Iterative Design of Semantic Grouping Guidelines for Mobile User Interfaces

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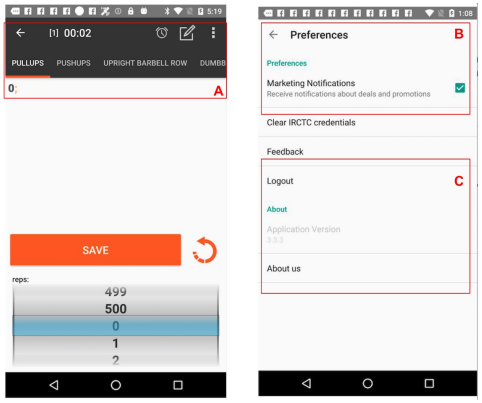
Motivation

Prior work in computation evaluation and optimization of user interfaces (UI) have focused on **visual aspects**, such as spatial layout[1] and aesthetics[2].

Computational methods have not touched on **semantic grouping:** grouping based on the functionality, content, or purpose of its elements

Currently, there are no formal guidelines for semantic grouping. Poor semantic grouping leads to lower learnability[3] and slower task completion[4]:



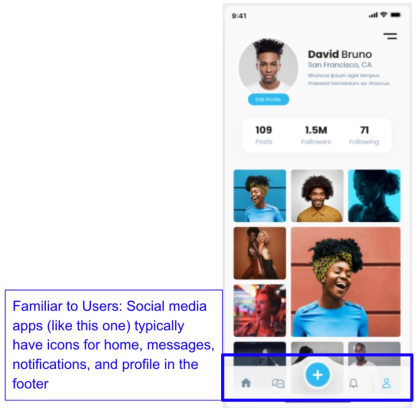
Goal

We conducted a study to **determine guidelines for semantic grouping and applied them to build computational metrics**

Guidelines

Results: 6 Multi-part Guidelines

Guideline 2: Familiar to Users
Concise Version: The grouping should be familiar to users. This can be achieved by following established design conventions.

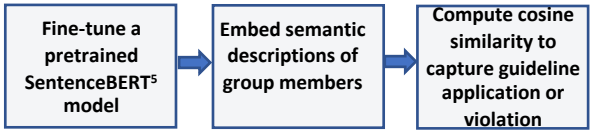


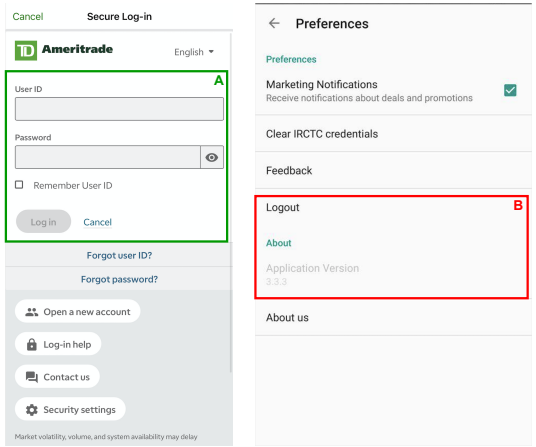
Detailed Version: The grouping should be familiar to the app's target user base. It follows established design conventions, so users likely would have seen this grouping before and recall its purpose. These design conventions depend on the type of app (e.g. social media apps typically have icons for home, messages, notifications, and profile in the footer). However, this guideline is not meant to discourage innovation when appropriate.

Expert Review Results:

Guideline	Clarity (Concise)	Clarity (Detailed)	Importance	Comments on Importance
1. Related Group Members	3.71 ± 0.92	4.35 ± 0.69	5. ± 0.	"core of any interface design"
2. Familiar to Users	4.28 ± 0.45	4.57 ± 0.73	4.5 ± 0.5	"users may not interact with unfamiliar groupings"
3. Labeling for Clarification	4.71 ± 0.45	4.71 ± 0.45	5. ± 0.	"apps will be unusable if there weren't labels helping users understand what's going on"
4. Avoiding Redundancy	4.42 ± 0.73	3.91 ± 0.93	4.5 ± 0.71	"redundancy is confusing and distracting"
5. Hierarchical Subgrouping	4.42 ± 0.49	4.28 ± 0.70	4.88 ± 0.33	"hierarchical subgrouping will make it easier for users to find the information they need"

Computational Metrics (Work in Progress)





Group A applies Guideline 1 and has a cosine similarity score of **0.70**, while **Group B** violations the guideline and has a score of **0.43**.

Guideline	Application	Violation
1. Related Group Members	0.65 ± 0.12	0.48 ± 0.10
3. Labeling for Clarification	0.81 ± 0.16	0.52 ± 0.16
4. Avoiding Redundancy	0.77 ± 0.15	0.90 ± 0.024
5. Hierarchical Subgrouping	0.76 ± 0.18	0.62 ± 0.022

Average cosine similarity scores

1. Duan, Peitong, et al. "Optimizing User Interface Layouts via Gradient Descent." *CHI 2020*.
2. Todi, Kashyap, et al. "Sketchplore." *DIS 2016*
3. Tim Halverson. et al. "The Effects of Semantic Grouping on Visual Search. " *CHI 2008 EA*
4. Bailly et al. "Model of Visual Search and Selection Time in Linear Menus. " *CHI 2014*
5. Reimers, Nils, et. al. "Sentence-BERT: Sentence Embeddings using Siamese BERT-Networks". *ACL 2019*