

How Graduate Computing Students Search When Using an Unfamiliar Programming Language

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```
<?php  
echo "Hello, World!";  
?>
```

disp('Hello, World!')

Hello, World!

console.log("Hello, World!");

print("Hello, World!")

```
#include <iostream>  
using namespace std;  
int main()  
{  
    cout << "Hello, World!";  
    return 0;  
}
```

```
public class HelloWorld  
{  
    public static void main (String[] args)  
    {  
        System.out.println("Hello, World!");  
    }  
}
```

“Hello World” in Visual Basic for Applications (VBA)

	A	B	C	D	E	F	G	H	I	J	K	L	
1													
2													
3		Goal 2: Hello World											
4													
5													
6		Task 2: Create a button that pops a message box with "Hello World!" on it once being clicked											
7													
8													
9		2.1: Be able to create a message box function											
10													
11													
12		2.2: Be able to create a button for this macro											
13													
14													
15													

How about This One?

Hashtable?

Goal 4: Find Matches

Task 4: Create a button that return matched prices for certain items

4.1: Be able to return the price for one item

4.2: Be able to return prices for all items

4.3: Be able to create a button and assign this macro to it

Hashmap?

Dictionary?

Sample Output			
Item	Price	Item	Price
a	\$1.00	a	\$1.00
b	\$2.00	c	\$4.00
c	\$4.00	e	\$7.00
d	\$5.00	f	\$9.00
e	\$7.00		
f	\$9.00		

Regex?

Example Search Queries & Reformulations

userID: 3554248655

Graduate Student, Java & C++, Expert, Often search online

vba hashmap



vba hashmap iteration

vba dictionary iteration

vba hashtable in excel

VLOOKUP

Challenges in Code Search

Knowledge of one language can interfere with learning a new language. However, **terminology** between languages often **differs** drastically.

[Scholtz, HCI 1990]
[Shrestha, ICSE 2020]

Prior Studies on Code Search

- ❖ Professional developers & daily work
- ❖ Seek to understand
 - How and why developers search
 - Properties of search queries and search sessions
 - Code search tool
 - New tools
 - Potential improvement of existing tools

Study Design

Factors that impact
the success of search queries

	Sadowski [FSE 2015]	Bai [ICPC 2020]
Duration	15 consecutive days	90-minute lab session
# Participants	27 Google developers	18 CS graduate students
Context	Daily work	5 VBA tasks
Data Types	Logs (browsing activities) & Surveys	Logs (browsing activities) & Surveys
Survey Types	1 survey, 4 questions	4 surveys, 2-6 questions each
Survey Setting	10 surveys per day 10-minute time interval	10 surveys per hour 1-minute time interval
Survey Collection	Browser extension	Browser extension

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Java, JavaScript, C++, C, Python

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Chrome Extension Demo – Logs & Surveys

The screenshot shows a Google search results page for "Chrome Code Search - Chrome". A yellow callout box is overlaid on the page, containing the following text:

- Time Interval between Surveys / Clicks**
- #Query, #Click, #avgClick/Query**
- Types of Visited Websites**
- Query Responses**

Overview of Logged Data



18 participants



3,508 log entries



229 queries

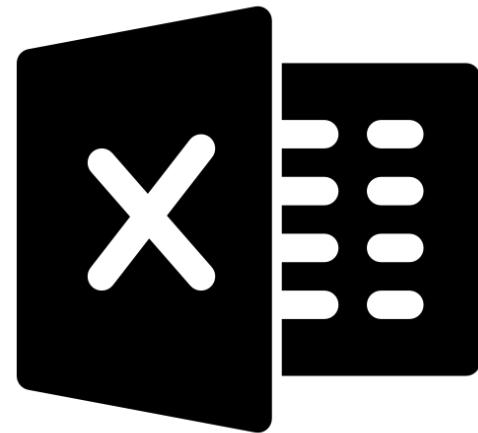


216/389 deployed
surveys were completed

Research Questions

- ❖ RQ1 – Why do subsequent language learners search?
- ❖ RQ2 – What does a typical search session entail?
- ❖ RQ3 – What are the factors that impact the success of search queries?

RQ1 – Why do learners search?



Example Code

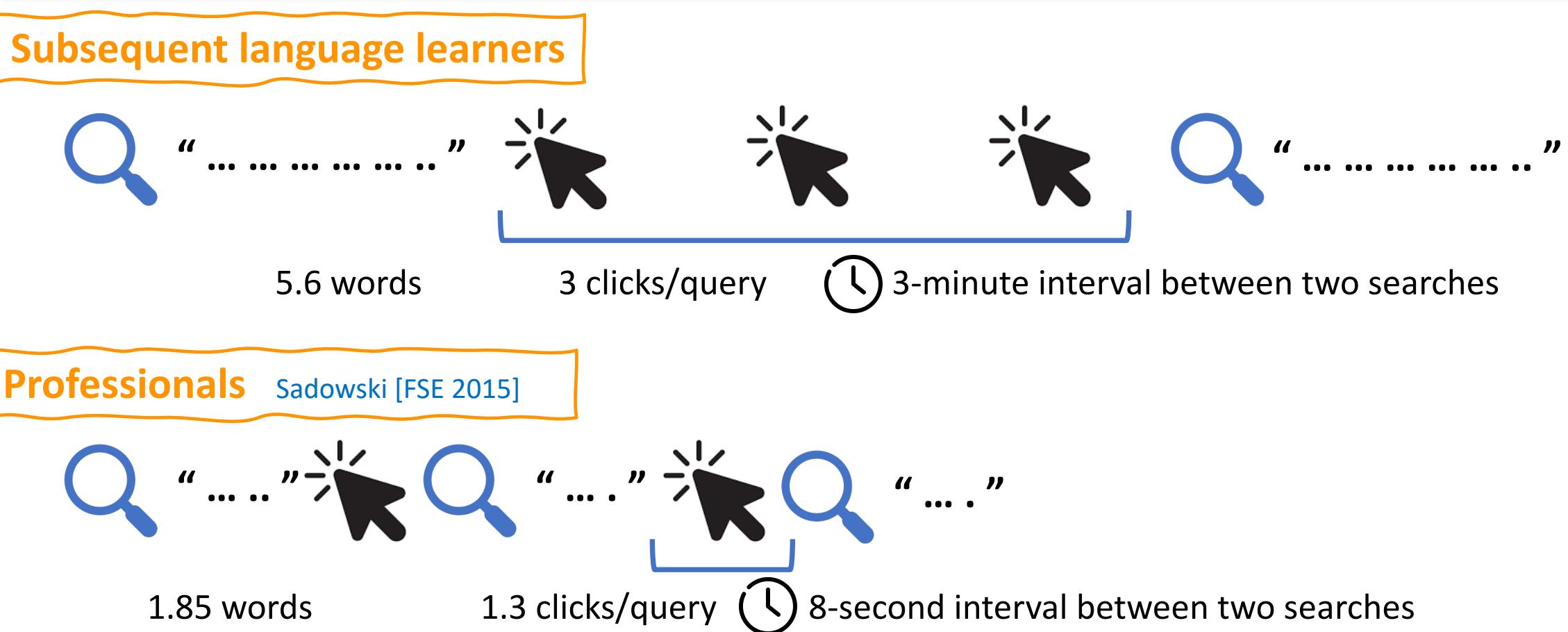


Resolve Bugs/Errors

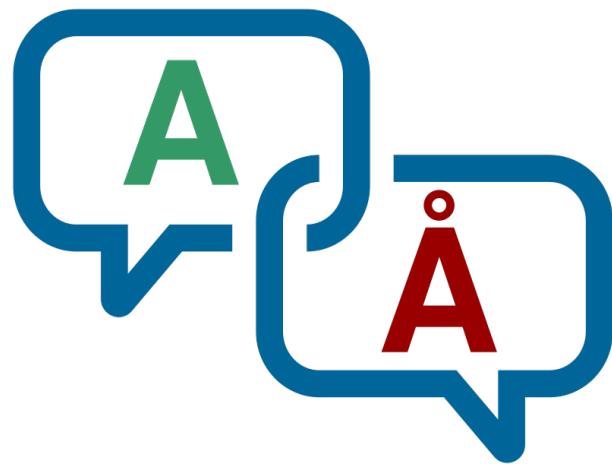


All searched
for exploring

RQ2 – Typical Search Session



RQ3 – Success of Search Queries



Borrow terms from
familiar languages



Consult tutorials &
documentation
rather than Q&A



Use natural languages
& Consult others

Takeaways

- ❖ Reformulations occur much more quickly after a previous query than searching for a new topic
- ❖ The word-based Levenshtein distance between successive queries alone may not indicate a reformulation
- ❖ Term borrowing was commonly observed
- ❖ The impact of term mismatch in terms of query success and reformulation is fairly neutral