

Echoes From Space:

Grouping Commands with Large-Scale Telemetry Data

Alexander Lattas

Imperial College
London

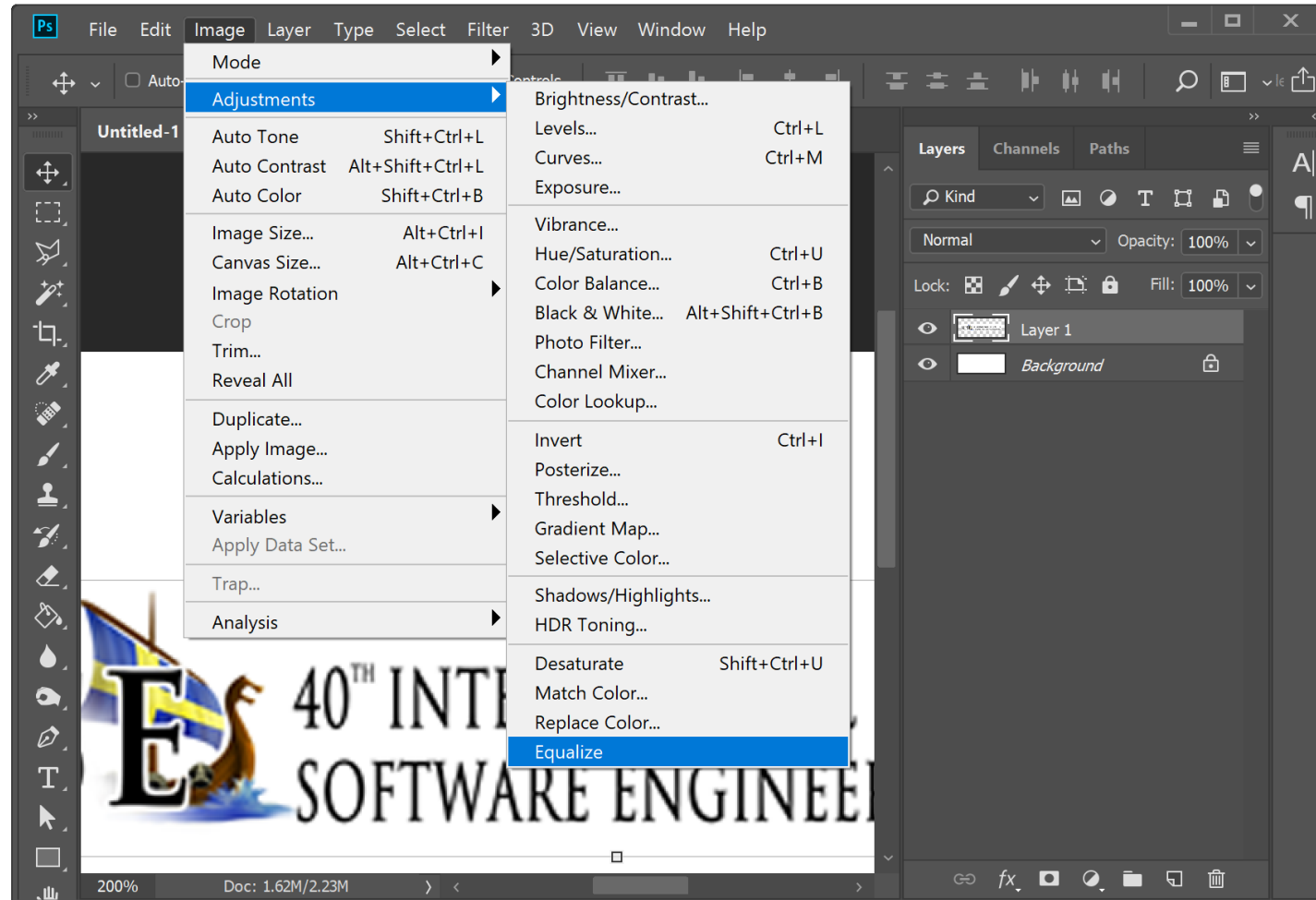
Diomidis Spinellis



ICSE  40TH INTERNATIONAL CONFERENCE ON
SOFTWARE ENGINEERING MAY 27 - JUNE 3 2018
GOTHENBURG, SWEDEN



Command Grouping





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Machine Learning Algorithms
Deep Learning Algorithms
Data Mining and Visualization

Object-Oriented Programming
Technical Consulting Experience
Experience in Entrepreneurship

Education

Imperial College London | MSc in Advanced Computing | 2017-2018
Thesis | Generative Adversarial Networks (Tensorflow, Tensorflow.js, PyTorch)
Modules | Advanced Statistical Machine Learning, Deep Learning, Reinforcement Learning, Pattern Recognition, Computational Finance

Athens University of Economics and Business | BSc Management Science and Technology | 2013-2017 | Grade: 9.35 (2%)
Modules | Software Engineering, Algorithms, Statistics, Databases, Business Analytics, Website Architecture, IT Systems Design

University College London | School of Management (Affiliate Student) | 2015 - 2016 | Grade: 70%
Modules | Innovation Management, Project Management, Corporate Financial Strategy, Digital Marketing, Organizational Psychology

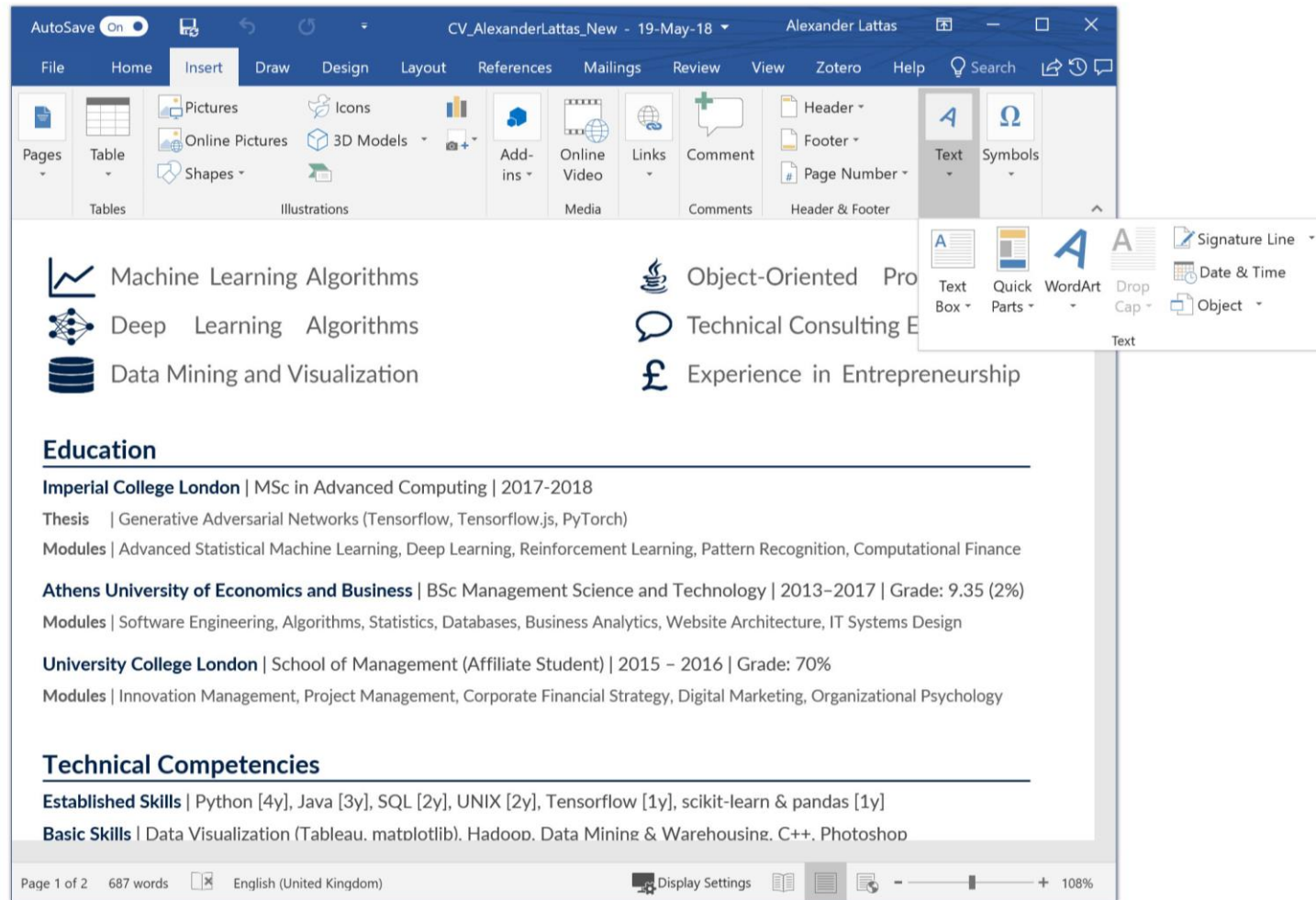
Technical Competencies

Established Skills | Python [4y], Java [3y], SQL [2y], UNIX [2y], Tensorflow [1y], scikit-learn & pandas [1y]
Basic Skills | Data Visualization (Tableau, matplotlib), Hadoop, Data Mining & Warehousing, C++, Photoshop

Page 1 of 2 687 words English (United Kingdom) Display Settings 108%

A Galaxy of Commands

Command Grouping Problem



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Object

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687 words

English (United Kingdom)

Display Settings

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Draw Horizontal Text Box

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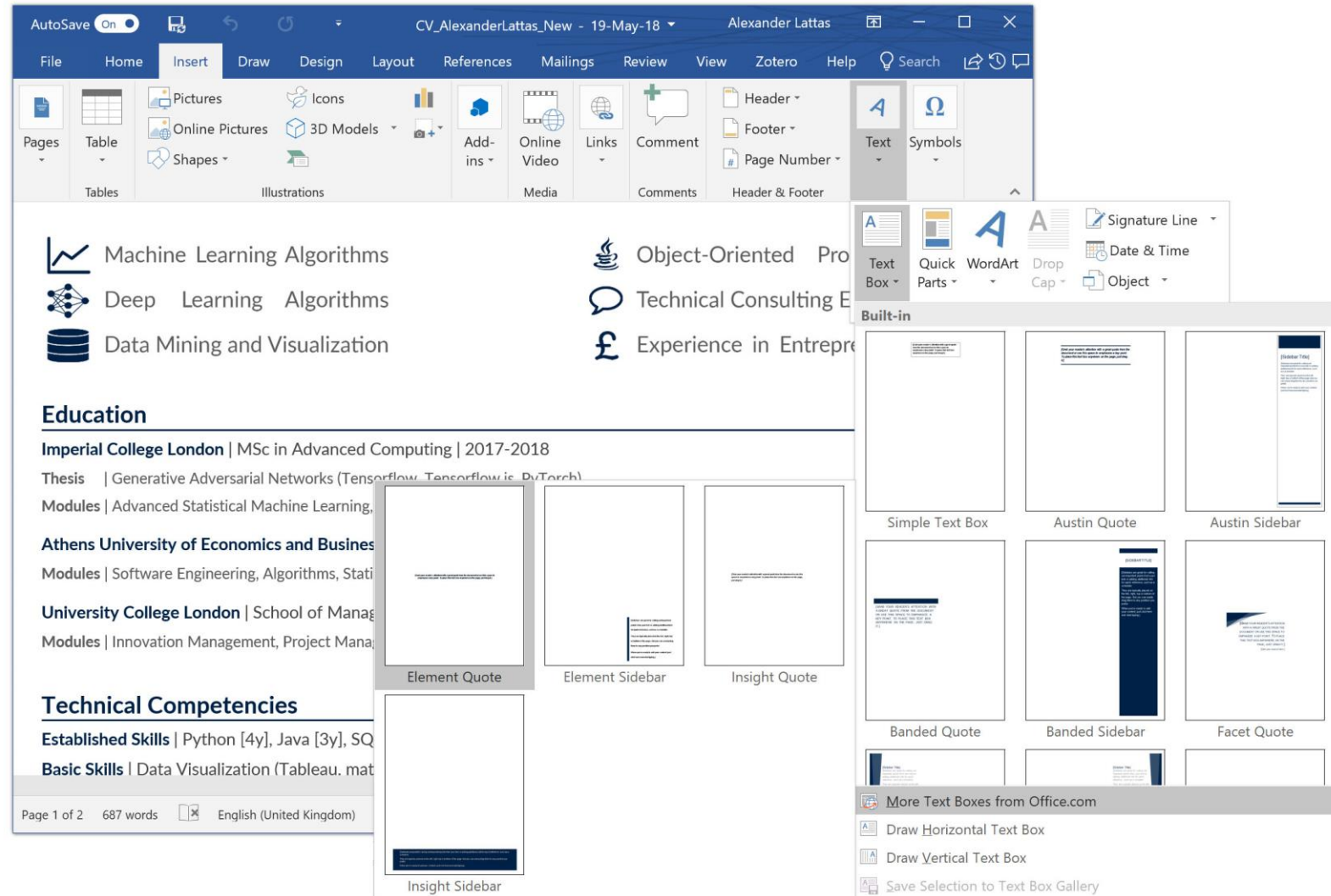
Save Selection to Text Box Gallery

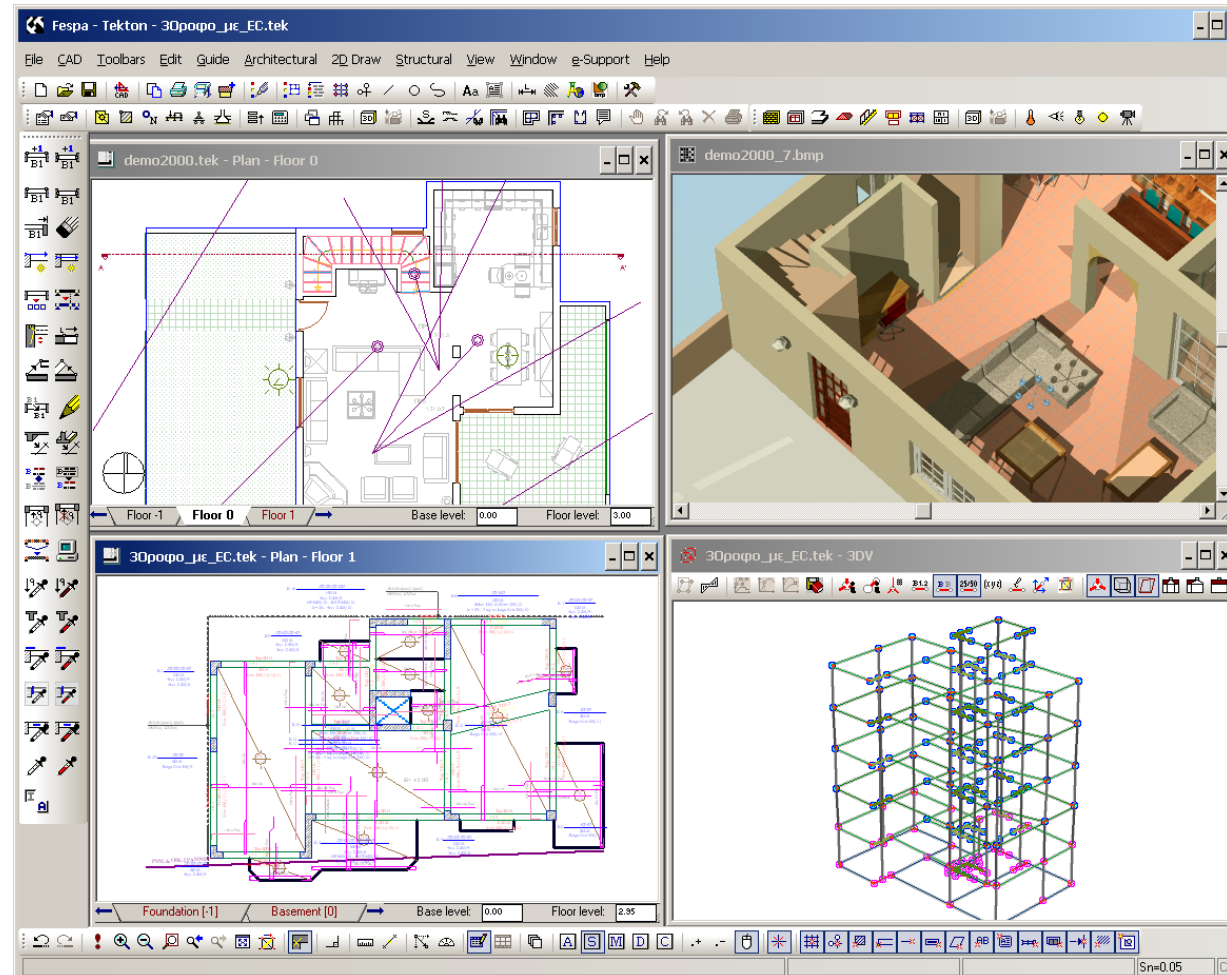
01/06/2018

Alexander Lattas, Imperial College London | Diomidis Spinellis, Athens University of Economics and Business

A Galaxy of Commands

Command Grouping Problem







Command Grouping

Systematic generic methods for grouping commands into multi-level menus and toolbars

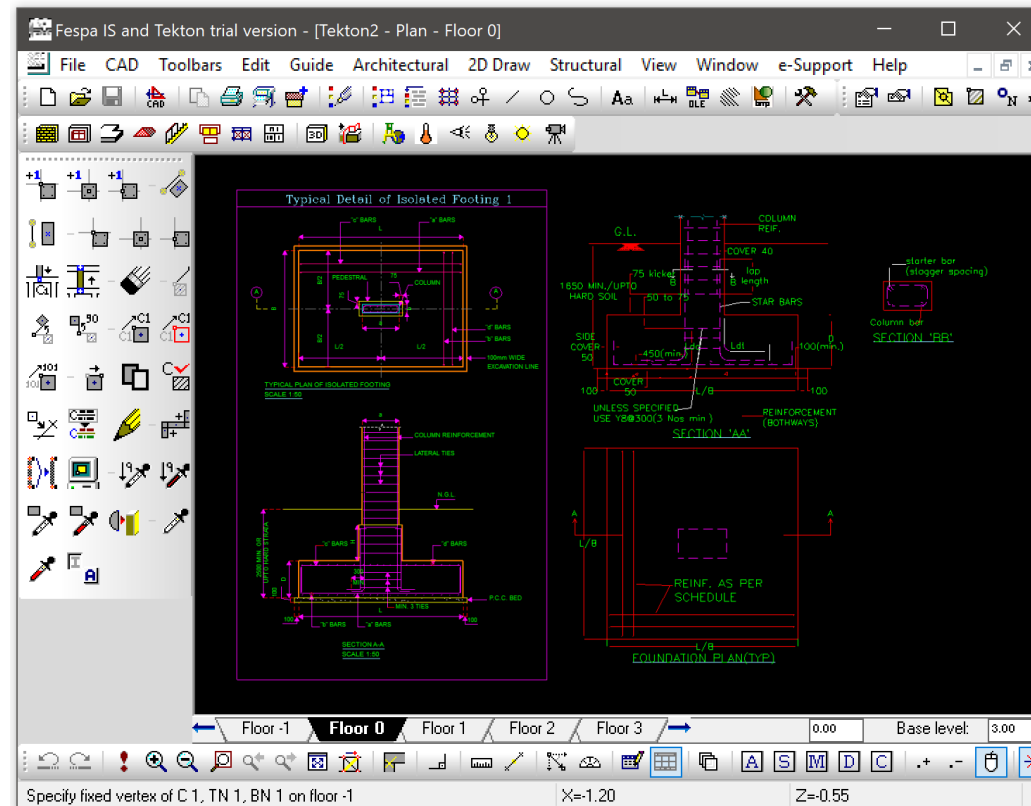
- ✓ User usability and speed
- ✓ Improved GUI design process



Keystroke-Level Model (KLM)

Card et al., 1980

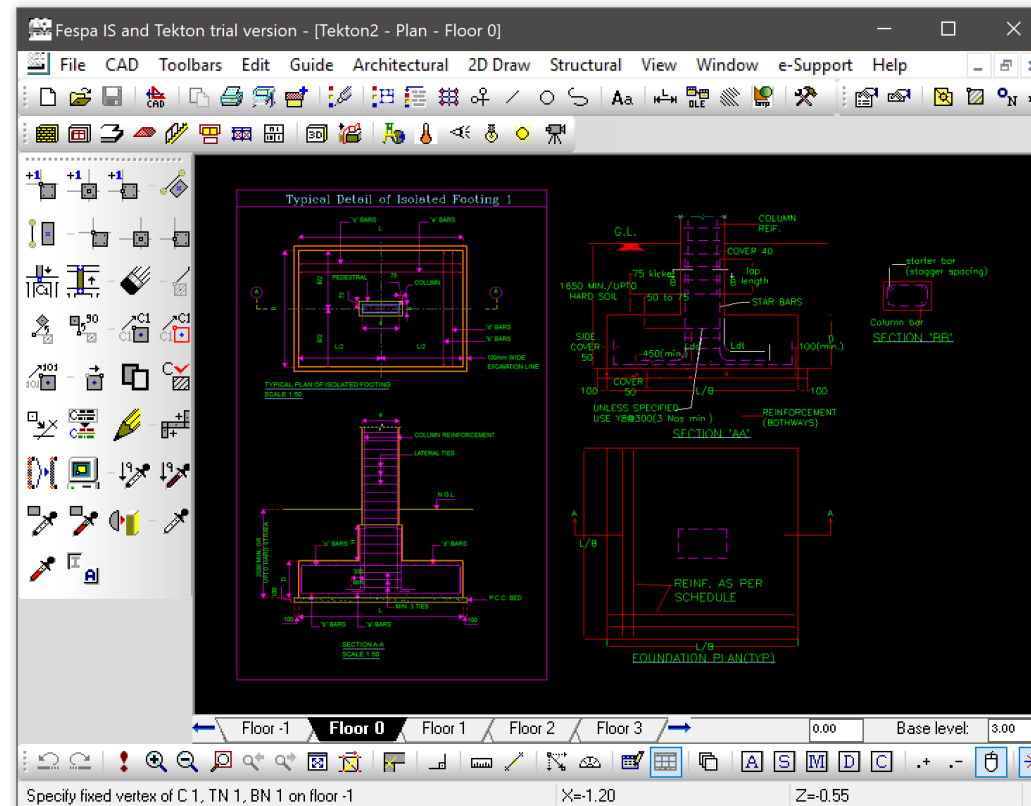
$$T_{command} = T_{Mental} + T_{Move} + T_{Point} + T_{Key} + T_{System}$$



Keystroke-Level Model (KLM)

Card et al., 1980

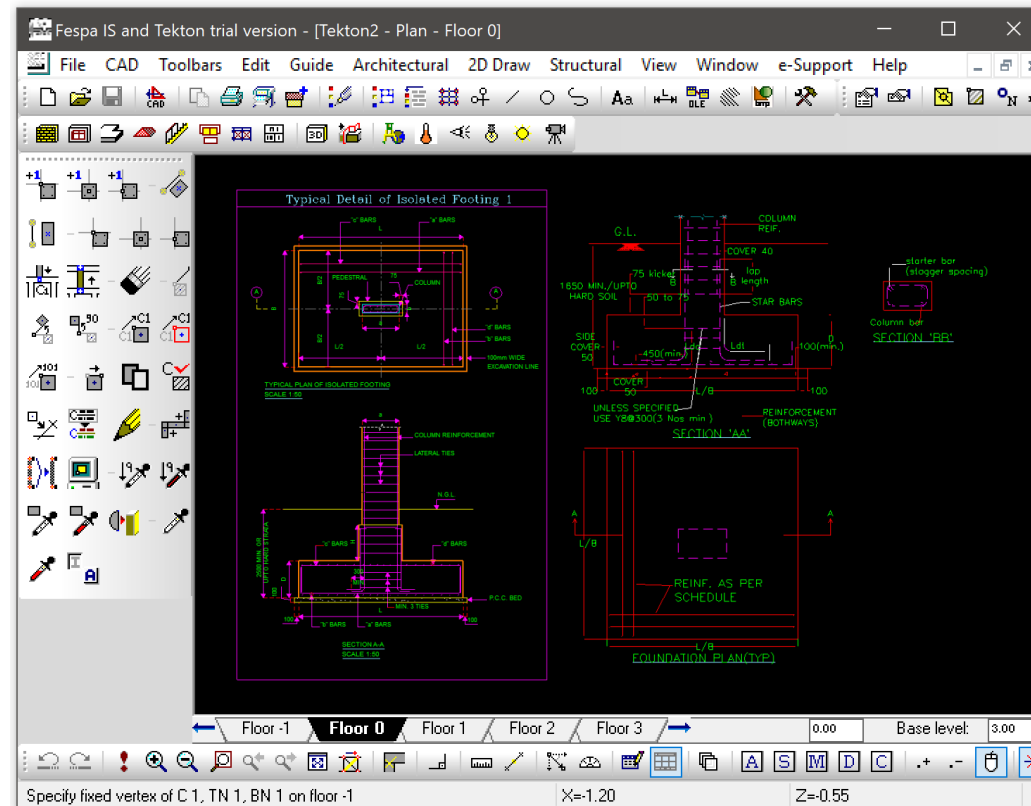
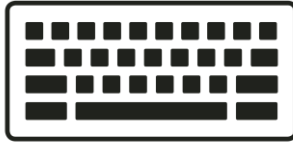
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Keystroke-Level Model (KLM)

Card et al., 1980

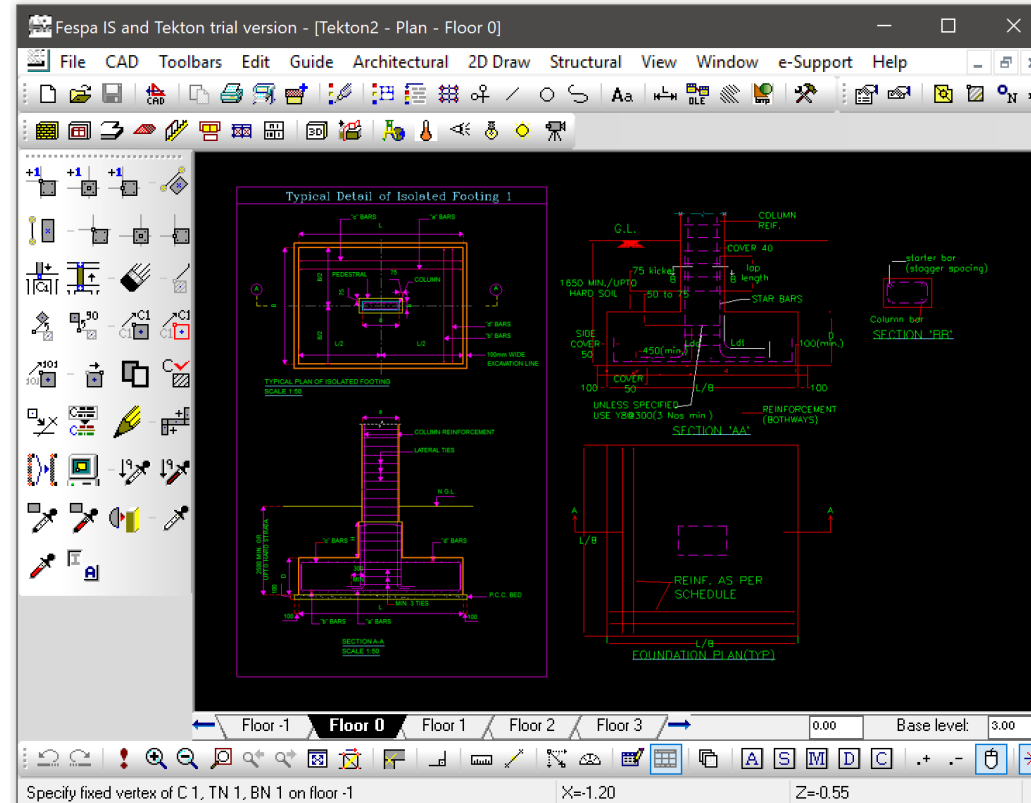
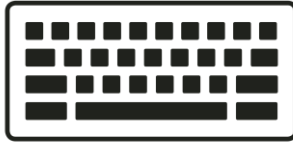
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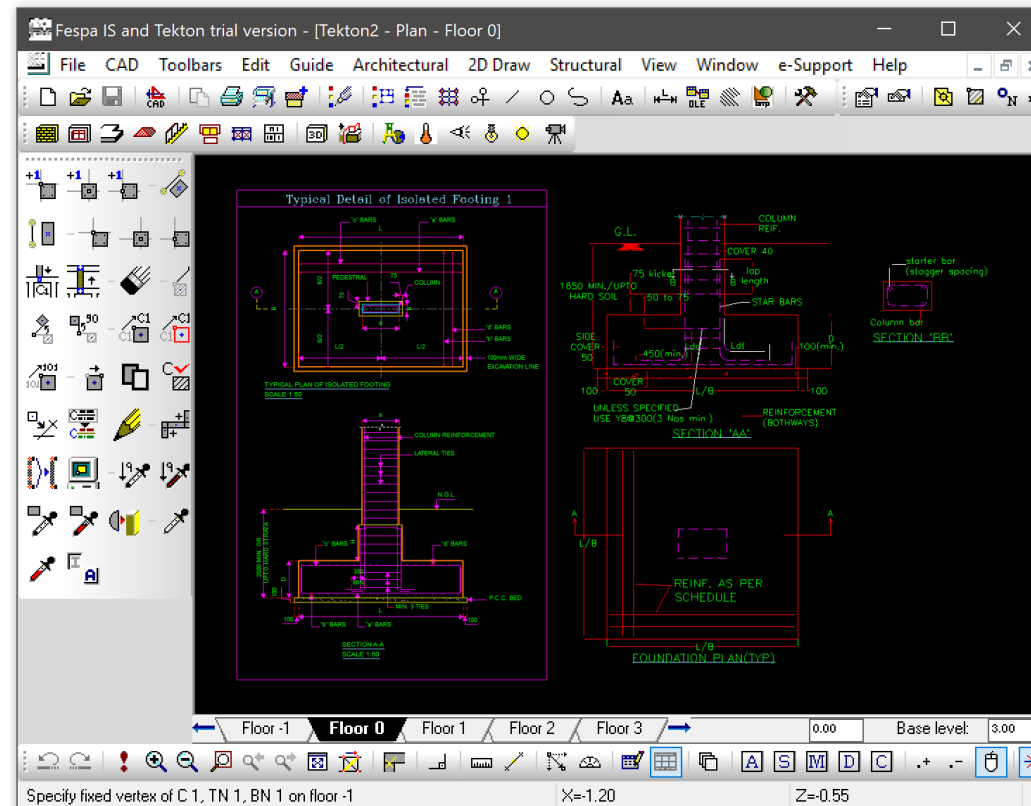
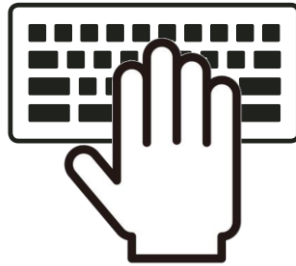




Keystroke-Level Model (KLM)

Card et al., 1980

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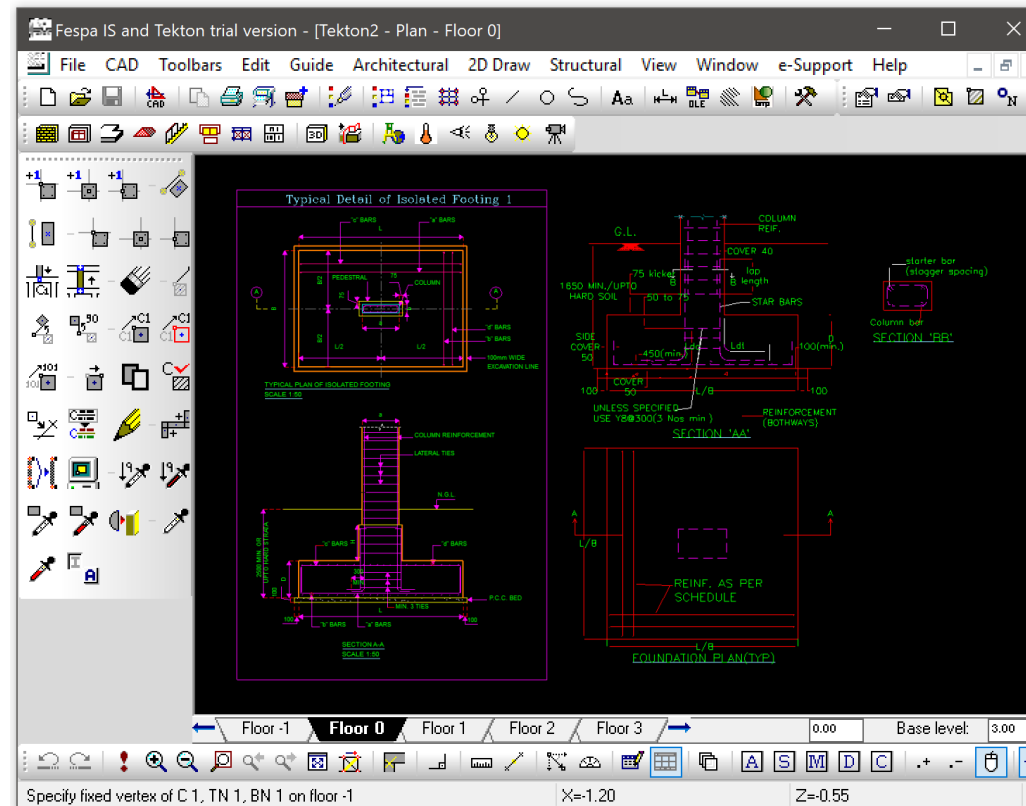




Keystroke-Level Model (KLM)

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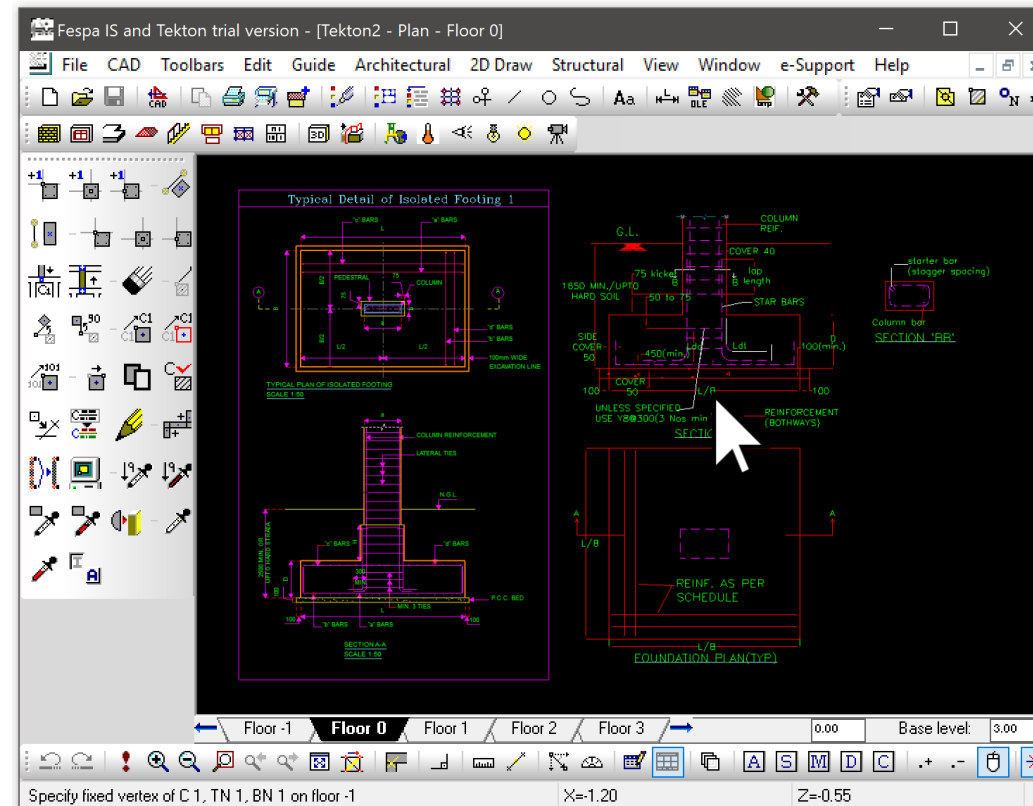




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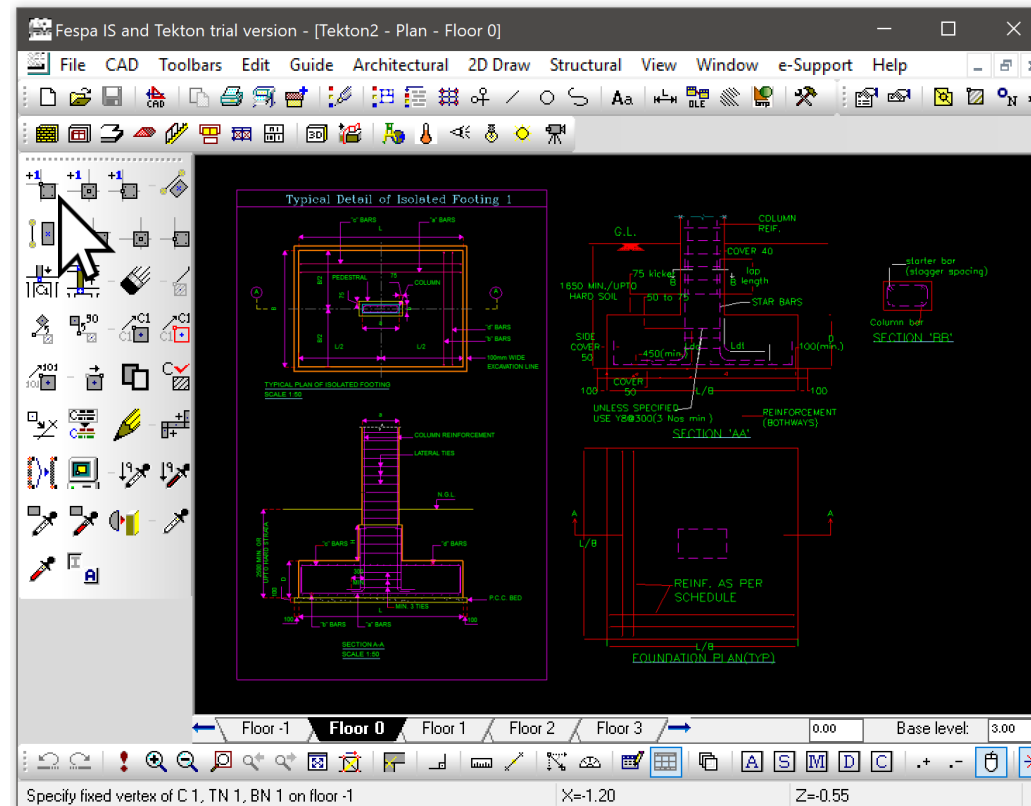
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Card et al., 1980

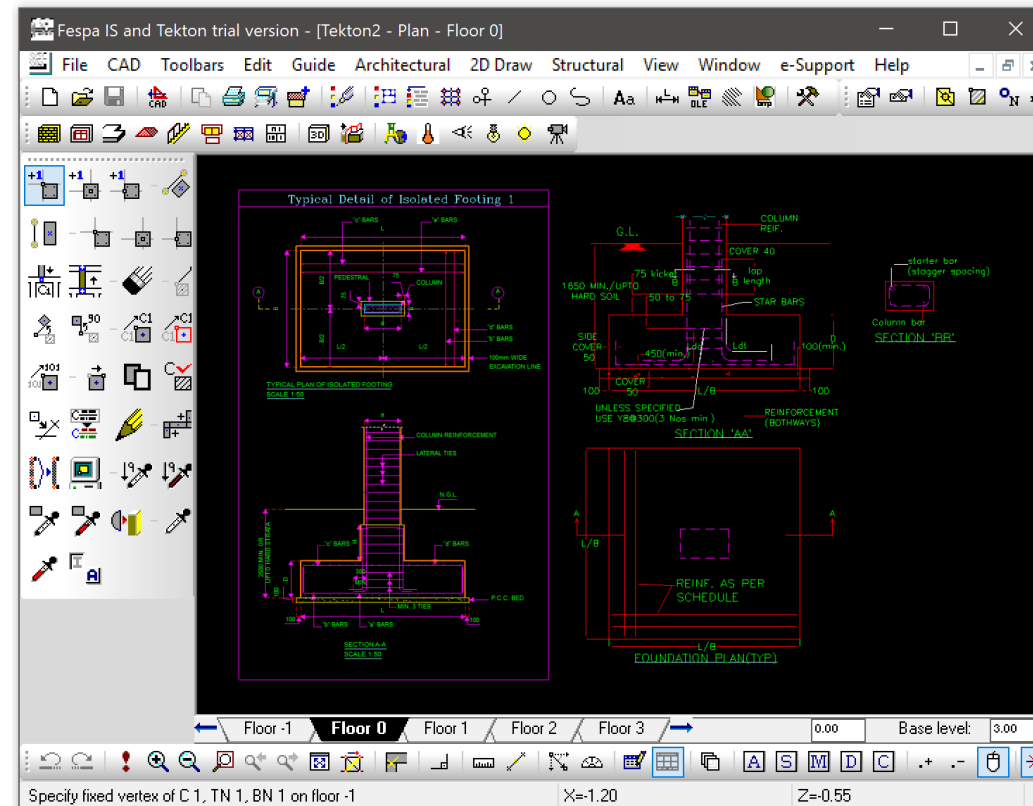
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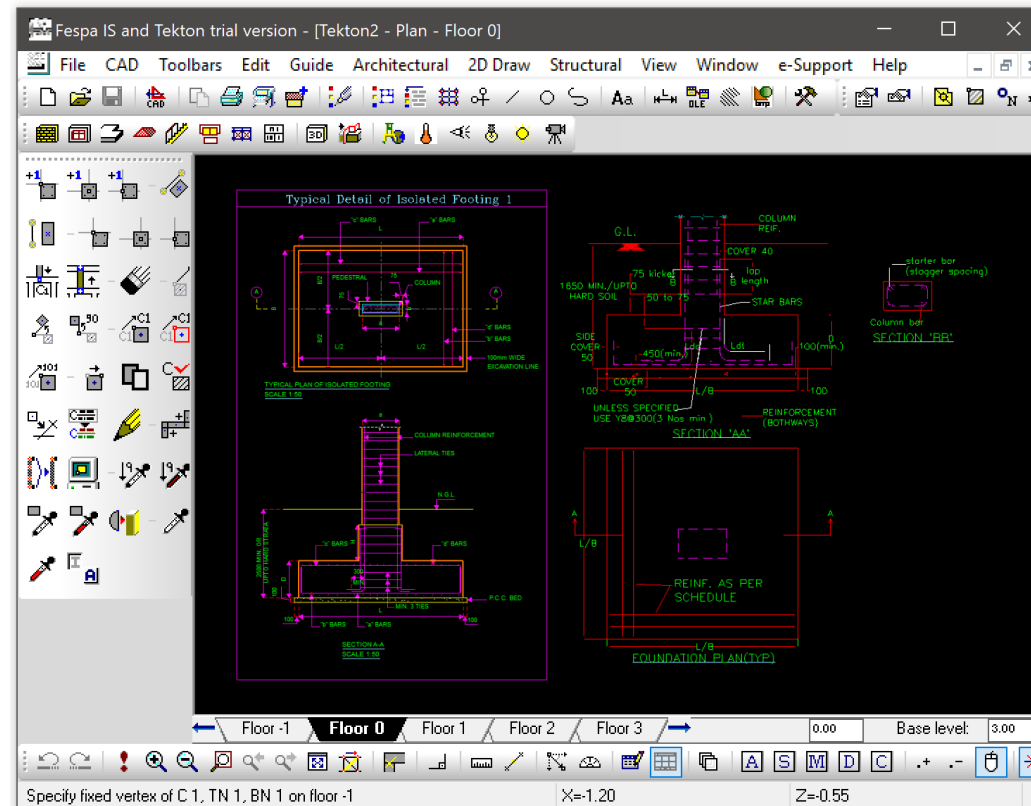




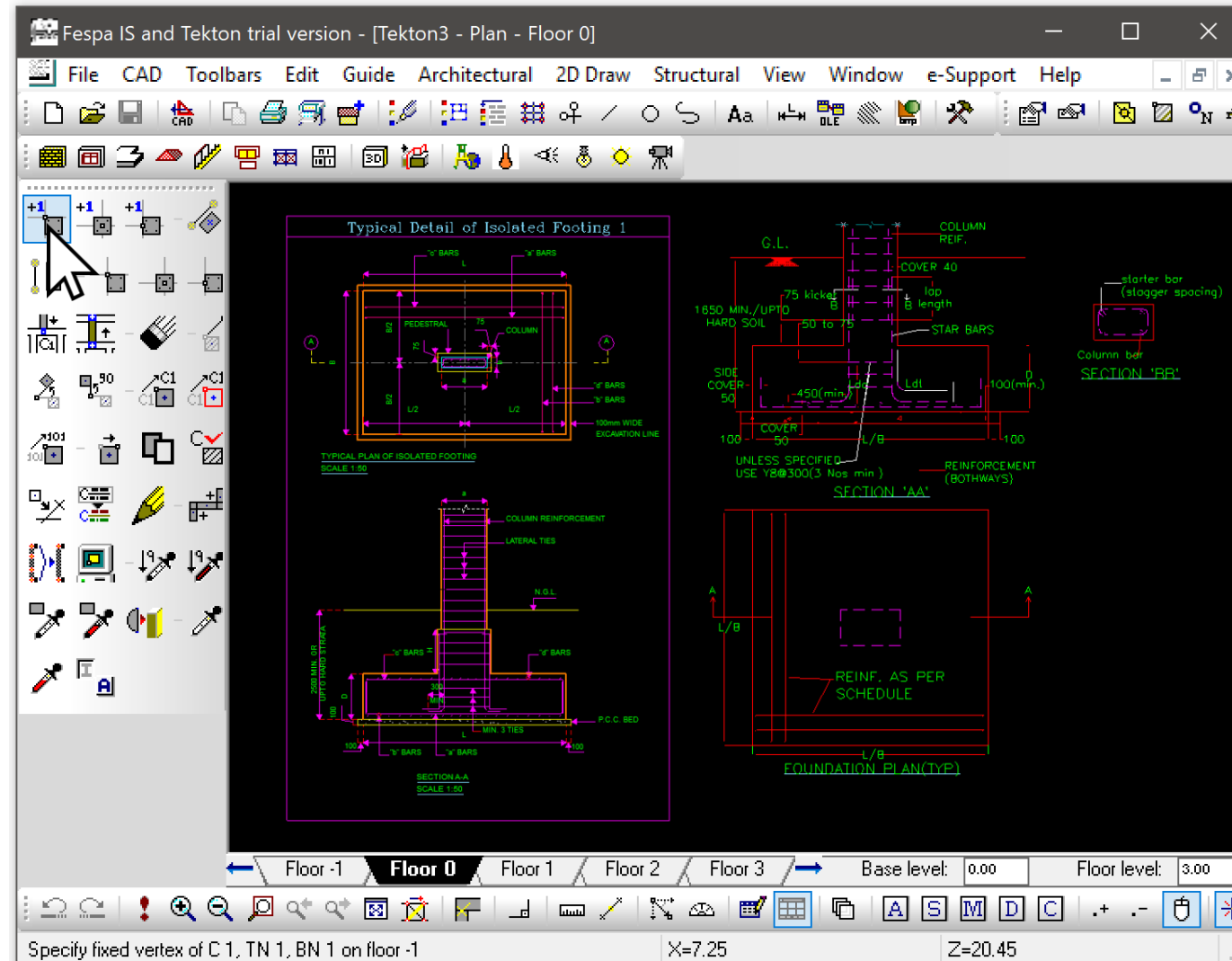
Keystroke-Level Model (KLM)

 Card et al., 1980

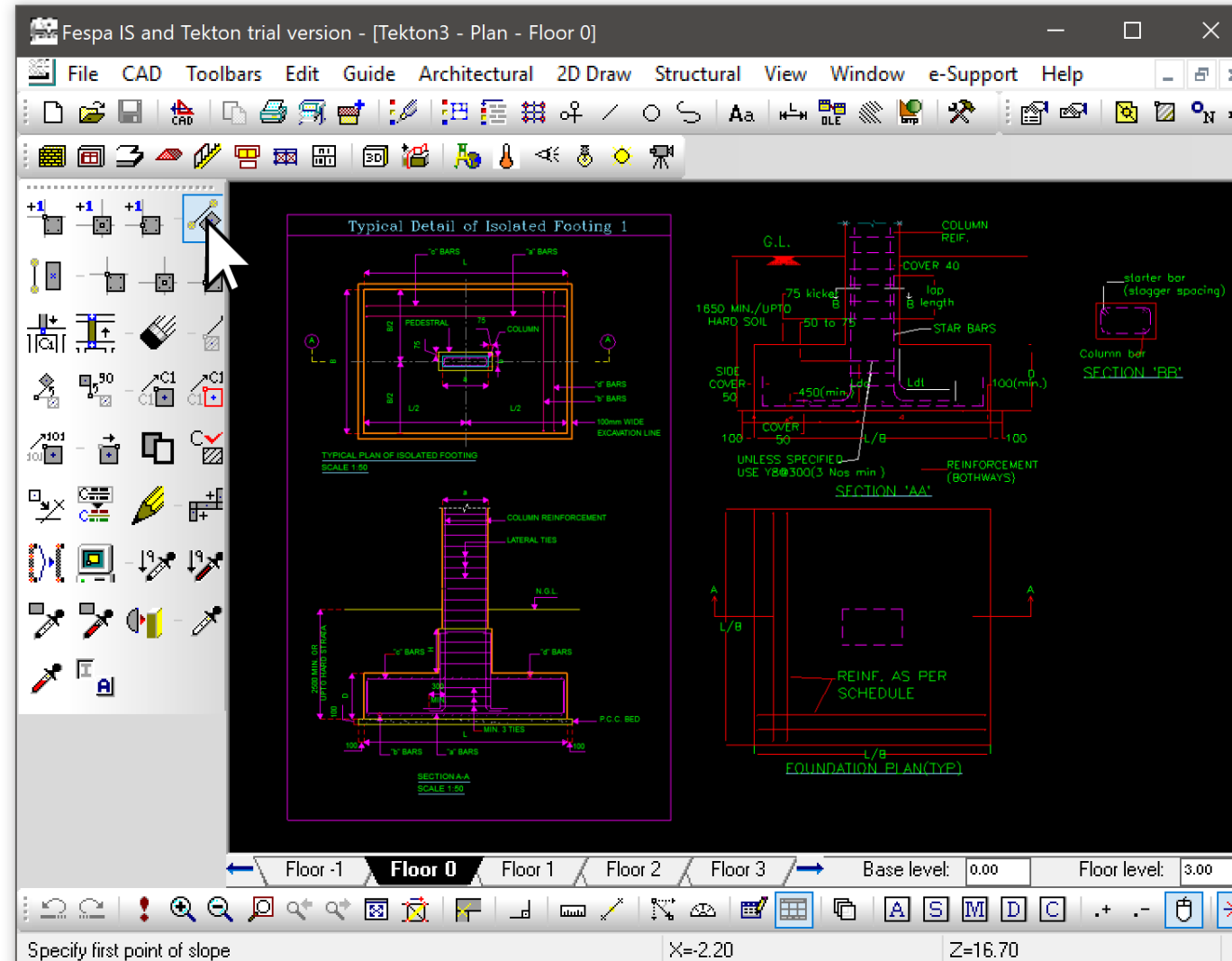
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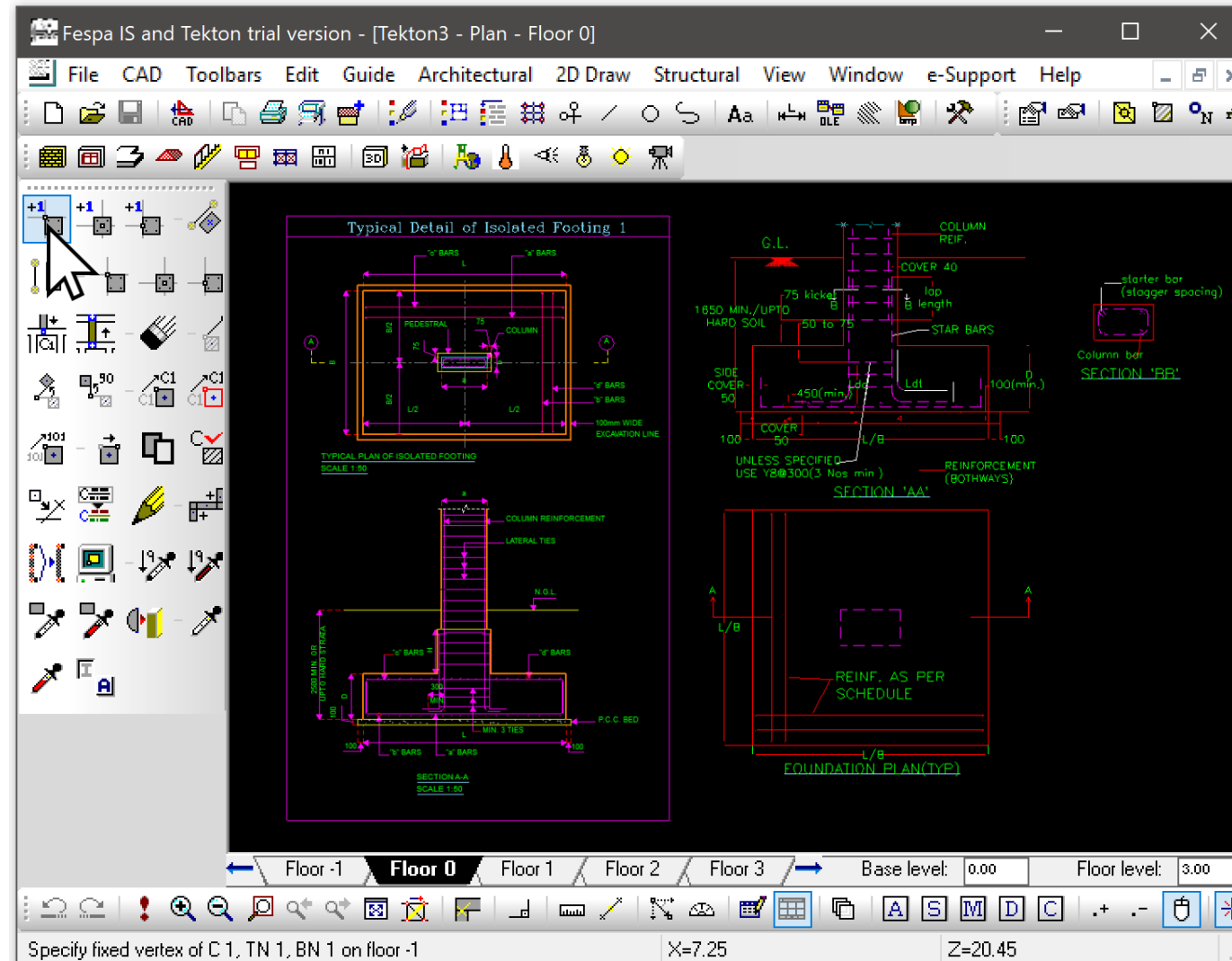
T_{Same}



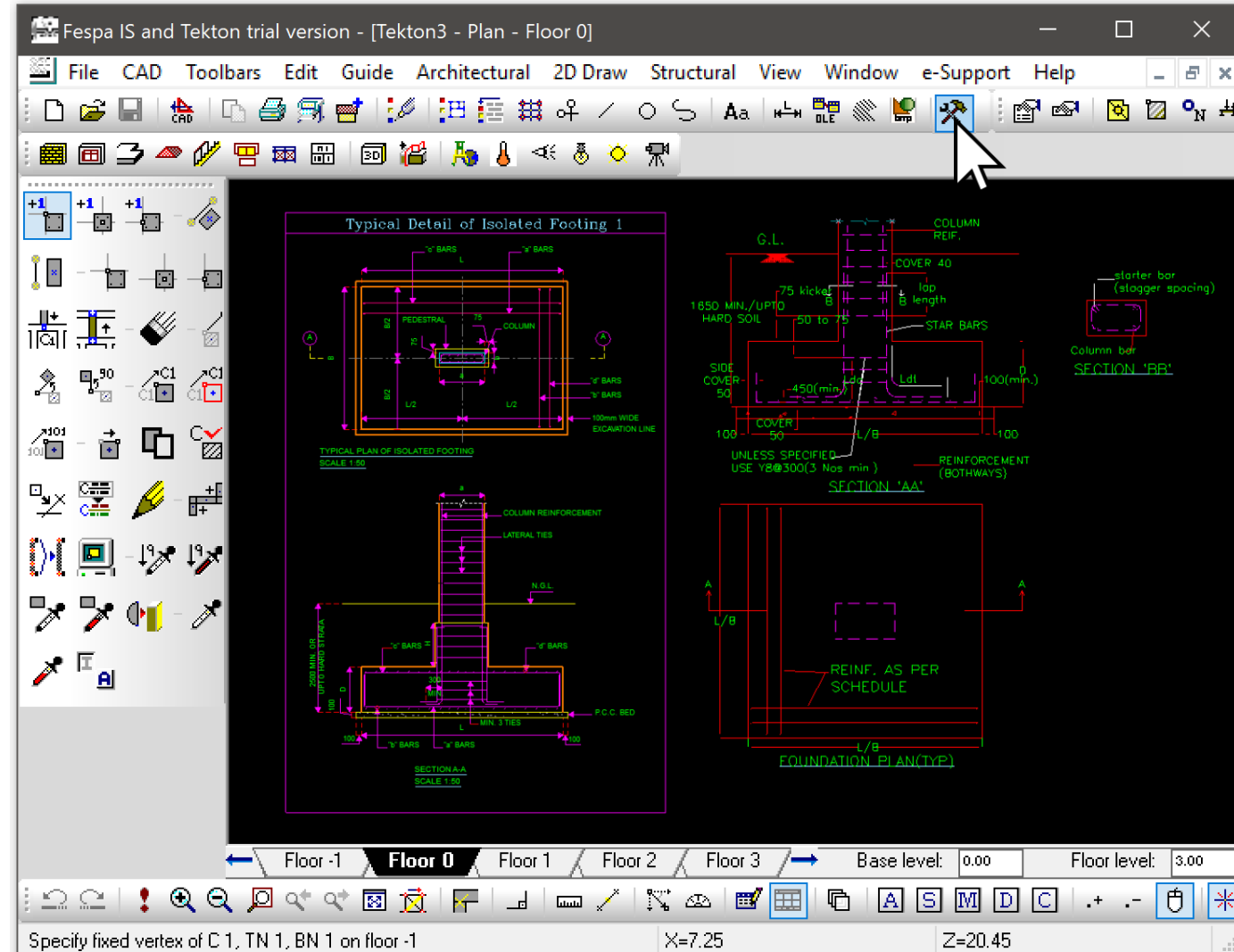
T_{Same}



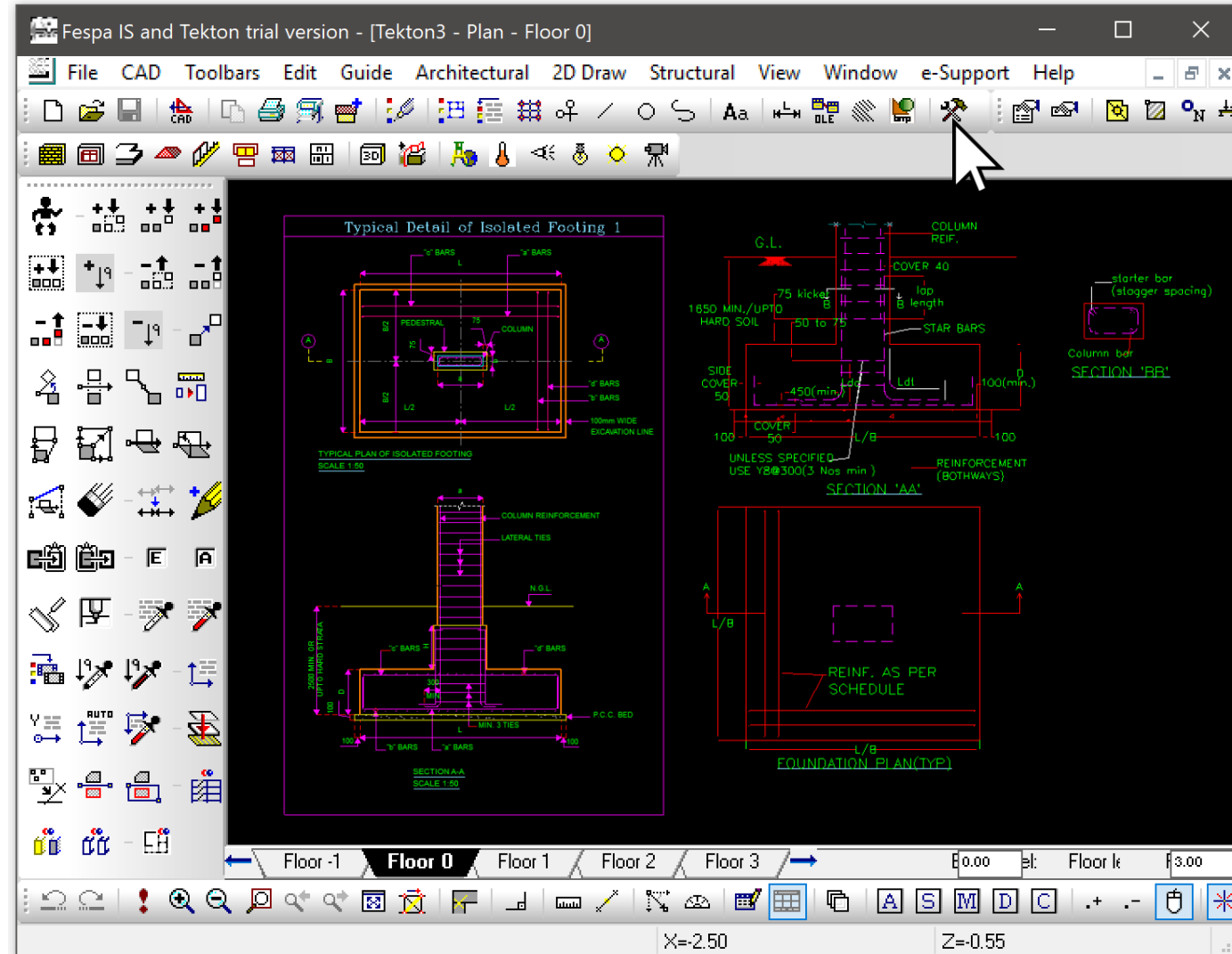
$T_{different}$



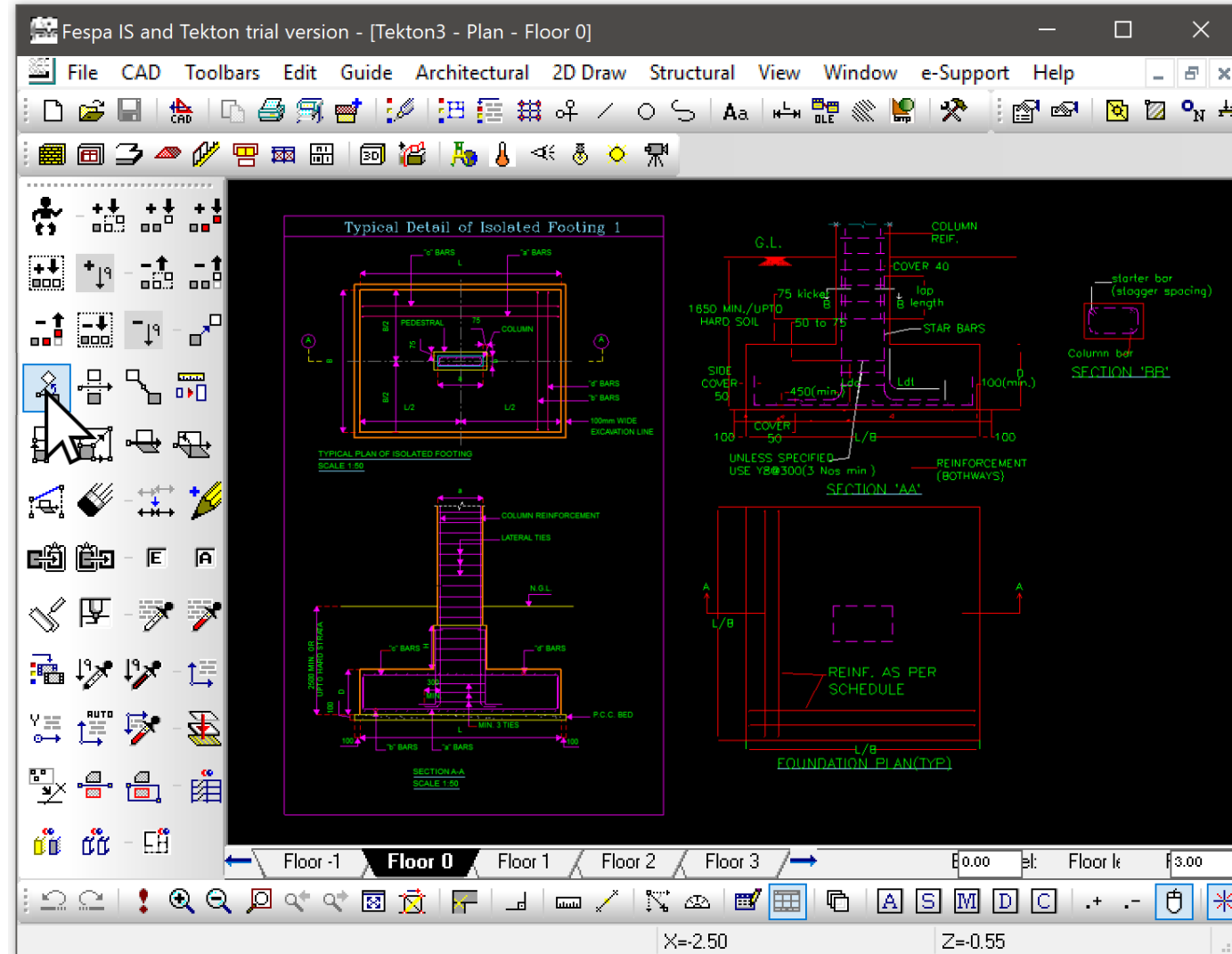
$T_{different}$



$T_{different}$



$T_{different}$



Our Model

Eliminate T_{System}

Combine rest to:

T_{Same} : previous command in same entity

$T_{Different}$: previous command in different entity

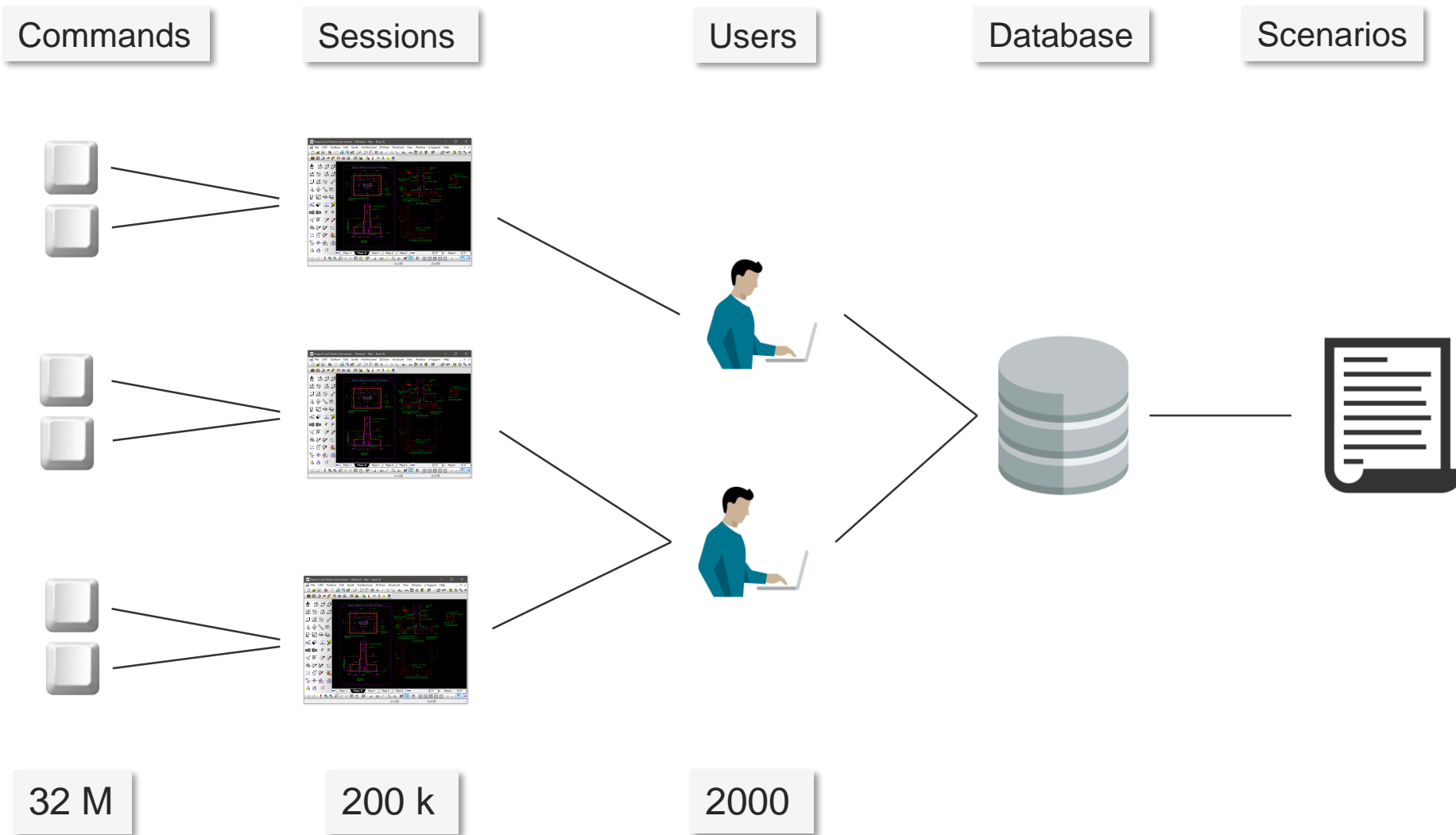
Count commands:

N_{Same} : previous command in same entity

$N_{Different}$: previous command in different entity

$N_{Toolbar}$: command always available in a toolbar

$$T_{Total} = T_{Same} \times (N_{Same} + N_{Toolbar}) + T_{Different} \times N_{Different}$$

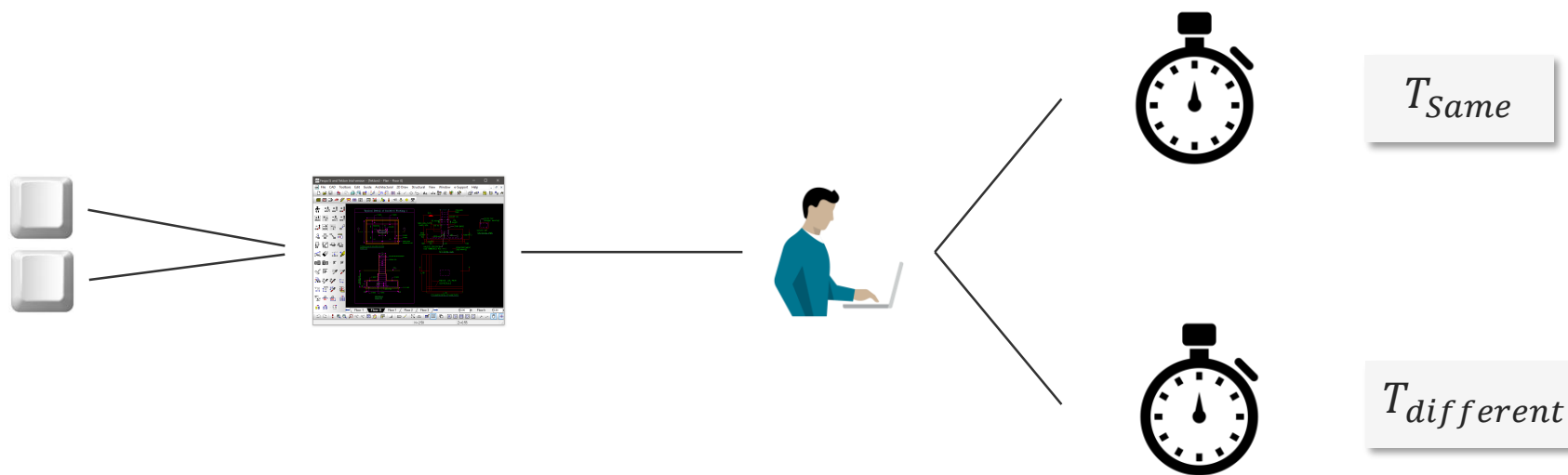




Commands

Sessions

Users



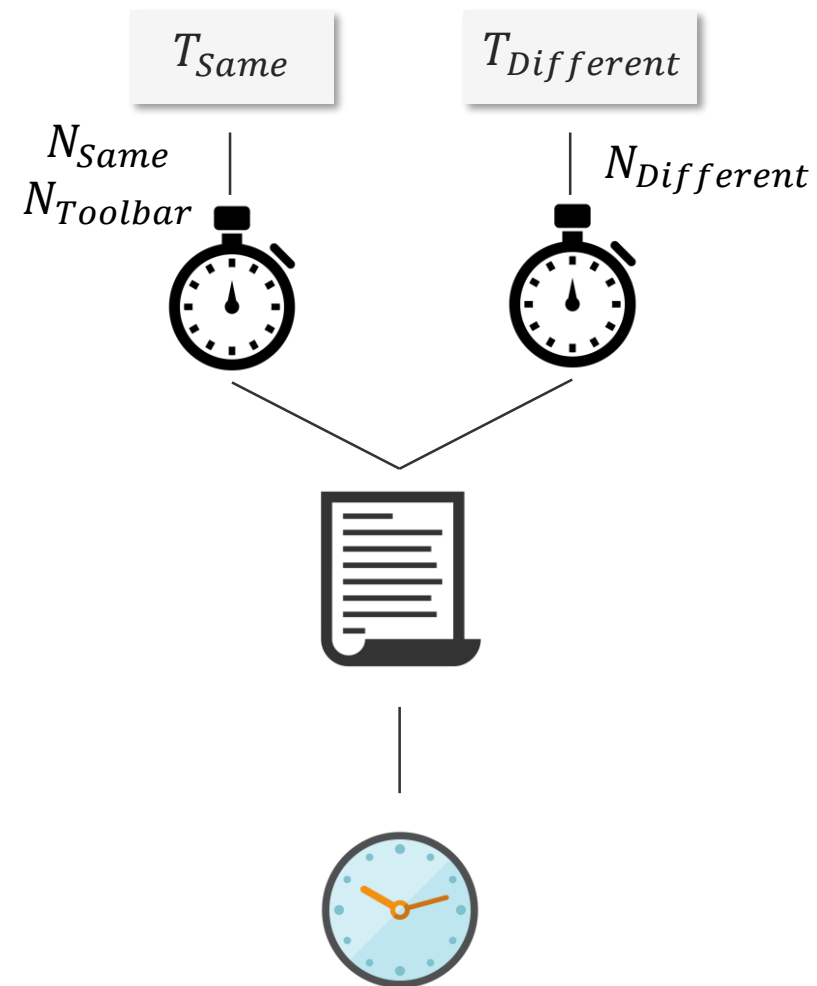


Optimization Algorithms



CURRENT

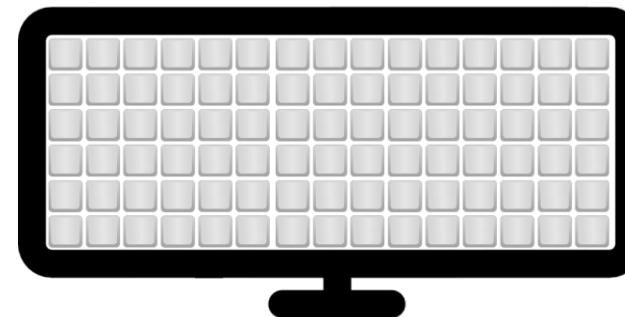
Measurement with the GUI
at the current setup.





ALL

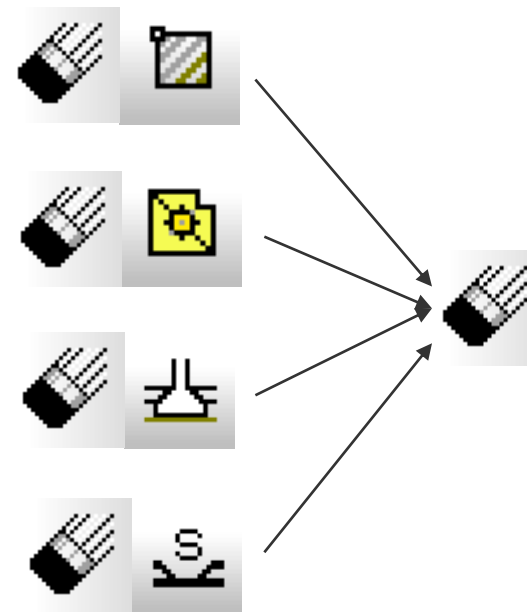
All commands available
directly on the screen.





GROUP

Group together commands between entities.





NAIVE

*N most frequent commands
always available on a toolbar.*





MRU-B

*N most frequent commands
always available on a toolbar.
For each user,
from a small batch.*





MRU-O

*N most frequent commands
always available on a toolbar.
For each user,
online.*





OPT(GA)

*N best commands always
available on a toolbar, using a
stochastic Genetic algorithm.*



OPT(GA)

*N best commands always
available on a toolbar, using a
stochastic Genetic algorithm.*



OPT(GA)

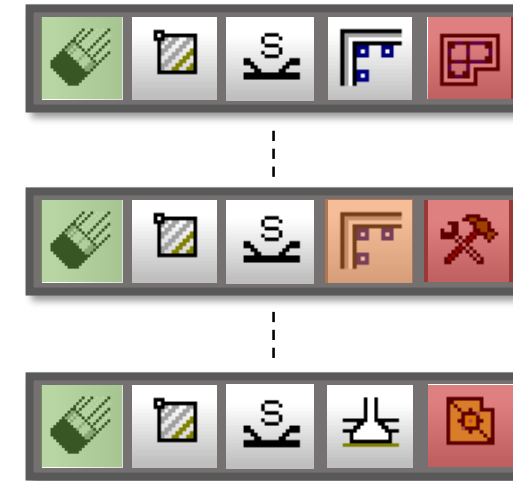
*N best commands always
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OPT (GA)

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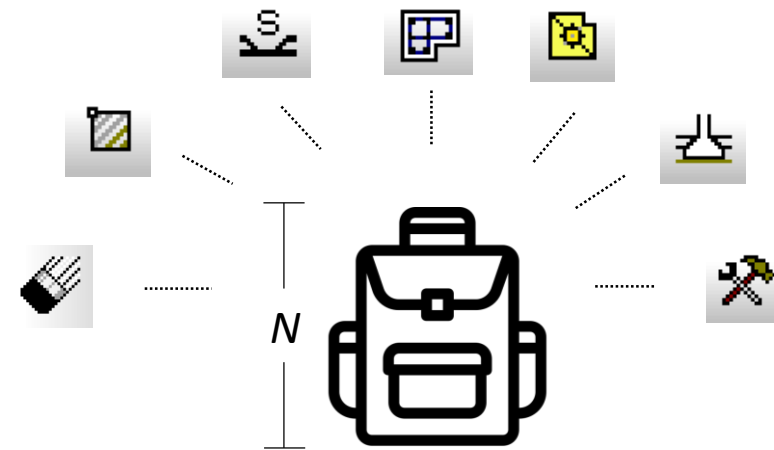


17.40%



**OPT(KS)**

N best commands always available on a toolbar, using a heuristic Knapsack algorithm.



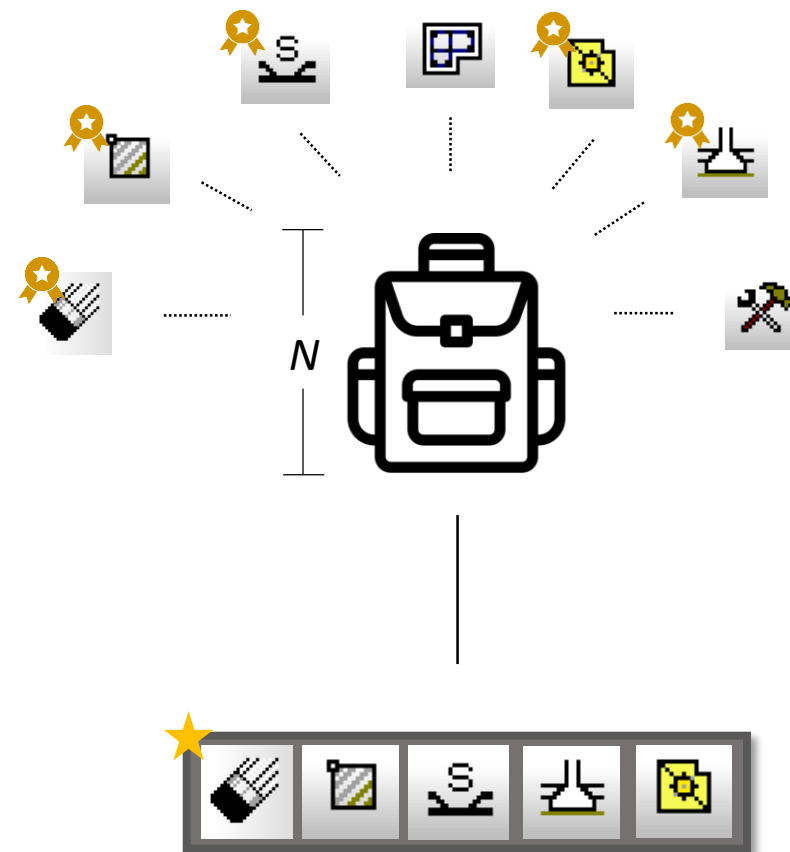


OPT(KS)

N best commands always available on a toolbar, using a heuristic Knapsack algorithm.

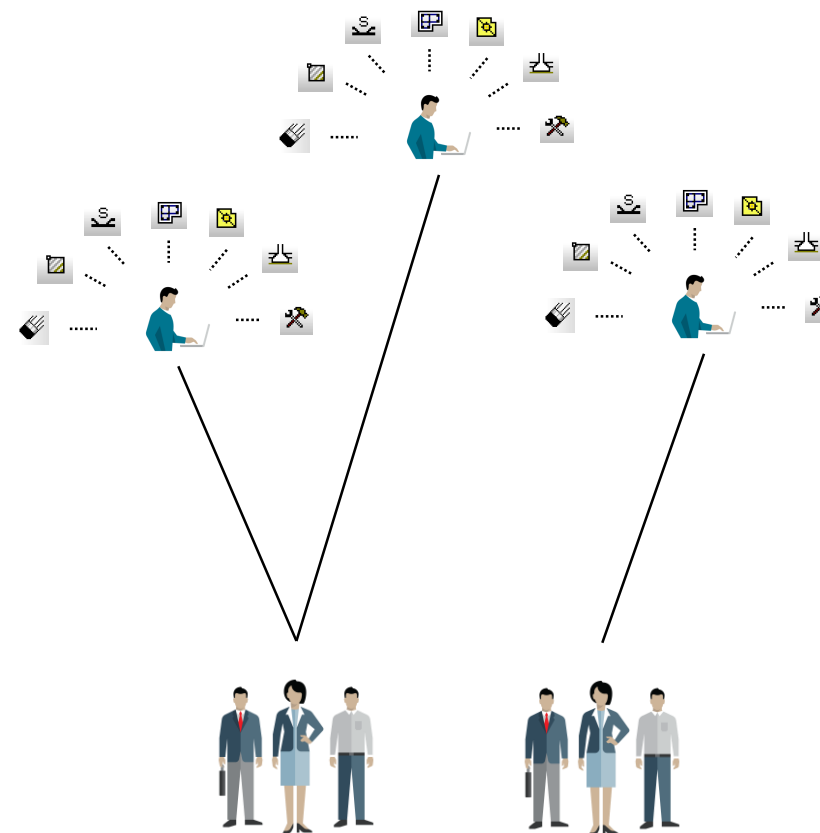


17.43%



**CLUSTER**

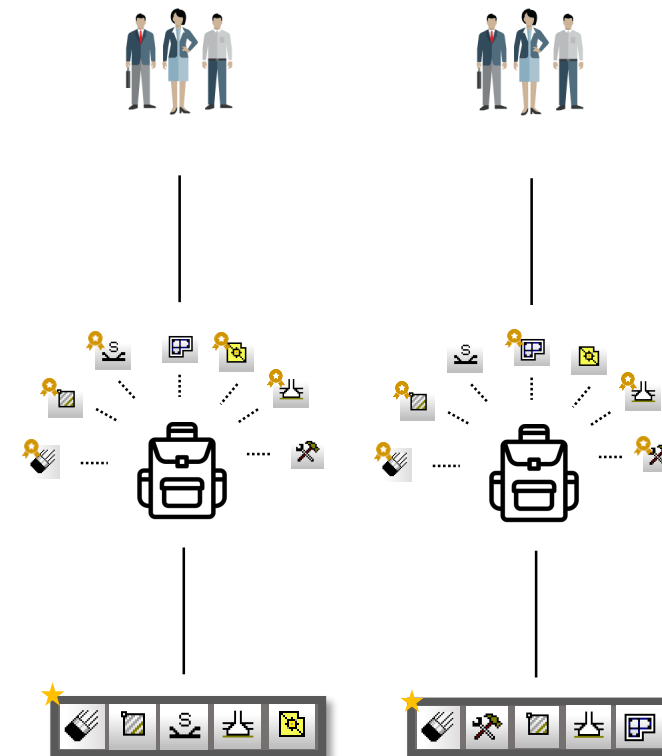
*Make clusters (kmeans) of users
Run OPT(KS) for each cluster.
Show best N commands to each.*





CLUSTER

Make clusters (kmeans) of users
Run OPT(KS) for each cluster.
Show best N commands to each.





CLUSTER

Make clusters ($kmeans$) of users
Run OPT(KS) for each cluster.
Show best N commands to each.



17.43%

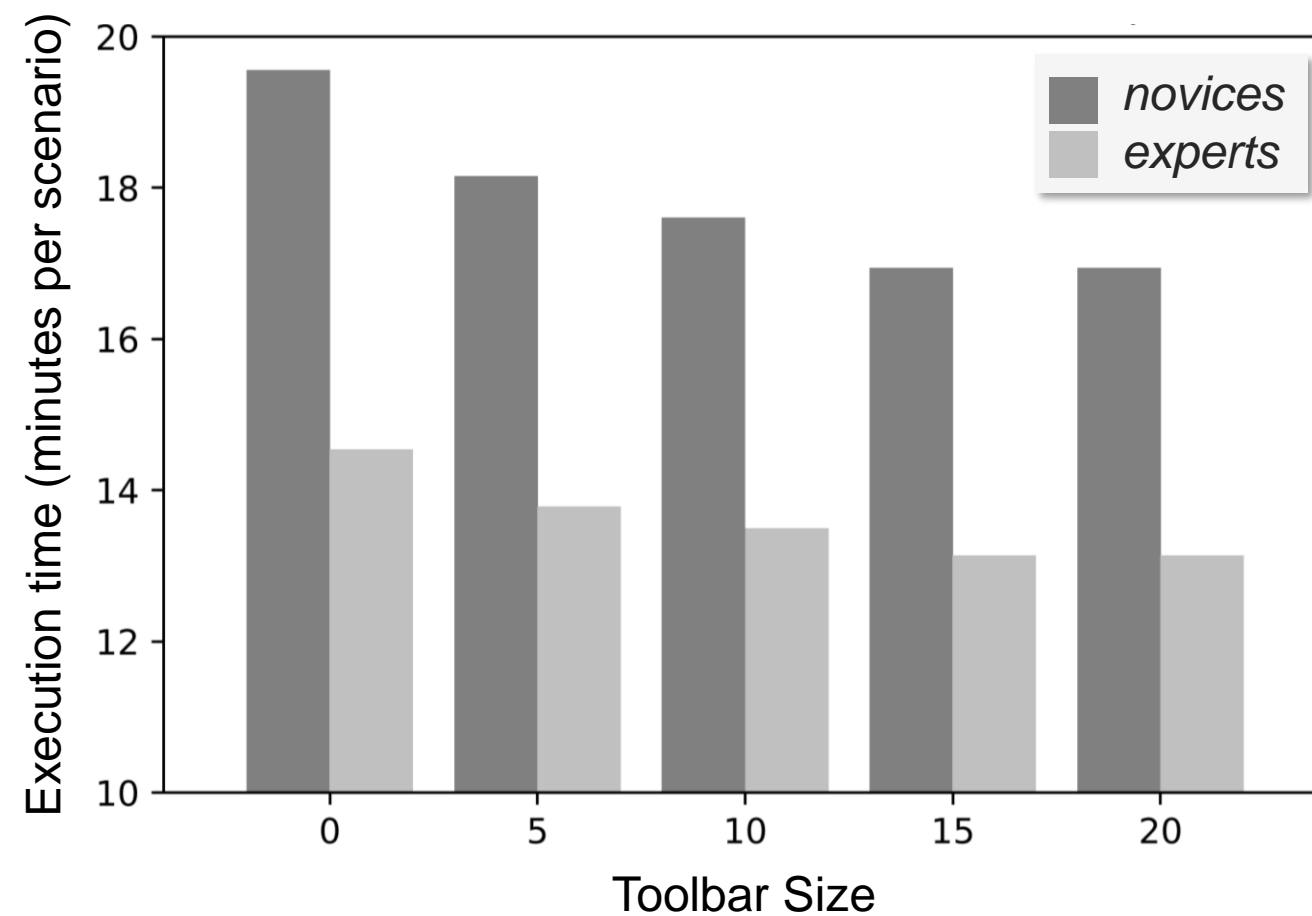


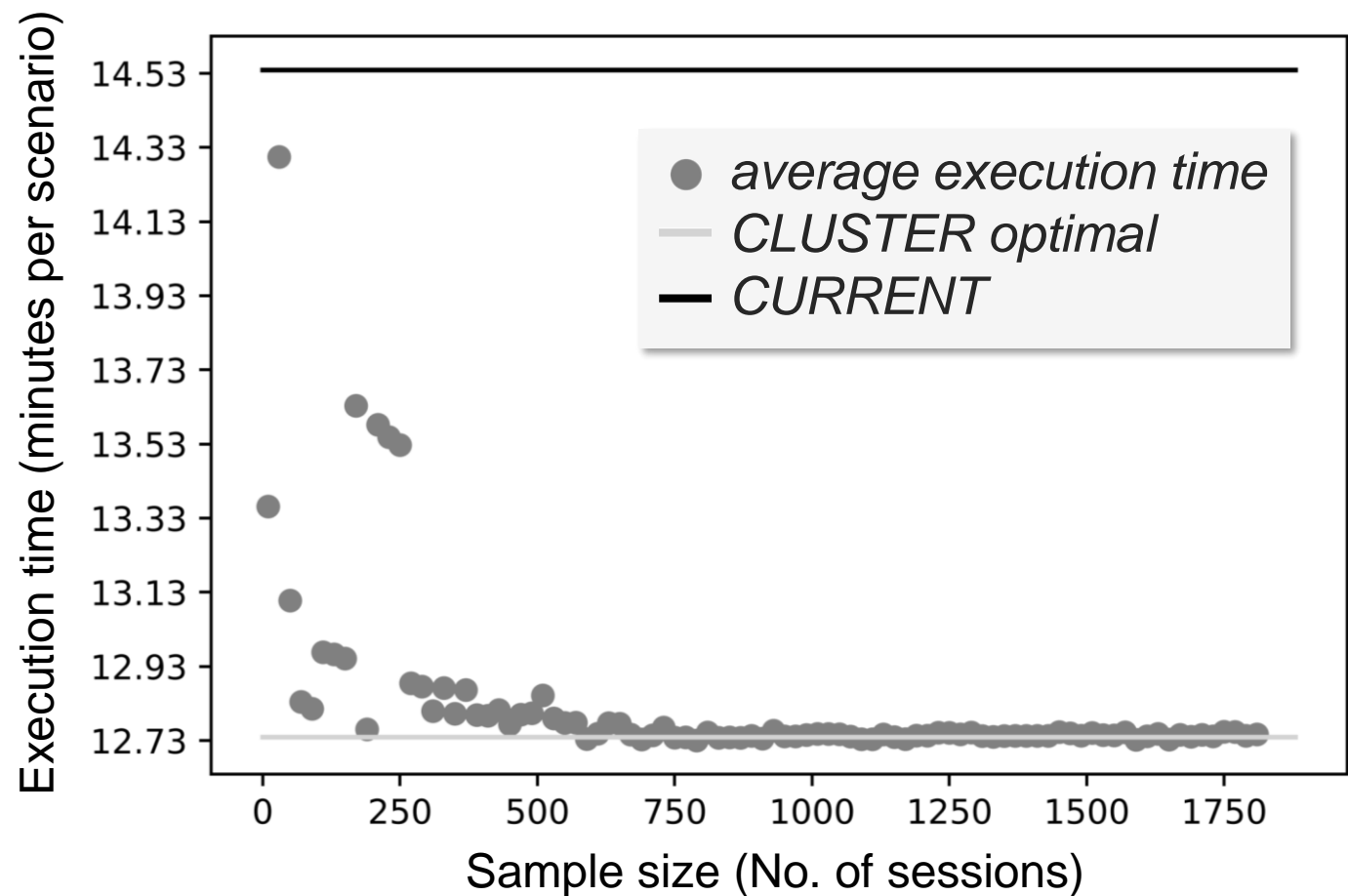
Method	Optimization	Training Time (s)
ALL	18.5%	-
GROUP	0.6%	-
NAIVE	13.2%	7.8
MRU-B	10.4%	74.2
MRU-O	13.5%	- *
OPT (GA)	17.40%	19,749
OPT (KS)	17.43%	1,946
CLUSTER	17.43%	2035 *



* user data

■ good
■ optimal
■ bad







Command Grouping

GUI optimization
systemization



Command Grouping

GUI optimization
systemization

CLUSTER





Command Grouping

GUI optimization
systemization

CLUSTER

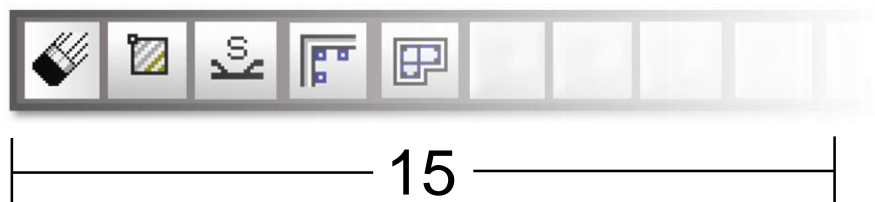


15

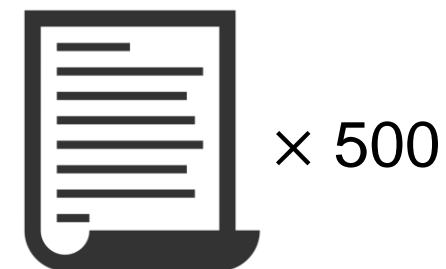


Command Grouping

GUI optimization
systemization



CLUSTER





Thank you!

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efs.lattas.eu



@CoolSWEng