What is good, bad, and ugly QR codes?

Educause 2022
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The Good Bad and Ugly QR Code

Everyone is going to have a slightly different way of thinking about the good bad and ugly QR code but here are my thoughts.

Poster session
10/26/2022 10:15:00 AM - 10/26/2022 11:00:00 AM and 3:00-3:45 PM (Mountain Time Zone)
Speaker: Robert Birkline, Manager of Web Technology, University of Houston

What is good, bad, and ugly QR codes?

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Definitions

Good:

A QR code that is place in a secure location with little chance of tampering. The QR code should also be easier for the user to scan and clearly demonstrate its intent.

Bad:

Bad QR codes are easily tampered with, forgeable or can be used in malicious activity.

Ugly:

This type of QR code has a bad implementation, kind of good and bad.

Poster questions and answers:

Q. When were QR codes first created? (DENSO WAVE INCORPORATED, n.d.)
A. 1994

Q. What are the smallest dimensions a QR code can be?
A. It depends on where the user will be scanning it from. Distance/10 should be the smallest. Example: 10 feet away (304 cm) / 10 = 30.4 x 30.4 cm. (QRTIGER, 2022)

Q. How much of a QR can be destroyed before it cannot be read?
A. 30% at level H (Wikipedia, n.d.) (DENSO WAVE INCORPORATED, n.d.)

Q. What can you scan in a QR code?
A. Anything that can be represented in text.

Q. Can you store the complete answer to this test in a QR code?
A. Yes,

> Q. When were QR codes first created? (DENSO WAVE INCORPORATED, n.d.)
> A. 1994
>
> Q. What are the smallest dimensions a QR code can be?

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A. IT DEPENDS ON WHERE THE USER WILL BE SCANNING IT FROM. DISTANCE/10 SHOULD BE THE SMALLEST. EXAMPLE: 10 FEET AWAY (304 CM) / 10 = 30.4 X 30.4 CM. (QRTIGER, 2022)

Q. How much of a QR can be destroyed before it cannot be read?
A. 30% AT LEVEL H (Wikipedia, n.d.) (DENSO WAVE INCORPORATED, n.d.)

Q. What can you scan in a QR code?
A. ANYTHING THAT CAN BE REPRESENTED IN TEXT.

Best Practices

1. QR codes should have a clear intent. Text such as "Scan Me" is not enough, text should include a @handle, URL or text indicating the intent.
2. Securing your QR code is important and should be able to be checked on regularly and verified periodically to make sure that QR codes have not been tampered with.
3. Damage to QR codes can cause trust issues. Make sure that you use the highest standard possible with allows for up to 30% of your QR code to be damaged before being invalid.
4. QR codes in digital delivery systems are the best because these types are difficult for them to be modified.
5. URL shorteners are discouraged because they hide the true intent of the QR code. There are some exceptions if being used to verify the intent.
6. Security of high importance, while QR codes provide convenience to the end user malicious people are looking for ways to exploited QR codes.

Tips to Protect Yourself (FBI, 2022):

- Once you scan a QR code, check the URL to make sure it is the intended site and looks authentic. A malicious domain name may be similar to the intended URL but with typos or a misplaced letter.

- Practice caution when entering login, personal, or financial information from a site navigated to from a QR code.
- If scanning a physical QR code, ensure the code has not been tampered with, such as with a sticker placed on top of the original code.
- Do not download an app from a QR code. Use your phone's app store for a safer download.
- If you receive an email stating a payment failed from a company you recently made a purchase with and the company states you can only complete the payment through a QR code, call the company to verify. Locate the company's phone number through a trusted site rather than a number provided in the email.
- Do not download a QR code scanner app. This increases your risk of downloading malware onto your device. Most phones have a built-in scanner through the camera app.
- If you receive a QR code that you believe to be from someone you know, reach out to them through a known number or address to verify that the code is from them.
- Avoid making payments through a site navigated to from a QR code. Instead, manually enter a known and trusted URL to complete the payment.

How are QR codes being used in Marketing (Noble Studios, 2021)

1. Link to your portfolio
2. Drive traffic to your website
3. Increase your social media following
4. Distribute coupons on print advertisements
5. Create personally relevant experiences

What Does the QR Landscape Look like in 2022? (O'Neill, 2021)

- 45% of responding shoppers from the United States stated they had used a marketing-related QR code in the three months leading up to the survey. The share was highest among respondents aged 18 to 29.
- 46.75% agreed on an increase in QR Code usage
- 96% growth in QR Code Reach

- 94% surge in the number of interactions
- 98% increase in the number of interactions per object
- This all adds to a 96% growth in total QR reach over the same 2018-2020 time period.
- 1 billion smartphones will access QR codes by 2022. Given that smartphone ownership increased 42% from 2014 to 2019, we can extrapolate that same increase for QR code usage.
- 11 Million households were forecast to have scanned a QR Code in 2020.

How Has Consumer Behavior Changed? (O'Neill, 2021)

- Access to high-speed mobile internet increased from 48.8% in 2014 to 61.2% in 2018
- Internet users have grown by 7.3% from Jan 2020 to Jan 2021
- Most secure location for scanning the QR Code : 42.55 % felt most secure at a restaurant, bar, or café. On the other hand, 19.4 % felt the same level of assurance at a gym, pool, or any other fitness center.
- It's estimated that by 2022, about 5.3 Billion coupon codes will be redeemed via QR Codes
- 38.99% of respondents want to see QR Codes used more broadly in the future.
- 57% scanned a food QR code to get specific information about the product
- 67% of the respondents agreed that these codes make life easier

Do Consumers have Concerns? (O'Neill, 2021)

- 37% were aware that a QR code can download an application and only 22% were aware that a QR code can give away physical location
- 49% stated they either do not have or don't know if they have security installed on their mobile device
- Two thirds of respondents felt confident that they could identify a malicious URL, but only 39% stated they could identify a malicious QR code
- 48% have concerns about QR codes but use them anyway

How Does Usage Vary Across Demographics? (O'Neill, 2021)

- The people are scanning QR Codes, what age groups do they fall under? Well, they're predominantly between 24 to 54 years of age.
- 16% of male respondents used their smartphones to scan QR codes to obtain information, while only 10% of female respondents stated they had done the same.

- 24% of Millennials and 18% of Gen Xers prefer to scan a QR Code to redeem an offer.

How Does Usage Vary Across the Globe? (O'Neill, 2021)

- **In the UK and Europe** 86.66% of smartphone users had scanned a QR Code at least once in their lifetime. 36.40 % scan at least one QR Code a week.
- The term QR Code was searched 60,000 times in **Australia** in 2021.
- **In Brazil and Europe**, QR Code usage is 7% and 8% of consumers, respectively, scanning QR Codes several times a week.
- **Chinese payment app, Alipay**, is the world's most used payment app in the world apart from social networking apps. 15 million SMB accept Alipay's QR Code payments in China
- **In China**, 50% of users scan QR Codes several times a week.
- 65% of consumers in **China** think QR codes on packaging instils trust.
- 40% of global QR code coupon redemption comes from the **Far East and China**.
- **In Brazil,** 75% of shoppers are ready to scan QR Codes on a regular basis to access shopping assistance
- 25% of **Irish adults** scan a QR code more than once per quarter
- 57% of **Canadian respondents** scanned a food QR code to get specific information about the product
- **The United States** alone has 1 million+ restaurants. 52% of them have already switched to QR code menus and the others are catching up.

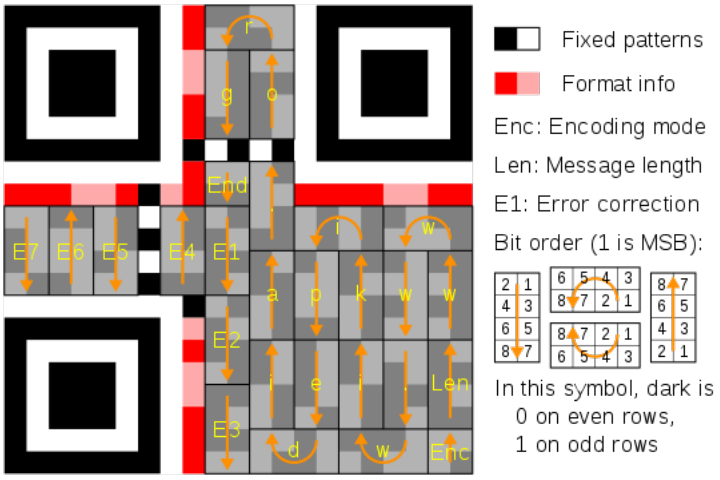
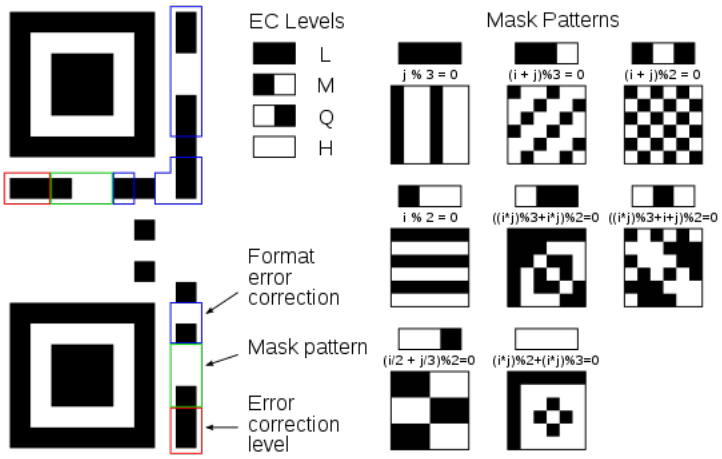
QR code facts.

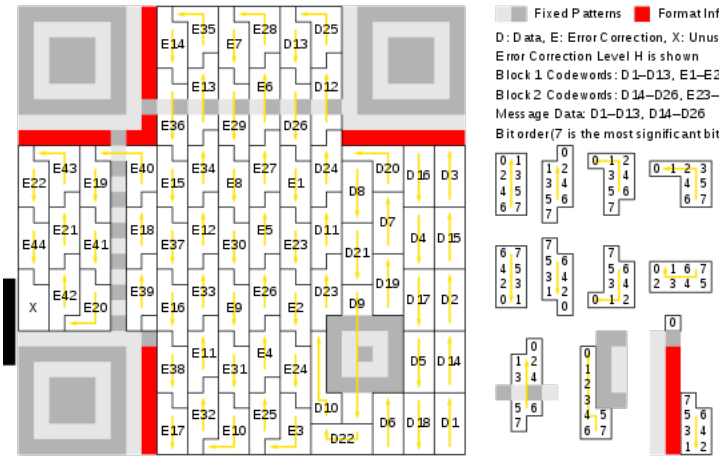
- QR codes are 10 times faster than other codes. (DENSO WAVE INCORPORATED, n.d.)
- "Unlike 1D bar (Rizwan, 2017)codes, QR Codes can store both numbers and alphabets. A QR Code can store up to 7,089 numeric characters (without spaces). Or 2,953 alphanumeric characters with spaces and punctuation." (Rizwan, 2017)
- 30% or less of a QR code can be removed and it will still function (DENSO WAVE INCORPORATED, n.d.) (Wikipedia, n.d.)
- The QR code was invented in Japan; They required more storage to code kanji characters into bar codes. (DENSO WAVE INCORPORATED, n.d.)
- The QR code was first adopted by the auto industry for us in their electric Kanban (A communication tool used in production management systems) (DENSO WAVE INCORPORATED, n.d.)

- While the DENSO WAVE group retains the rights to the QR code as a patient, but it declared that it would not exercise them. They wanted it to be used as a "public code" all over the world. (DENSO WAVE INCORPORATED, n.d.)
- The QR code was created in 1994 but it became widespread in Japan in 2002, 8 years after its creation. (DENSO WAVE INCORPORATED, n.d.)
- In 2000 the QR code was approved to be into the ISO international standard.

- QR codes can come in different formats. It is well known but other such as iQR can store more information. (DENSO WAVE INCORPORATED, n.d.)

How QR codes are included (Wikipedia, n.d.)

	Message placement within a QR symbol. The message is encoded using a (255,249) Reed Solomon code (shortened to (24,18) code by using "padding") which can correct up to 3 byte errors.
	Meaning of format information. In the above figure, the format information is protected by a (15,5) BCH code, which can correct up to 3 bit errors. The total length of the code is 15 bits, of which 5 are data bits (2 EC level + 3 mask pattern) and 10 are extra bits for error correction. The **format mask** for these 15 bits is: [101010000010010]. Note that we map the masked values directly to its meaning here, in contrast to image 4 "Levels & Masks" where the mask pattern numbers are the result of putting the 3rd to 5th mask bit, [101], over the 3rd to 5th format info bit of the QR code.



Larger symbol illustrating interleaved blocks. The message has 26 data bytes and is encoded using two Reed-Solomon code blocks. Each block is a (255,233) Reed Solomon code (shortened to (35,13) code), which can correct up to 11 byte errors in a single burst, containing 13 data bytes and 22 "parity" bytes appended to the data bytes. The two 35-byte Reed-Solomon code blocks are interleaved so it can correct up to 22 byte errors in a single burst (resulting in a total of 70 code bytes). The symbol achieves level H error correction.

Other interesting reading

FBI Warns That Cyber Criminals Now Using QR Codes for Theft
https://www.govtech.com/security/fbi-warns-that-cyber-criminals-now-using-qr-codes-for-theft

Oregon FBI Tech Tuesday: Building a Digital Defense Against QR Code Scams
https://www.fbi.gov/contact-us/field-offices/portland/news/press-releases/oregon-fbi-tech-tuesday-building-a-digital-defense-against-qr-code-scams

Cybercriminals Tampering with QR Codes to Steal Victim Funds
https://www.ic3.gov/Media/Y2022/PSA220118#:~:text=Malicious%20QR%20codes%20may%20also,withdraw%20funds%20from%20victim%20accounts.

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Rizwan, Z. (2017, November 28). *Scanova Blog*. Retrieved from QR Code Facts: https://scanova.io/blog/blog/2017/11/28/qr-code-facts/

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