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QR Codes and Modern Marketing

An examination of the marketing potential, U.S. market adoption, and functionality of QR codes.

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Introduction

What Are QR Codes?

QR codes are a new type of two-dimensional barcode capable of storing a massive amount of information, and therefore have significantly more applications than the standard bar code. This makes them an excellent tool for marketing to smartphone users, aided by the fact that free QR code scanners are available through most app stores. Smartphone users can scan a QR code that then directs them to a host of options including websites, specific apps, electronic business cards, and more.

QR codes were developed in Japan in the 1990s as a better method for labeling auto parts, and the concept quickly spread to other industries. While used extensively in Japan for years, they have only recently begun to enjoy widespread use in the United States, fueled primarily by the rapid adoption of smartphones.

QR code

How to Use QR Codes

QR codes are extremely simple to use and do not require special equipment to scan or create. This low entry barrier is partially responsible for the rapid adoption of QR codes in North America and Europe. Simply open a barcode scanning app, aim the phone's camera at the QR code, and wait for the camera to read the barcode.

Uses For QR Codes

QR codes enable marketers to link the digital and physical world, making otherwise static advertisements "clickable." They have a wide variety of uses, but possibly the most important is the ability to launch URLs in the mobile web browser. This feature is a very basic concept, but to the creative marketer, it represents a giant leap forward in direct and point-of-purchase marketing. Anything that can be put on a web page can now be attached directly to physical signage in the real world. Advertisements on the street can be linked directly to a purchase page, and contest announcements can link participants directly to a sign-up page.

Another effective use for QR codes is in reordering material goods. QR codes placed on product labels can be linked to reordering pages, increasing the convenience of reordering and improving the likelihood of repeat sales.

U.S. Market Adoption

Global QR code usage has exploded over the past few years. According to reports published by Mobio Identity Systems, QR code scans increased by 4,549% from Q1 2010 to Q1 2011. Widespread adoption by hundreds of major brands such as Ford, Calvin Klein, Redbox, Starbucks, and Coca-Cola has helped to push the technology into the limelight.

With these major brands behind the technology, QR codes are quickly becoming a pervasive tool. According to a study conducted by Austin & Williams, 52% of people in the United States have seen or heard of a QR code, and 28% have scanned one. At the current rate of growth that QR codes are currently experiencing, those numbers will only continue to skyrocket. According to a report by comScore Inc., a leader in measuring the digital world, in the month of June, 2011, 14 million mobile users in the United States scanned a QR code on their mobile device.

QR code users tend to be young to middle-aged individuals. According to the comScore report, 53.4% of QR code scanners in June were between the ages of 18 – 34 and over sixty percent of the scanning audience was male.

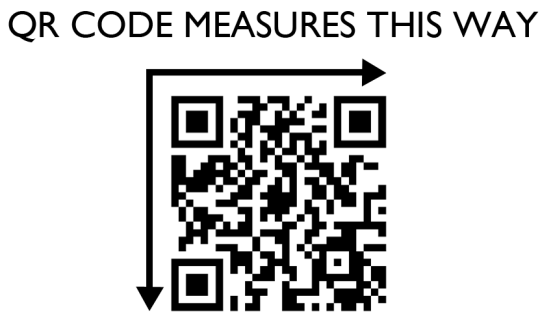
How QR Codes Work

Conventional barcodes are 1-dimensional, meaning they only measure sideways. When the scanner shines the laser on the barcode, it makes no difference whether it scans the very top of the code or the very bottom as long as it makes it all the way across from one side to the other.

That's not the case with QR Codes. QR codes are a type of "matrix barcode," or "2-Dimensional" (2D) barcode, meaning that they are arranged like a grid. 2D barcodes measure both side-to-side and up and down, and because height is a measuring factor, the traditional black bars are replaced with black squares called "modules" or "data points."

The modules are arranged into patterns to encode the barcode's information, similar to how letters are arranged into patterns to make words. These individual patterns are called "codewords."

There are currently 49 different types of 2D barcodes. QR codes are by far the most commonly used. Most types of 2D codes are proprietary technology belonging to American corporations, and are more often used by manufacturers for internal functions than used externally for marketing to the public.



QR codes were originally developed and patented by Denzo Wave, a subsidiary of Toyota, but have since been released as public domain and are free to use for both personal and commercial purposes.

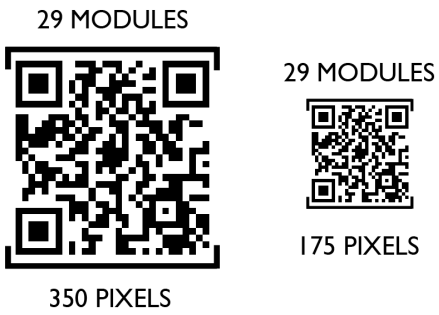
QR Code Size

There are two methods of measuring QR codes: pixel size and module size. Both methods are similar and often confused, but there are distinct differences between the two.

Pixel size refers to the physical dimensions of the QR code as it would appear on a screen, such as 350px x 350px. Pixel size does not denote the number of modules or data capacity, and can be changed without affecting the contents of the code.

Module size refers to the number of modules that compose the code both from top to bottom and side to side, such as 21 x 21. Module size does not denote the physical dimensions of the code, but rather the number of modules and, therefore, the data capacity. Consequently, module size cannot be changed without affecting the contents of the QR code.

DIFFERENCE BETWEEN MODULES AND PIXELS AS MEASUREMENTS



QR Code Capacity

There are three main factors that determine the amount of information any given QR code can contain:

1. Version (module size)
2. Error Correction Level
3. Type of Characters Encoded

Version/Size

The physical dimensions of a QR code determine how much information it is capable of storing. There are two general methods of describing the size and capacity of a QR code. As described above, "pixel size" refers to the physical width and height of the code, whereas "module size" refers to the number of modules. QR codes are usually measured in modules rather than pixels or inches, however the "modules" unit does not necessarily denote physical dimensions.

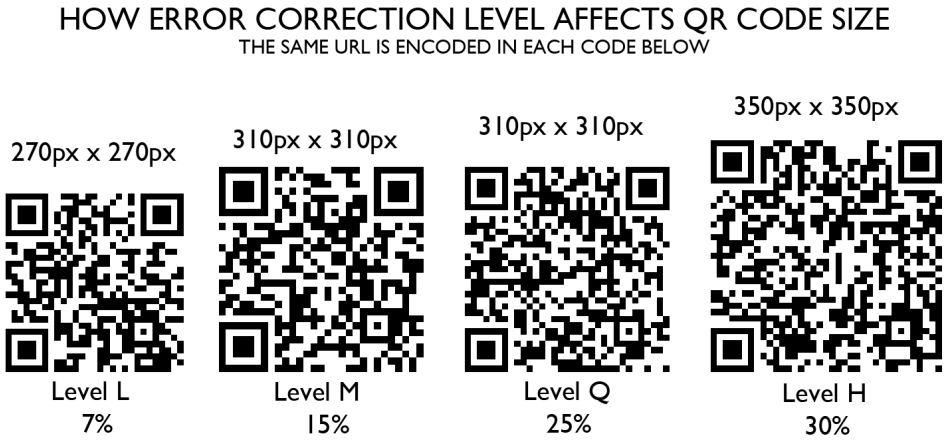
QR codes come in 40 different sizes, called "versions." Each version increases in increments of 4 modules. Version 1= 21 x 21, version 2 = 25 x 25, etc., all the way up to Version 40, which is 177 x 177 pixels.

Error Correction Level

The difference between QR code levels (L, M, Q, H) is the level of error-correction they provide. The lowest level, "L," can withstand destruction of up to 7% of the total codewords before it stops working. The highest level, "H," can have up to 30% damaged before it breaks.

The higher the error correction level, the more data points there are in the QR code — meaning a larger, more complex QR code.

Choosing a low error correction level is appropriate when QR codes are being displayed in small spaces and when damage is unlikely. Conversely, in situations where QR codes are at risk of damage, defacement, or dirtying, such as on an outdoor sign, a higher error correction level is appropriate.



What Can You Encode

QR codes are capable of encoding more than one type of character. The more complex the type of character encoded, the fewer characters the code can hold. In total, there are 4 different types of characters supported by QR codes:

1. Numeric characters include the numbers 1, 2, 3, 4, 5, 6, 7, 8, 9, and 0. The largest QR code (Level 40) can hold up to 7,089 numeric characters.

2. Alphanumeric characters include the English alphabet, as well as numbers. The Largest QR code (Level 40) can hold up to 4,296 alphanumeric characters. That's enough for a 4 page paper, double spaced in 12pt Times New Roman!

3. Binary is comprised of strings of 1s and 0s (e.g. 11100111) and is the most basic language of which computer programs are composed. The largest QR code (Level 40) can hold up to 2,953 binary characters.

4. Kanji characters are Japanese written characters (QR codes were developed in Japan). Because of the vast number of different characters and the complexity of those characters, QR codes cannot encode as many of them. The largest QR code can hold up to 1,817 Kanji characters.

Error Correction

An important feature of QR codes is their designed ability to function normally even after sustaining damage. This protects QR codes from damage and dirtying, and greatly increases their real-world usability. In each codeword, an algorithmic code is added as a "backup" in order to piece the information back together in the event of damage. If some of the original data points are missing, this "backup" data around them recreates the missing or damaged information.

The tradeoff is that adding this algorithm takes up a lot of physical space. In order to work properly, the ratio of backup data points to regular data points is 2/1 and they must be added to each individual codeword throughout the entire QR code.

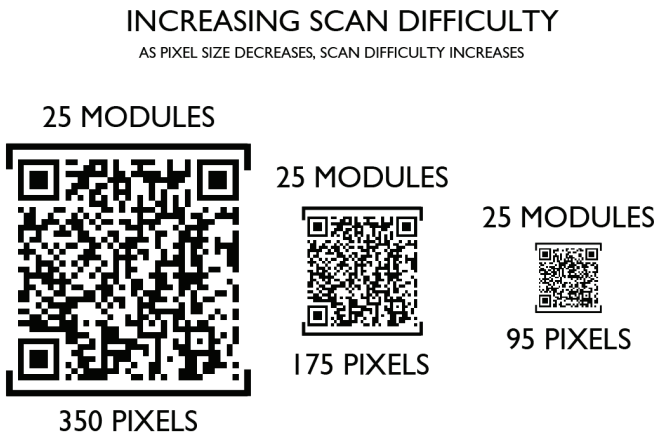
This means that if you have 20 data points in a given codeword and you want to "back up" all of them, you have to add an extra 40 data points of backup code. This triples the total size of each codeword throughout the entire QR code from 20 data points to 60.

Because QR codes offer a limited amount of space, several different levels of error-correction are available: 7%, 15%, 25%, and 30%.

Depending on the level of error correction selected, up to 30% of all the data points in the QR code can be damaged or deleted, and the algorithm will still be able to piece it back together instantly. It doesn't matter which data points are missing as long as the percentage is lower than the error-correction rate.

Choosing the Proper Error Correction Level

Adding a higher error correction level to a QR code allows for faster scanning with a smartphone, but as explained above, also significantly increases the size of the code. Because most QR codes will be displayed in a location with limited space, it is not always possible to have large codes.



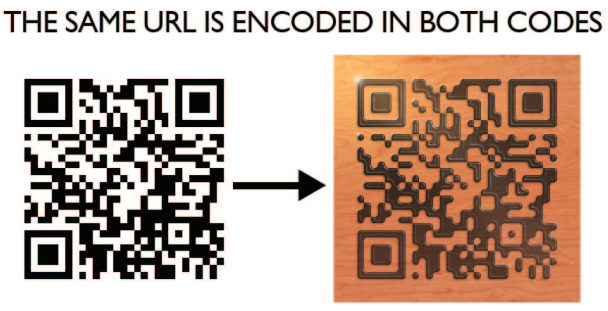
For example, if a QR code is created for a business card, then the size of the code is limited to the available space on the card. The pixel size of a large QR code can be shrunk to fit on the business card, however in doing so the code's details may become so fine as to be unreadable to the relatively unsophisticated smartphone camera.

Unfortunately, there is no method to predict that point other than trial and error. When using QR codes, always scan the code with multiple devices and scanner programs before running them. If the code fails to scan or requires several attempts, a lower error correction rate should be used or pixel size should be increased.

Code Customization

Designer QR codes

Because QR codes can lose up to 30% of their total stored data and continue to work, it is possible to create designer codes by adding logos, colors, and even changing the entire theme. Simply changing the colors and rounding the edges of modules can drastically soften the look of a QR code. There are several code generators today that offer designer colors and automatic logo placement; however, in order to achieve a truly customized layout, it is necessary to create the code manually with a graphics program such as Photoshop. For an explanation of which elements of QR codes can be removed and which must be included, refer to the illustration on the next page.



Anatomy of a QR Code

Element Descriptions

- The Position Detection Patterns allow the scanner to identify the code as a QR code. The lack of a fourth pattern in the bottom right corner allows for quick determination of orientation and tells the scanner which side is the top even if the code is rotated.
- The Alignment Pattern allows the scanner to correct for distortion when the code is bent or curled.
- The Timing Pattern determines the coordinates of the code. These patterns connect all three Position Detection Patterns and are comprised of alternating black and white modules.
- The Format Information is located next to all three Position Detection Patterns and contains the code's error correction rate and mask pattern. This is the first element to be read by a scanner.
- The Version Information identifies the version of the QR code, which determines data capacity and error correction level.
- The Encoded Data contains all the data that the QR code contains, such as a URL, text, etc.
- The Quiet Zone is a 3-module wide empty space left around the code. It should be noted that this required part of QR codes is necessary for proper scanning.