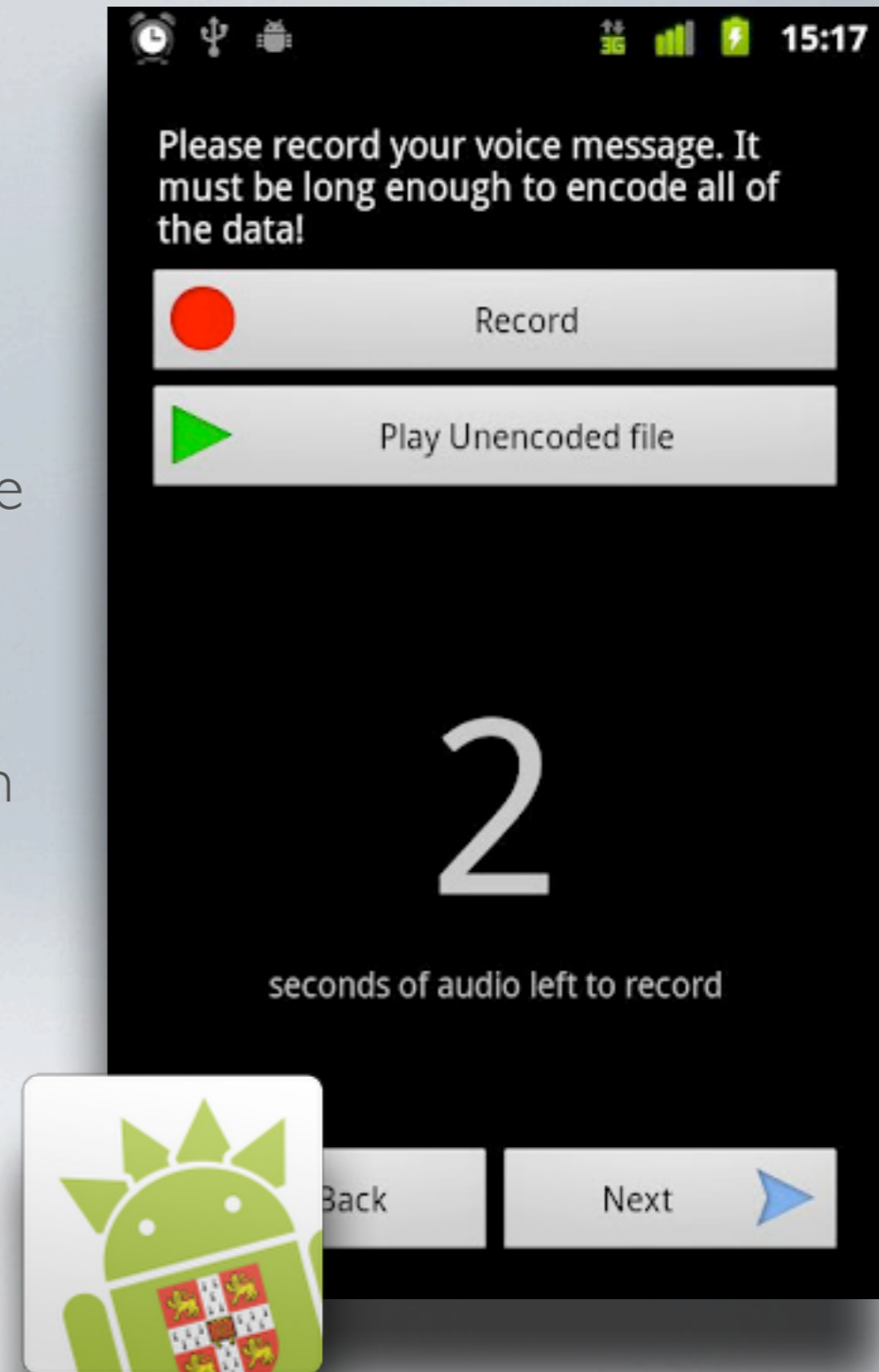
Landscape Analysis of Existing Tools on Different Platforms.



# STEGDROID

Voice recording according to length of hidden message.

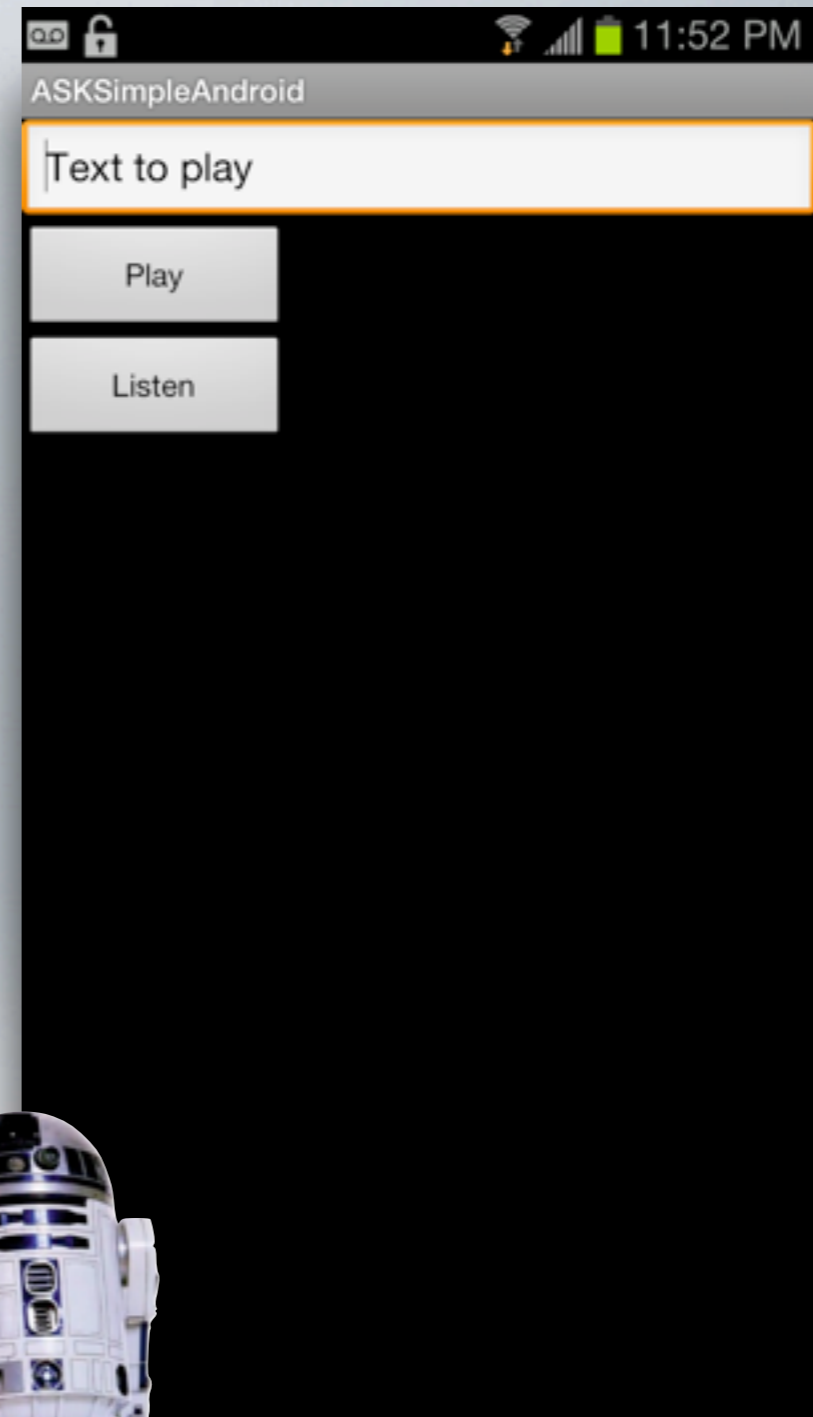
- Usability
  - One button to start.
- Technical
  - Records audio, and embeds a secret text message into the audio file using Echo Steganography.
  - Developed as part of Computer Science at the University of Cambridge.
  - From the dev: encoding is inaudible to the human ear, only complex steganalysis can determine whether the file has any data hidden in it. This method of data hiding is also resistant to transcoding between audio formats.
- Accessibility
  - Developer site
    - <http://www.tommedley.com>
  - Developer Code
    - <https://github.com/fredley/StegDroid>
  - Free App
    - <https://play.google.com/store/apps/details?id=uk.ac.cam.tfmw2.stegdroid>



# DIGITAL VOICES

Inter-machine aerial  
acoustic communications

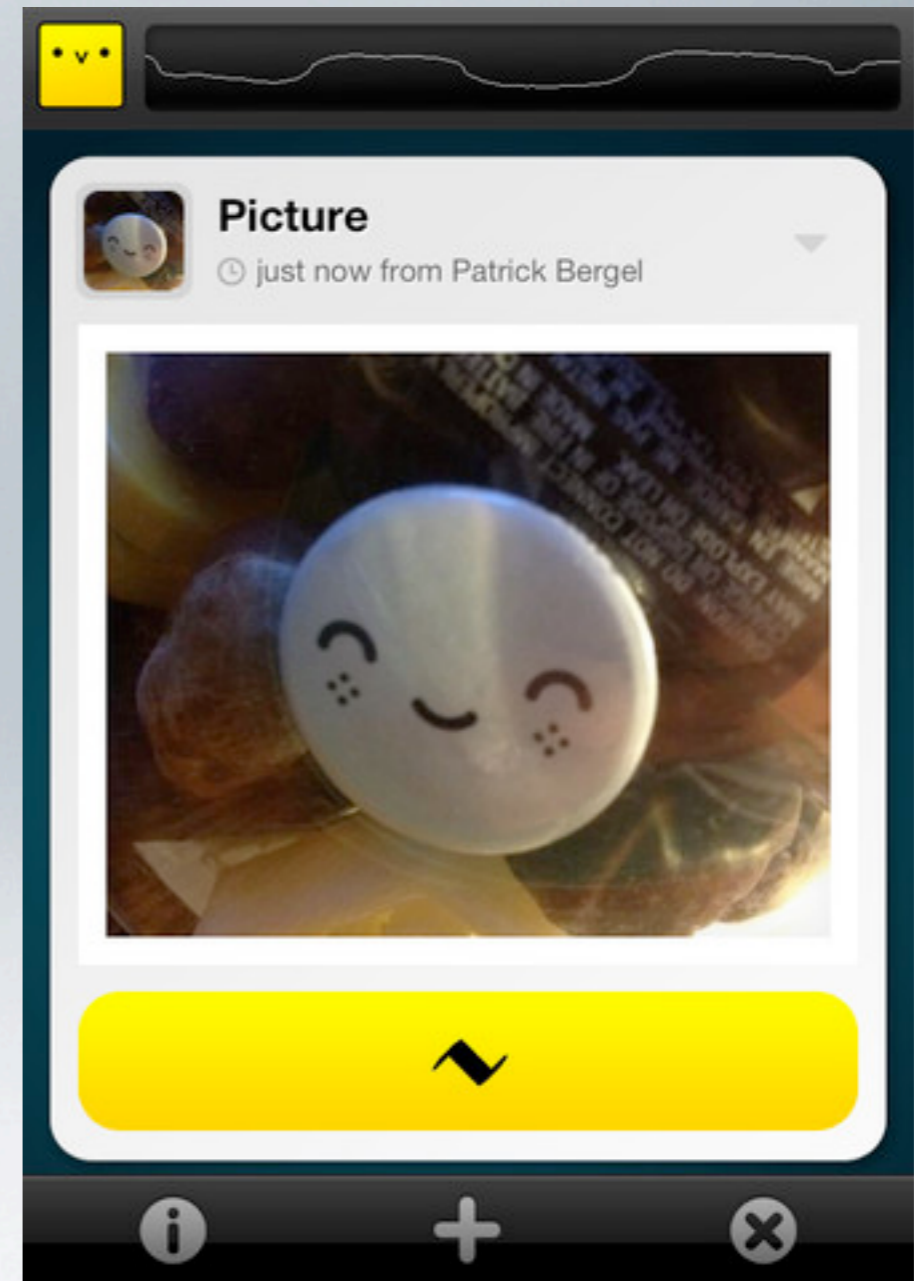
- Usability
  - Functional
- Technical
  - Network stack is built with MongoDB, nginx and Pyramids running on Amazon's cloud
  - Emits a series of sine tones between 1.7khz and 10.5khz with accurate timing
  - Encoding: Bach = 400 characters
  - This app is being developed as part of Xerox Parc by Prof. Crista Lopes
- Accessibility
  - Developer site
    - <https://www.ics.uci.edu/~lopes/dv/dv.html>
    - <http://tagide.com/>
  - Compiled Code
    - <https://github.com/diva/digital-voices/blob/master/ask-simple-android/bin/ask-simple-android.apk>



# CHIRP

Inter-machine aerial  
acoustic communications

- Usability
  - Chirp 'sings' information from one iPhone to another. Share photos, links, notes and more: all from the iPhone speaker
- Technical
  - Network stack is built with MongoDB, nginx and Pyramids running on Amazon's cloud
  - Emits a series of sine tones between 1.7khz and 10.5khz with accurate timing
- Accessibility
  - Developer site
    - <http://chirp.io/tech/>
    - <http://animalsystems.com/>
  - Free App



## Guardian Project & Steganography Moving Forward:

We're skeptical yet optimistic about steganography usage in the field. Most existing steganography tools are security through obscurity. Detection has become easier, but we're experimenting with new newer methods. Getting users to adopt the tools means insuring that these tools, are verifiably secure, and also usable. We're exploring options and reviewing best design practices from the field. Overall, this research and not a definitive study. We look forward to further focus, research, and collaboration in the field.





# THE GUARDIAN PROJECT

[WWW.GUARDIANPROJECT.INFO](http://WWW.GUARDIANPROJECT.INFO)

[INFO@GUARDIANPROJECT.INFO](mailto:INFO@GUARDIANPROJECT.INFO)

