

Prospectus

Review of Refactoring Tools for JavaScript (Technical Topic)

Impacts of Video Game Live Streaming on Psychosocial Well-being (STS Topic)

By

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Technical Project Team Members: N/A

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

Most modern web applications utilize JavaScript as the programming language for creating interactive elements. In the process of creating these sites, however, the JavaScript code can become complex and difficult to understand. It can be easy for code smells, patterns known to be detrimental to maintainability and comprehension, to find their way into the source code. Refactoring allows developers to eliminate these patterns and increase software quality. Refactoring refers to the process in which developers restructure code to increase maintainability while leaving the software's external behavior unchanged. Since manual refactoring can be tedious and error-prone, tools for automatic refactoring exist for many programming languages but such tools for JavaScript are still immature (Feldthaus & Møller, 2013).

JavaScript contains a number of features which make performing automatic refactoring particularly challenging. Whereas a statically typed programming language like Java can leverage static type information about classes and objects, JavaScript is a dynamically typed programming language, meaning that object properties and their values can be created, changed, or deleted at runtime (Fard & Mesbah, 2013). This flexibility makes even renaming the field of an object complicated (Feldthaus et al., 2011). My technical report reviews existing solutions found in literature for automatic refactoring of JavaScript and presents future research directions.

My STS research paper focuses on one type of web application that has experienced growing popularity—video game live streaming sites. They are a “kind of real-time video social media that integrates traditional broadcasting and online gaming” (Sjöblom & Hamari, 2017, as cited in Li et al., 2020). Sites such as Twitch provide entertainment,

information, and/or community to millions of users daily (*Press Center*, n.d.). Users on these sites can be divided into two primary groups: streamers and viewers. The streamers produce content and can earn revenue through the platform while viewers consume content and can offer monetary rewards to streamers through donations or subscriptions. These two groups primarily interact through the chat rooms that accompany every stream. The potential for frequent, mediated interaction between viewers and streamers makes the environment favorable for the development of parasocial relationships. These one-sided relationships can take on extreme and delusional forms that could be detrimental to viewers' well-being, but they could also help satisfy lonely individuals' need to belong (Hartmann, 2016). The aim of this study is to investigate how video game live streaming platforms might contribute to the audiences' well-being through the lens of parasocial interaction theory.

Technical Topic

Developed originally as a scripting language, there are many problems that have arisen from JavaScript's transition into a large-scale programming language due to its weak, dynamic typing system that leniently resolves type mismatches by discreet type conversions. In addition to JavaScript's broad and complicated type conversion ruleset, the language possesses a number of other features that create substantial challenges in applying static analysis; JavaScript supports prototype objects, first-class functions, the ability to freely remove and add object properties during runtime, and many more (Jensen et al., 2009). Due to these characteristics, JavaScript programs can be particularly error-prone and difficult to maintain.

Refactoring is one method by which to increase software quality by transforming code containing patterns adverse to maintainability while leaving the software's external behavior unaffected. In comparison to research on refactoring applications developed using static programming languages, research on refactoring applications created using dynamic programming languages, and especially JavaScript, is limited. Similarly, existing tools for performing refactorings for JavaScript are less mature than those found in other languages. This paper presents challenges in developing tools for refactoring in JavaScript and reviews solutions found in literature to address them. The paper also identifies areas for future research based on the analyzed literature.

There are a number of different kinds of refactoring, each typically identified by a name, such as `RENAME FIELD`, and collectively referred to as refactorings (Feldthaus et al., 2011). Feldthaus et al. (2011) presents three common refactorings: `RENAME FIELD`, `ENCAPSULATE FIELD`, and `EXTRACT MODULE`. The first of these refactorings involves renaming a property of an object, `ENCAPSULATE FIELD` refers to making a property of an object private, and `EXTRACT MODULE` consists of changing the scope of top-level variables and functions to avoid name collisions. A specific refactoring can be described by the set of preconditions under which it is applicable and a set of operations to transform the code (Feldthaus et al., 2011).

One of the most basic forms of refactoring is renaming a variable. While renaming a local variable is largely trivial due to scoping rules, renaming object properties is challenging in part due to the need for static analysis in order to identify related tokens (Feldthaus & Møller, 2013). When renaming a field, all related tokens of that field must also

be updated consistently and unintended refactorings should be avoided in order to preserve the program's behavior (Feldthaus & Møller, 2013). Additionally, in order for refactoring tools to be practical, they need to be precise, scalable, and fast (Feldthaus & Møller, 2013). Feldthaus et al. (2011) proposed to use static pointer analysis on top of queries as a solution while Feldthaus & Møller (2013) present a semi-automatic solution that uses a combination of static analysis alongside input from the programmer.

STS Topic

Video game live streaming sites, have grown tremendously in popularity within the last decade. According to popular news sites CNBC and Business Insider, Amazon purchased Twitch in 2014 in a deal valued at \$970 million (Kim, 2014; Morris, 2014). Twitch remains very popular and is one of the leading sites for video game live streaming, reportedly attracting at least 30 million users daily and over a trillion minutes watched in the last year alone (*Press Center*, n.d.).

Streaming platforms offer social support for some by providing viewers the ability to interact in real-time with streamers of their choice alongside other viewers through the chat room that accompanies every stream. Social motivations for using these platforms may be especially relevant in light of current social distancing regulations imposed in response to the COVID-19 pandemic, as de Wit et al. (2020) found that viewers spent more time watching and were more engaged with game live streams while going through difficult periods.

The potential for frequent, mediated interaction between viewers and streamers may facilitate the development of parasocial relationships (PSRs). In contrast to

interpersonal relationships, PSRs are the relationships media users perceive to have with the media personality (Klimmt et al., 2006, as cited in Leith, 2021). The parasocial compensation hypothesis posits that these relationships could “satisfy the need to belong, diminish loneliness, and eventually compensate for a lack of social benefits acquired in real-world relationships” (Hartmann, 2016). While streamers will find most viewers participating in the chat indistinguishable, some viewers may begin to feel as though they have formed a relationship. A concern with these platforms is that the unilateral relationships stemming from illusionary feelings of reciprocity could result in negative effects on the well-being of an individual, such as addiction to the site. This study aims to answer the question of whether videogame live streaming platforms actually benefit viewers’ psychosocial well-being or serve as a maladaptive coping strategy for loneliness.

Parasocial interaction (PSI) describes encounters between media users and media personas in which the former group experiences immediate, though illusionary, feelings of reciprocity, mirroring those felt in non-mediated interactions (Hartmann, 2016).

Psychologists have studied parasocial phenomenon in the past within the context of traditional forms of entertainment such as television, but live streaming platforms differ from some older forms of entertainment in that they allow for moments of actual interaction. However, outside of a few rare instances, these exchanges are too quick to develop into an interpersonal relationship in the same way that a celebrity and a fan interacting at a scheduled meet-and-greet are unlikely to develop an interpersonal relationship (Leith, 2021). Yet, the possibility of turning a PSR into a reciprocal relationship may act to further cultivate the development of PSRs (Leith, 2021).

While viewers may form interpersonal relationships between each other as a result of interaction in a streamer's chat room, this study primarily focuses on the interaction and relationship between streamer and viewer. Although interaction with other viewers may be an integral part of users' experience using the service, it has been found that streamer-targeted messages generally possess greater verbal immediacy than viewer-targeted ones, suggesting that "viewers may generally feel closer to the streamer than to other viewers" (Leith, 2021).

Cohen (2004) revealed that individuals with an anxious-ambivalent attachment style formed the most intense parasocial relationships. de Bérail et al. (2019) similarly discovered a relationship between anxiety, in this case social anxiety, and the development of PSRs on YouTube. Additionally, they observed a positive correlation between the intensity of the PSR and the degree of addiction to the platform. Cabeza-Ramírez et al.'s (2021) study reaches a different conclusion, however. They found that the group of users most likely to develop addiction and maladaptive behaviors were those primarily motivated by informational rather than social needs. Hartmann (2016) synthesizes Cohen's work alongside other experts in the field and analyzes how PSIs and PSRs might influence well-being. He argues that they can satisfy the need to belong or better the self-perception of individuals with low self-esteem, among other things. However, he also points out how new interactive technologies could affect people's well-being differently than how the non-interactive forms analyzed did. Cabeza-Ramírez et al. (2020) disagree with this idea though, pointing out that "as the number of viewers increases, communication becomes more and more unidirectional, interactivity is lost and they [video game streaming

platforms] increasingly come to resemble a conventional medium such as television.” The result of their study implies that it may be among smaller audiences that PSRs develop.

Conclusion

The technical report provided a literature review of the existing solutions for automatic refactoring for JavaScript programs. The paper identified key challenges in the development of such tools, approaches to overcome these challenges, and directions for future research. The STS research paper examined the social interaction between viewers and streamers on video game live streaming platforms and how it might impact the well-being of the former group. This study showed that individuals do in fact turn to streaming platforms for social interaction, and that this parasocial interaction could positively or negatively affect the well-being of the audience. The primary contribution of this research was the identification of factors, both in the online environment and in the characteristics of individual viewers, that mediate the relationship between viewing of a live streaming platform and well-being. Additionally, this paper summarized areas for future research.

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