Visualizing the Keystroke Level Model in Web Form Filling Tasks through Adaptive Animation towards Learning

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Outline

- Introduction
- Presentation of the KLM-FA application
- Recent Case Study Results
- Presentation of the KLM-FA new Feature: “Watch and Learn”
  - Functionality
  - Live demonstration
- Conclusions and Future Work.
The Keystroke Level Model (KLM) (Card et. al., 1980) supports the modeling of a user’s behavior while performing well-known HCI tasks. In this way, the estimation of the time required to complete a task is feasible.

Furthermore, the combination of KLM with Fitts’ Law (Fitts, P.M. 1954) can be more accurate than using only KLM in desktop environments.

Both KLM and Fitts’ Law are used as predictive models in a variety of scientific areas.

They are also part of educational issues in HCI education.
While there is a lot of document resources that can be used to teaching KLM there is only a short list of KLM related available software for educational purposes.

The KLM Form Analyzer (KLM-FA) is one of them.

The Learning Impact of the KLM-FA has been recently proved during two studies in students on both traditional and distance education.

However KLM-FA needs to be enhanced with additional functionality in order to facilitate KLM Learning.
Introduction 3/3

The contribution

Recent studies have shown that exploiting animation in education may be helpful in particular circumstances in which details are significant (Morrison et. all., 2000)

So, this paper presents the implementation of a new KLM-FA feature entitled “Watch and Learn”.

The “Watch and Learn” feature visualizes the KLM analysis through animation and provides in a comprehensive way explanation for the KLM reasoning.
The KLM-FA 1/2

KLM-FA V1.7 is a Windows Desktop Application

- It uses both KLM and Fitts’ Law to estimate the required time for filling a web form (Karousos et. al, 2013) (Katsanos et. al, 2013):
  - It downloads a web form,
  - parses it and identifies the form elements,
  - analyzes the elements (identifies the required KLM operators) and
  - calculates the estimated time for filling the form

http://klmformalyzer.weebly.com/
The KLM-FA
2/2

The tool allows users to configure the entire estimation process by setting up KLM analysis parameters.

KLM Rules
User can set up the model
KLM-FA is flexible and allows users to declare where to use Mental Operator (M) and other critical KLM - rules

Operators Values
User can set up the values
Since KLM values of a and b constants are not fixed, user can change them and recalculate the time. Furthermore user can set the default operators values.

Initial settings
User can enable Fitts’ Law and define initial settings
KLM-FA supports different formalizations of Fitts’ Law. Moreover one can setup user typist ability, user age and the device for selecting or manipulating the elements.
KLM-FA in the Classroom

Two (pre-post) studies were conducted in order
a) To investigate the learning impact of KLM-FA
b) To get feedback for KLM-FA improvement

(Katsanos et. all, 2015) (Katsanos et. all, 2018)

Learning Impact

The positive Learning impact of KLM-FA has been proved in two different educational models: distance and traditional

Things to change

1. Enhance KLM reasoning explanation
2. Provide KLM-FA to other that Windows Platforms.
The “Watch and Learn” Feature 1/3

It visualizes, step-by-step, the KLM analysis of a web form filling task using animation

- It builds a transparent layer over the web form that includes all the appropriate animation tools.
- It allows a user to simple watch as a movie the entire process of a web form filling task and assist him/her in order to understand the application reasoning during the KLM analysis.
- It can mute/unmute vocal description, pause/play the animation and move forward or backward in the animated form filling steps.

It can produce animation in every web form that is loaded by user!!!
The “Watch and Learn” Feature 2/3

The Internal Mechanism

Step 1: Load the Web Form
When web form is loaded the KLM-FA identifies all the web-form elements adds them to a custom List and then is ready to execute the estimation algorithm.

Step II: Generate the Scenario
Together with the KLM estimation, KLM-FA is generate a set of animation commands that can depict the KLM-analysis in a movie-like view over the particular Web Form.

Step III: Play the Animation
An animation player that has been built in JavaScript is being injected in the KLM-FA internal web browser and then it starts playing the animation commands.
The “Watch and Learn” Feature 3/3

Watching micro-steps and summing-up.

- While user is watching every micro-action that is required to reach or to manipulate an element...
- He/she can be informed about the entire set of the required operators for the particular step.
- Both animation and grid preview are synchronized.
Challenges and Future Work

We have already started working on the first and the third targets.

1. **Prove the usefulness of the new feature**
   - Conduct an appropriate study aiming at the examination of the learning impact of the particular ‘Watch and Learn’ functionality over real students in HCI courses under specific learning activities.

2. **Improve some technical issues regarding animation**
   - Support page scrolling.
   - Solve compatibility problems with several web pages (CSS or Javascript issues).
   - Support speed configuration, subtitling, language.
   - Better visualize Fitts’ law.

3. **Make the entire KLM-FA functionality available through the web**
   - Previous research showed that many users were not satisfied with the fact that KLM-FA requires only Windows OS. We believe that moving KLM-FA functionality to the web will extend the number of potential users of it.
Conclusions

KLM-FA is a unique tool that estimates web form filling tasks and can be effectively used for educational purposes as well.

- The results of the previous research regarding the learning impact of KLM-FA application emphasized the need for user interface improvement towards learning enhancement.
- We strongly believe that this unique (in the area of KLM) feature will help students to learn how Keystroke Level Model works by explaining them visually and in details each step of the KLM analysis.

KLM-FA is available for download at: http://klmformanalyzer.weebly.com/
THANK YOU!

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References


## Appendix: Keystroke Level Model Operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
<th>Execution time</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Keystroke</td>
<td>0.28 sec. (40 wpm: average non-secretary typist)</td>
</tr>
<tr>
<td>P</td>
<td>Pointing</td>
<td>1.1 sec.</td>
</tr>
<tr>
<td>B</td>
<td>Press or release mouse button</td>
<td>0.1 sec.</td>
</tr>
<tr>
<td>H</td>
<td>Home hands to keyboard or mouse</td>
<td>0.4 sec.</td>
</tr>
<tr>
<td>M</td>
<td>Routine thinking or perception</td>
<td>1.2 sec.</td>
</tr>
<tr>
<td>W(t)</td>
<td>Waiting for the system to respond</td>
<td>-</td>
</tr>
</tbody>
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