Replication Study: Eye Tracking Study on camelCase and under_score Identifier Styles

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Abstract

The purpose of this paper is to replicate the results of two earlier studies, Binkley *et al.* (2009) as well as Sharif *et al.* (2010), where the aim was to determine if the identifier naming conventions affected code comprehension. The two styles that are examined are camelCasing as well as the under_score style. The study is conducted by using an eye-tracking device to gather data through a timed responsed test.

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Chapter 1

Introduction

Naming variable identifiers in a effective and efficient way is important for code comprehension. Good identifiers enables, for example, abstraction of concepts, collaboration and code preservation. This is put into perspective when reading a paper by Deissenboeck *et al.*[2] which states that 70% of the source code for the popular Java IDE program *Eclipse* consists of identifiers. The two main styles of naming identifiers in code today are camelCasing (*e.g.*,coolBeans) and underscore casing (*e.g.*,cool_beans). [1]

Deciding which one to use is often a matter of the given convention within the programming language that the code is written in. Historically, the arguments for using camel casing is that it requires fewer keystrokes and improves typing speed.

So far there's been two other studies aiming to determine if there is a significant difference between the two styles. The first study conducted by Binkley *et al.*in 2009 [1] with 135 subjects concluded that the camel casing style leads to a better all round performance, at least when the subject is trained on the style, despite taking on average 0.42 seconds longer to read. The second study conducted by Sharif *et al.*in 2010 [3] with the help of eye-tracking equipment found that camel cased words took on average 0.932 seconds longer to read, and concludes that the under score style leads to an improvement in both reading time and visual effort. Even though the two studies differ in their conclusions, the eye-tracking study suffers from a small sample size, with a meagre 15 subjects compared to the 135 subjects in the 2009 study. However, the eye-tracking equipment used in the 2010 study lends a lot of credibility to the data presented.

This study will also be conducted with the help of eye tracking equipment and will aim to provide additional data that would further aid in the judgement regarding which one of these two styles would be the most beneficiary for code comprehension.

1.1 Purpose and Goals

1.2 Delimitations

I will limit the project by not extending the original study with more than a few additional variables that are relevant to the subject. I will furthermore limit the size of participants to the minimum amount necessary to achieve statistical significancy,

[1] Underscore casing is more commonly known as snake casing, though the previous expression will be used to be more consistent with the established literature

if time doesn't permit otherwise. All data gathered will solely be through the same means used in the original 2010 study, the Tobii eye tracker as well as interviews.

Chapter 2

Background

In 2010 a study published at ICPC examined how identifier naming conventions affect code comprehension with the help of eye tracking equipment. The two styles that were analysed were camelCase as well as under_score identifiers. The goal of this project is to try and replicate the results of the study with the same method, as well as taking more variables into account, if time and the sample size of the study group permits.

Identifier names are keystones in software programming for presenting and working with data in any kind of function. If any way of writing these identifiers improves the speed of which we comprehend the code, it could potentially entail better overall program understanding.

Historically, underscores were used as the primary identifying style because of early programming languages being case insensitive. Later on, camel-case identifiers became the norm, maybe partially because of the number of keystrokes and ease of writing it had over using underscores.

The results from the 2010 study concluded that there were no significant differences in regards to accuracy between the two styles. However, the camel-cased identifiers took longer to identify. The 2010 study in turn sought to replicate a study conducted in 2009, which similarly concluded that camel-cased identifiers were slower to identify, but that underscored identifiers brought about less accuracy. It's worth mentioning that the two studies differed their methods of gathering data, as the 2009 study used a game like interface to gather timed responses, while the 2010 study used eye tracking equipment to gather more quantitative data.

Chapter 3

Methodology

3.1 Research questions

Explore design space, motivate method, consequences,

I will attempt to replicate the 2010 study using an eye tracker device from tobii. I will set up a test process as similar to the original as I can, as to gather a minimum of the same amount of data. My aim is also to gather more data about the subjects that could act as confounding variables, such as what programming languages that they've used historically and currently, age gap, and other variables TBD (to be determined).

In the original test process subjects were instructed to observe an identifier on a screen, which was then replaced with another four identifiers. One of them matched the previous identifier, whereas the rest of them were incorrect, meant of distract the subject. The data that was then measured is the accuracy of the subject to identify the correct word, as well as the time it took to reach an answer. From the tobii eye tracker additional data such as time spent on each word, amount of fixations vs saccades (eye flicker), can be extracted. Furthermore, data such as subject age, experience and background will be extracted in an interview like setting.

3.2 Eye-tracking Equipment

3.3 Material and Stimuli

3.4 Visual Effort and Areas of Interest

3.5 Study Variables

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3.7 Participants

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Chapter 4

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4.2 Visual Effort

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Chapter 7

Conclusions & Future Work

7.1 Future Work

Bibliography

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