

camelCasing or underscore_casing; Which one is
easier to read?

Johannes Almroth

5th June 2019

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 responded test.

Contents

1	Introduction	1
1.1	Purpose and Goals	2
1.2	Delimitations	2
2	Background	3
3	Methodology	5
3.1	Research questions	5
3.2	Eye-tracking Equipment	5
3.3	Material and Stimuli	5
3.4	Visual Effort and Areas of Interest	5
3.5	Study Variables	5
3.6	Hypotheses	5
3.7	Participants	5
3.8	Instrumentation	5
4	Results	7
4.1	Correctness and Find Time	7
4.2	Visual Effort	7
4.3	Similarities and Differences	7
5	Discussion	9
6	Threats to Validity	11
7	Conclusions & Future Work	13
7.1	Future Work	13

Chapter 1

Introduction

Naming variable identifiers in a effective and efficient way is important for code comprehension. A programmer can only get so far with using variables like x and y , and to write code that encapsulates complex mental models of thinking that need to be understood by multiple people in a development team, appropriate identifier names need to be chosen. 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 a given release of the popular Java IDE program *Eclipse* consisted solely of identifiers. But assuming that the wording of the identifiers is sufficient, the question remains of *how* they can be written to further aid in code comprehension.

The two main styles of writing identifiers 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. As noted in a previous study on the subject [4], early programming languages such as Basic, Cobol, Fortran and Ada were case-insensitive, and thus encouraged the use of either the underscore or hyphens to write variables. When languages such as C and Java were introduced, camel casing became more common, and the argument can be made that it requires fewer keystrokes, and thus improves writing speed. However, natural language research suggests that this is the wrong approach. A paper by Epelboim *et al.*[3] found that un-spaced text lead to a 10-20% slower reading speed in subjects, while characters similar to the underscore had the less impact on reading speed overall. So while there is a short term gain for the programmer in the form of typing speed, it could lead to a steeper cost in code maintainability. How severe this affects maintainability is outside the scope of this paper.

As of today there's been two studies aimed at answering the question which one of camel casing or underscore casing affects reading comprehension the most. These are papers by Binkley *et al.*[1] and Bonita *et al.*[4] conducted in 2009 and 2010 respectively. The latter aimed to replicate the former, and they both draw different conclusions from their findings.

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

1.1 Purpose and Goals

This study 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. Furthermore, it will use data gathering equipment in the form of an eye-tracker, and aim to achieve a solid statistical significance through a high enough subject count.

1.2 Delimitations

The study will be limited by primarily aiming to replicate the 2010 study. The same test data and variables will be gathered, as well as focusing on acquiring more subjects. Additionally, a few extra variables about the subjects will be gathered pertaining to previous programming experiences as well as their identifier style of choice, as to expand the given research and to contribute data to the [...] (research area?)

Chapter 2

Background

So far there's been two studies aiming to determine if there is a significant difference between camel casing and underscore casing. 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 [4] 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 underscore style leads to an improvement in both reading time and lessens the amount of visual effort required by the subjects. Visual effort is denoted by how long a subject stares at a given part of the screen, and how often this gaze wanders and switches focus. 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, in contrast to the 2009 study where some subjects participated via an online interface in a non-controlled environment that could potentially obfuscate data.

Chapter 3

Methodology

- 3.1 Research questions
- 3.2 Eye-tracking Equipment
- 3.3 Material and Stimuli
- 3.4 Visual Effort and Areas of Interest
- 3.5 Study Variables
- 3.6 Hypotheses
- 3.7 Participants
- 3.8 Instrumentation

Chapter 4

Results

- 4.1 Correctness and Find Time
- 4.2 Visual Effort
- 4.3 Similarities and Differences

Chapter 5

Discussion

Chapter 6

Threats to Validity

Chapter 7

Conclusions & Future Work

7.1 Future Work

Bibliography

- [1] Dave Binkley, Marcia Davis, Dawn Lawrie, and Christopher Morrel. To camel-case or under_score. IEEE, May 2009. doi: 10.1109/ICPC.2009.5090039.
- [2] Florian Deissenboeck and Markus Pizka. Concise and consistent naming. *Software Qual Journal*, 14(3):261–282, 2006. doi: 10.1007/s11219-006-9219-1. eclipse.org.
- [3] Julie Epelboim, James R. Booth, Rebecca Ashkenazy, Arash Taleghani, and Robert M. Steinman. Fillers and spaces in text: The importance of word recognition during reading. *Vision Research*, 37(20):2899–2914, 1997. doi: 10.1016/S0042-6989(97)00095-3.
- [4] Bonita Sharif and Jonathan I. Maletic. An eye tracking study on camelcase and under_score identifier styles. IEEE, June-July 2010. doi: 10.1109/ICPC.2010.41.