

Age Differences in the Knowledge and Usage of QR Codes

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Abstract. The adoption of a new technology is often affected by its perceived utility and ease of use, both of which could vary by age due to cognitive differences. A recently invented technology, the quick response (QR) code, enables smartphone users to access content on their mobile devices by scanning two-dimensional barcodes. In this paper, we examine awareness, knowledge, and usage of QR codes across different age groups in the United States, using a representative survey. Controlling for demographic characteristics, we find that older adults were only 13% as likely as younger adults to have used a QR code. We discuss survey results and implications for future research.

Keywords: age, technology usage, technology adoption, QR, quick response.

1 Background

In recent years, there has been a rapid increase in the adoption of smartphones among U.S. adults, with an estimated increase in usage from 35% in May 2011 to 45% in September 2012 [1]. As levels of smartphone ownership increase, advertisers are taking advantage of the opportunity to engage consumers at their point of interest in a product by utilizing quick response (QR) code technology. The QR code is a two-dimensional barcode that was first used in 1994 [2]. QR codes are commonly used via smartphone applications (“apps”) that scan a code using the device’s camera. After the code has been scanned, the app displays content, such as a web link, video, or text. While there has been an increase in QR codes, their use is limited by whether or not people adopt this new technology [3].

In the Information Systems field, the technology acceptance model (TAM) is a well-established theoretical framework that explains the adoption of new technologies [4]. According to TAM, two of the key determinants in whether or not people will accept or reject a new technology are the perceived usefulness and perceived ease of use of the technology [5]. Thus, in examining the adoption of QR codes, it is important to keep these in mind.

Much research in psychology examines age-related differences in cognition. For example, speed and reaction time are well known to decrease with age [6], and this may significantly impact technological adoption [7]. Specifically, Morris and

Venkatesh found that older workers placed a higher priority than did younger workers on the ease of using a new technology in deciding whether or not to adopt it [7]. Thus, in this study, we examined the relationship between age and adoption of QR-code technology. Specifically, we hypothesized that awareness, knowledge, and usage of QR codes would be highest among younger adults and lowest among older adults.

2 Methods

Data were collected using the GfK KnowledgePanel®, an online panel that recruits members through probability-based sampling in order to ensure representativeness of the U.S. population [8]. The original goal of the survey was to poll youths' influencers on a quarterly basis. Panel members were screened to ensure they were parents of young people ages 12–21, grandparents of young people ages 12–21, or other adults ages 25+ who reported interacting regularly with young people ages 12–21, such as teachers, guidance counselors, and coaches. Following data collection, which occurred between July 2011 and June 2012, we redefined our groups by age so we could evaluate age-related differences. In all, there were 4,541 valid responses from 982 younger adults (ages: 25–39; mean age = 32.9), 2,654 middle-age adults (ages: 40–59; mean age = 48.2), and 905 older adults (ages: 60–94; mean age = 68.8).

Questions were asked to assess awareness, knowledge, and usage of QR codes. Respondents were first shown an image of a QR code and were asked, “Do you know what this is?” People who responded “Yes” (and thus had awareness of QR codes) were then asked, “Do you know how it is used?” and “Please describe how it is used.” Those who responded “Yes” to the first question (and thus had knowledge of how to use QR codes) were then asked, “Have you ever used one in the past?” and if so, “Where was it located?” and “What was it used for?”

For open-ended items, codes were designed to allow for quantitative analysis of the responses. Responses were coded independently by two coders, and after this initial coding, the coders discussed the codes that did not match and agreed on final codes for each item.

For the open-ended item about QR code knowledge (“Please describe how it is used”), responses were coded into three mutually exclusive bins that indicated level of understanding. The first bin, “clearly/probably understands,” encompassed responses that indicated the specific and correct name for QR codes, described specifically how to use one, and/or described a specific and correct outcome of using one. The second bin, “possibly understands,” comprised responses with a description that could apply to a QR code but that failed to differentiate QR codes from barcodes. The third bin, “no indication of understanding,” comprised incorrect descriptions, responses of “don’t know,” and refusals.

Open-ended responses to the two usage questions were coded, and the results were used to help guide the development of new closed-form questions on usage, which replaced the previous questions about usage in the fourth quarter of data collection (Apr–Jun 2012).

3 Results

First, we examined QR code awareness, knowledge, and usage by age, and we found significant age-related differences for all three. We conducted logistic regressions to predict awareness, knowledge, and usage based on age, smartphone ownership, Internet access, income, education, and gender. Age was found to be a significant predictor of awareness, $\text{Exp}(\beta) = 0.976$, $z = -5.82$, $p < .001$, with the model explaining 12.2% of the variance; age significantly predicted knowledge, $\text{Exp}(\beta) = 0.974$, $z = -6.25$, $p < .001$, with 12.6% of the variance explained; and age significantly predicted usage, $\text{Exp}(\beta) = 0.968$, $z = -5.00$, $p < .001$, with 25.0% of the variance explained.

Running the logistic models again using the three age groups, we found significant differences between each age group, with awareness, knowledge, and usage highest among younger adults and lowest among older adults. See Figure 1.

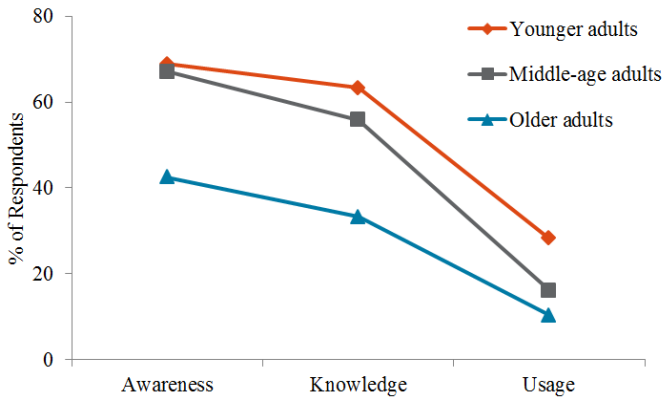


Fig. 1. Awareness, knowledge, and usage were highest for younger adults and lowest for older adults.¹ Controlling for income, education, and gender, older adults were 13% as likely as younger adults to have used a QR code. When also controlling for smartphone ownership and Internet access, older adults were 37% as likely as younger adults to have used a QR code.

Next, we examined if there has been change over time regarding QR code awareness, knowledge, and usage and whether this varied by age. We examined the four waves in which the QR code questions fielded (2011, third quarter; 2011, fourth quarter; 2012, first quarter; 2012, second quarter). We found that across all waves, QR code awareness, knowledge, and usage were lowest among older adults and highest among younger adults. See Figure 2. Awareness, knowledge, and usage increased across all age groups from the third quarter of 2011 to the second quarter of 2012. While usage increased by only 6%–7% for each of the three age groups, knowledge and awareness increased the most among middle-age adults.

¹ Proportions displayed for Figures 1, 3, and 4 are from the most recent wave of data collection.

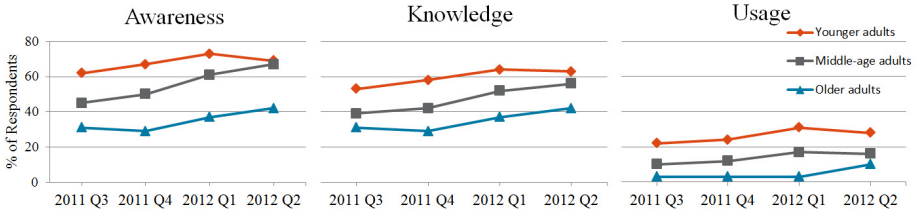


Fig. 2. QR code awareness, knowledge, and usage by age group and wave

Given that these measures of knowledge and usage of QR code were self-reported, it is possible that respondents who confused QR codes with barcodes incorrectly reported knowledge of them, leading to overestimates. In fact, analysis of coded open-ended data indicated that while 77% of younger adults and 76% of middle-age adults who reported knowing how to use a QR code were able to indicate a clear understanding of how to use one, only 64% of older adults reported knowing how to use one. See Figure 3. Many respondents in the older age group did not distinguish QR codes from barcodes in their descriptions, and some provided incorrect descriptions of how to use QR codes. This indicates that the knowledge and usage age differences may be greater than they appear in the self-reported knowledge and usage measures.

Part of the decreased awareness, knowledge, and usage of QR codes among older respondents could be due to their lower levels of smartphone ownership. In April–June 2012, only 17% of older respondents reported having a smartphone, compared with 38% of middle-age adults and 58% of younger adults. Many older respondents reported not owning any type of mobile phone, and among those who did report ownership, less than one third of these phones were smartphones. See Figure 3.

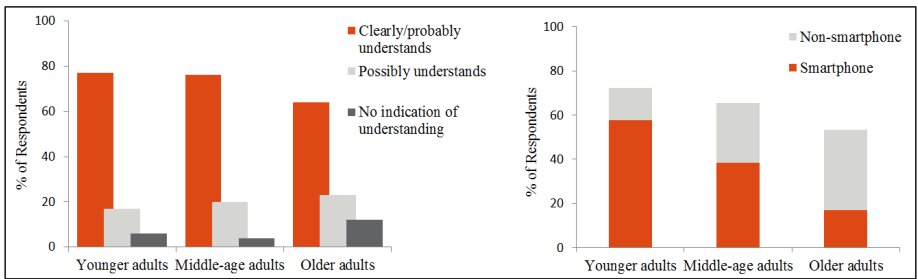


Fig. 3. Left panel: Percent of respondents who indicated understanding how to use a QR code, by age group. Right panel: Reported mobile phone ownership by age group.

Among the younger and middle-age adults who indicated using QR codes, overall trends in the locations of QR codes used were similar. For example, both age groups reported using a QR code on an advertisement, on the Internet, and on a letter with similar frequency. Younger adults, however, were nearly twice as likely to report using one that was on a billboard, poster, or sign (37%) than middle-age adults (22%). See Figure 4 for a depiction of reported locations of QR code usage.

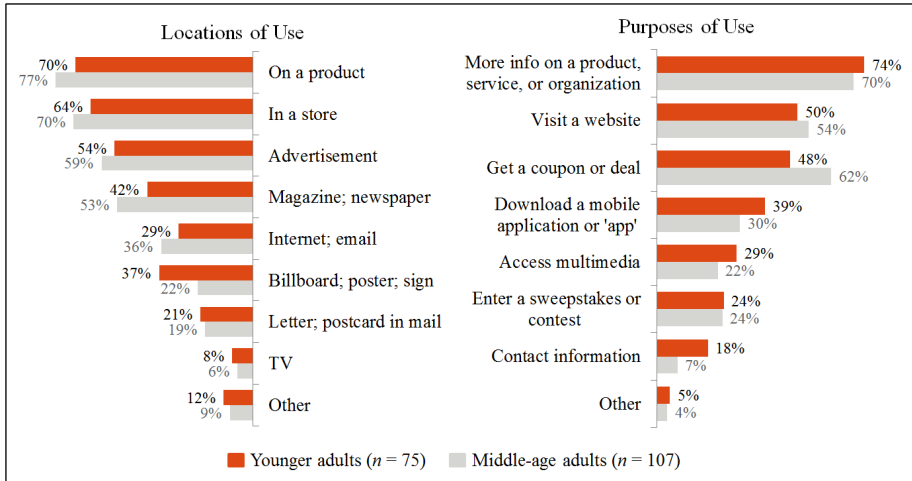


Fig. 4. Left panel: Reported locations of QR code usage, for younger adults and middle-age adults. Right panel: Reported purposes of QR code usage, for younger adults and middle-age adults. *Note: Data are not displayed for older adults due to insufficient sample size (n=20).*

Similarly, the purposes of using QR codes were relatively similar among younger and middle-age adults who reported using a QR code in the past, with few differences. Middle-age adults were more likely to use QR codes to get coupons or deals, whereas younger adults were more likely to use QR codes to download apps, access multimedia, or get contact information. See Figure 4.

4 Summary and Discussion

Overall, self-reported awareness, knowledge, and usage were much lower among older adults than among younger and middle-age adults. Much of the differences appear to be due to lower rates of smartphone usage among older adults. Given that smartphones are necessary in order to use QR codes, the need to own one imposes a ceiling on the number of people who are able to use QR codes on a regular basis.

Furthermore, merely self-reporting knowledge and usage of QR codes may underestimate the actual differences in QR code knowledge and usage by age group. Fewer older adults who reported knowing how to use a QR code indicated a clear knowledge of how to use one compared with younger and middle-age adults, with many older adults failing to distinguish them from barcodes and/or providing incorrect descriptions of how to use them.

Younger and middle-age adults who reported using QR codes reported similar locations of QR code usage and the purpose of using them, though with a few differences—particularly, younger adults were more likely to use them on billboards, posters, or signs and were more likely to use them to get videos, apps, and contact information, whereas middle-age adults were more likely to use them to get coupons or deals. Due to sample size limitations resulting from the small number of older

respondents who had actually used a QR code, we were unable to make inferences about usage patterns for older adults.

Given the literature on the technology acceptance model, we hypothesize that perceived usefulness and perceived ease of use may explain why older adults are much less likely to use QR codes; in particular, older adults may view smartphones and/or QR codes as less useful and/or harder to use. Future research that aims to discern the precise causes of QR code adoption should examine the perceived usefulness and perceived ease of use of QR code technology. Given that much of the variation in QR code knowledge, awareness, and usage appears to be driven by rates of smartphone ownership, future research should also examine the perceived usefulness and ease of use of smartphones. This could explain why older adults are so much less likely to use smartphones than younger adults.

Finally, future research should examine QR code and smartphone adoption patterns among the broader population of adults ages 18+. Given that technological adoption rates differ greatly by country, we similarly recommend research into the adoption of QR code and smartphone technology in other countries.

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