Usability of CAPTCHA in Online Communities and Its Link to User Satisfaction

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INTRODUCTION

CAPTCHA- Completely Automatic Public Turing test to Tell Computers and Humans Apart- is a security application that is used by many websites to avoid spamming and hacking. CAPTCHA provides a test that humans are able to solve, but computer programs cannot, to defeat websites and stop spammers and hackers. CAPTCHA test can be viewed as a function of random input that generates a challenge test and a solution. Previous research found that website users spend on average 10 seconds per CAPTCHA (Sutherland, 2012), which suggests for 200 million CAPTCHA that are solved by human users every day, more than 5000,000 hours on daily basis are lost productivity (Sutherland, 2012). CAPTCHA is developed as an instrument to limit misuse of websites that offer free services of email creation, weblogs posting, social networking, online voting, online games online banking, or chat rooms, etc. With this aim in mind, several CAPTCHAs (Boshmaf et al., 2012; Coats and Baird, 2001; Chellapilla and Simard, 2005a; Von Ahn and Blum, 2005) are developed. CAPTCHAs share a number of common characteristics: (i) automated test; (ii) publicly available; (iii) separability of test- generation and solution; and (iv) defeating attacks (Fidas et al., 2011, Swaid, 2013). A number of different techniques for generating CAPTCHAs have been developed, each satisfying the criteria of CAPTCHA test described above.

CAPTCHA types can be categorized to five main types: (i) text CAPTCHA such as reCAPTCHA and Gimby CAPTCHA (ReCaptcha, 2015); (ii) image-based CAPTCHA such as ASIRRA (Elson et al., 2007), Bongo (Bongo, 2015)and Pix (Pix, 2015) that rely on image-recognition techniques (Vikram et al., 2011); (iii) animation-based CAPTCHA; (iv) audio CAPTCHA (e.g., ReCaptcha Audio Captcha, Digg, and (v) other (e.g., mathematical functions, games, multiple choice, and cognitive based CAPTCHA) (Hernandez-Castro and Ribagorda, 2010; Yamamoto et al., 2010). Text CAPTCHA is the most common type where the user is presented with a challenge-response test in a form of numbers and letters, and user needs to strike in the right characters in the given text box. In this chapter, the author uses text CAPTCHA and CAPTCHA alternatively focusing on usability of text-based CAPTCHA that is formed of randomly generated sequence of letters and/or numbers that appear as a distorted image.

Cracking CAPTCHAs

Cracking CAPTCHA and bypassing the CAPTCHA tests have attracted a number of studies to examine methodologies used in solving CAPTCHA. Generally, text CAPTCHA cracking needs three steps. First phase is pre-processing CAPTCHA by removing background, color and added noise. Second, a segmentation process is used to locate individual character in CAPTCHA challenge. Finally, a classification or recognition phase is applied to solve CAPTCHA, such as using standard OCR software (Serrao, et al., 2013; Sutherland, 2012), CAPTCHA farms (Serrao, et al., 2013), or CAPTCHA smuggling (Egele et al., 2010). In addition, there are other alternatives of

commercial software that are developed to crack CAPTCHA such as Death BY CAPTCHA, CAPTCHA Sniper, Automated CAPTCHA Bypass, CAPTCHA Monster or PWNTCHA (Serro et al., 2013). Exploring mechanisms to crack CAPTCHA and its relation to usability is also important and of practical relevance, but beyond the scope of this chapter.

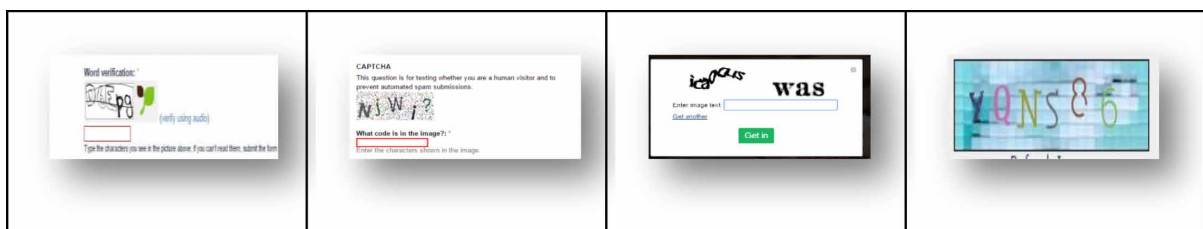## CAPTCHA Usability and Online Communities

In general, we may define the concept of usability as the effort required to use a computer system. For instance, Nielsen (2003) suggests that usability concerns several aspects such as the ease with which the user is capable of learning to manage the system, the ease of memorizing the basic functions, the grade of efficiency with which the site has been designed, the degree of error avoidance and the general satisfaction of the user in terms of manageability. Therefore, greater levels of usability will be associated to lower levels of difficulty to manage that functionality (Davis, 1993) and, as a result, usability is traditionally considered a key factor for predicting intentions to use a system (e.g. Davis, 1993). More specifically, text CAPTCHA usability might reflect perceived ease of solving CAPTCHA test (Swaid, 2013) explaining satisfaction. Designing successful CAPTCHA that is unsolvable by CAPTCHA solving software, yet, a user friendly one, is a challenging task (Ahamd and Yan, 2010). Several proprieties to make CAPTCHA resistant to Optical Character Recognition (OCR) software can make CAPTCHA unusable

(Sutherland, 2012) and therefore, suggest users' dissatisfaction.

Today, millions of people join online social gathering spheres to chat, to debate, to play games, to ask for information, or to find social support (Preece, J. and Maloney-Krichmar, 2003). Some forms of such online gatherings come in the form of forums, discussion groups, and social networking sites among others. These online social gatherings are known by a variety of names including 'online community', that is described as 'cultural aggregations that emerge when enough people bump into each other often enough in cyberspace' (Rheingold, 1994, p. 57). To eliminate automated spammers and other computer agents who are attempting to violate community norms, online communities ask applicants to complete a CAPTCHA test before subscribing. Studies showed that new comers to online communities are unable to join due to the entry barrier posed by visual CAPTCHAs (Chandrasheka, 2010).

A CAPTCHA that is robust, yet, unsolvable by humans is useless. The issue of usability has been studied focusing on the functional level (Ahmad and Yan, 2010; Burstein et al., 2010), however, the ultimate effect of CAPTCHA usability on legitimate goal-oriented users is not well documented in literature (Motoyama et al. 2010). According to Ellson et al. (2007), even relatively simple challenge can drive away a substantial number of potential customers to websites. Thus, a methodological analysis is needed for CAPTCHA schemes used in websites for online communities to understand the correlations between design characteristics and users satisfaction.

Figure 1.

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