Development of a User-Friendly Interface Design

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Abstract

With an increasingly aging population, Assistive Technologies (AT) are becoming a more important part of society. Even though many new AT devices are introduced each year, many older adults are reluctant to use them due to unfamiliarity and difficulty of use. This study implemented and tested the design of a user-friendly touch interface for a reminder system. User feedback was used in an iterative design approach which allowed improvements in usability for older adults and provided insights into older adults' perceptions of technology.

Motivations

Technology acceptance is a major problem when designing AT for older populations [1]. Modern user interfaces (UIs) on such devices can be problematic for older adults who have not used such devices from a young age [2]. Key concerns for older adults include:

Usability and Perceived Ease of Use:
- Older adults' acceptance of new technologies is based on their perceived usefulness/ease of use [3]
- Ambiguously defined actions can cause confusion decreasing potential to use the device further [4]

Stigma Associated with Assistive Devices:
- Stigmas associated with AT devices may have negative social consequences and may lead to discrimination, social isolation, and marginalization [5]

Self-Stereotyping:
- Older adults may internalize stereotypes about themselves, leading to negative consequences and avoidance of tasks to which those stereotypes may apply [6,7]

Methods

Iterative Development:
The user interface was developed in three iterations (plus an initial prototype), with 6 participants used in each iteration. Participants were adults over 65 recruited at local senior centers.

Participant Interaction Sessions:
- Participant sessions were held at local senior centers
- Participants given four tasks involving scheduling reminders for daily activities
- Interacted with interface on Android tablet
- Interactions were video-recorded for later analysis
- Participants were asked a series of questions regarding their opinions about the interface and general perceptions related to older adults and technology use

Iteration Improvements:
- Feedback from participants and observations of interactions with the interface used to refine prototype after each iteration
- Particular interest given to improving components which most frustrated or confused participants
- Some changes driven by participant suggestions or questions
- Focus on making design with clear interaction path and multi-modal interaction

Analysis:
- Each participant recording viewed by two investigators
  - Time to complete tasks was noted
  - User interaction with device coded for verbal/nonverbal elements
  - User responses to questions coded for analysis
- Inter-rater reliability examined to determine most coherent categories
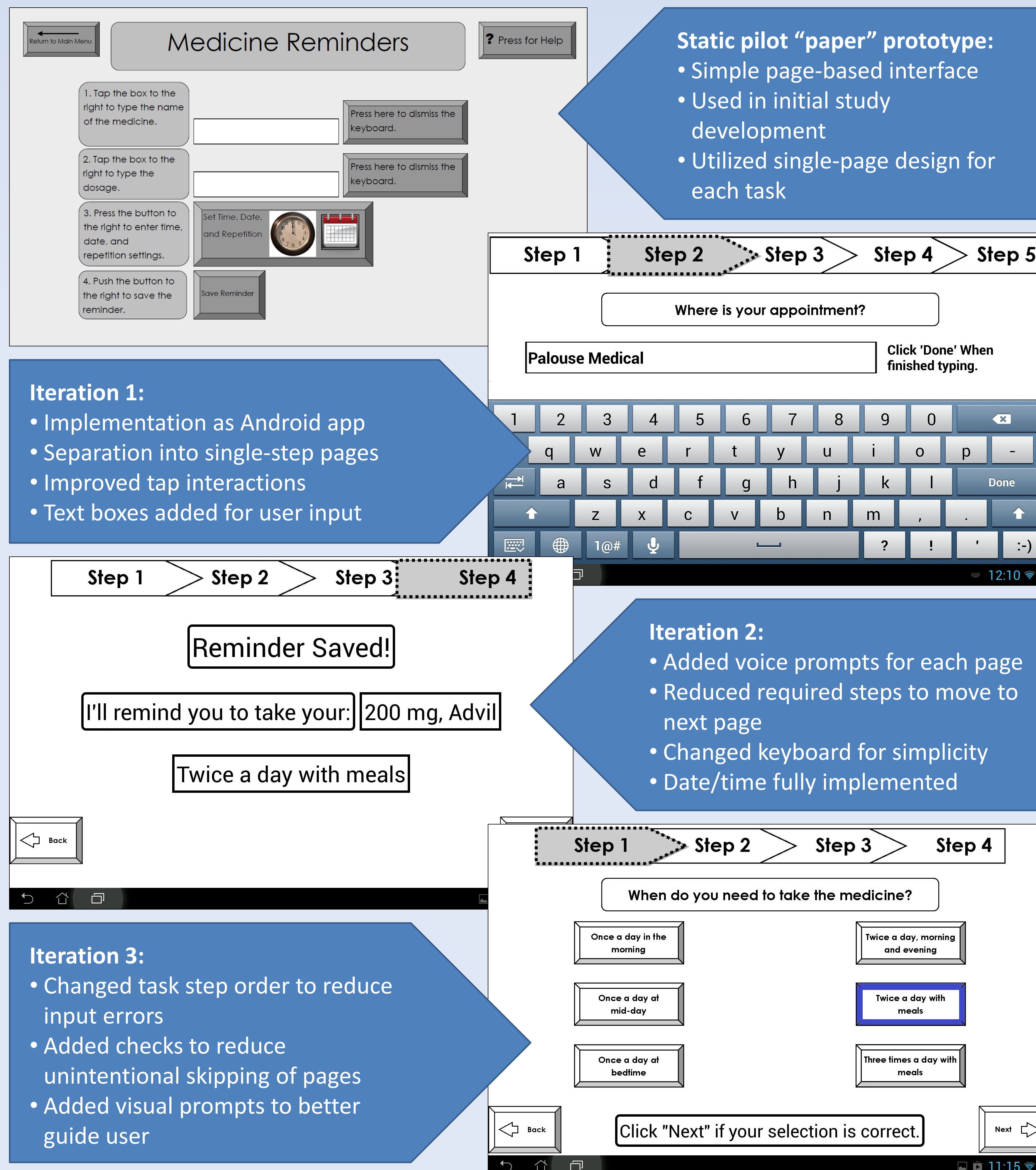
Hypotheses

H1: Use of familiar audio and visual cues and incorporation of older adults' feedback in the development of a smart home prompt scheduling user interface will increase subjects' willingness to adopt the technology for personal use.

H2: Users will prefer a customized interface over a standard universal design.

H3: Negative self-stereotypes of ageing affect willingness to adopt new technologies.

User Interface Design

Static pilot "paper" prototype:
- Simple page-based interface
- Used in initial study development
- Utilized single-page design for each task

Iteration 1:
- Implementation as Android app
- Separation into single-step pages
- Improved tap interactions
- Text boxes added for user input

Iteration 2:
- Added voice prompts for each page
- Reduced required steps to move to next page
- Changed keyboard for simplicity
- Date/time fully implemented

Iteration 3:
- Changed task step order to reduce input errors
- Added checks to reduce unintentional skipping of pages
- Added visual prompts to better guide user

Results and Future Work

Decrease in Task Time with Iteration:
One category that shows strong inter-rater reliability is the time of task completion. Bivariate regression analysis comparing task completion time to iteration number shows a negative correlation – indicating that time to complete tasks generally decreases as the interface was improved

Overall Task Time vs. Iteration:
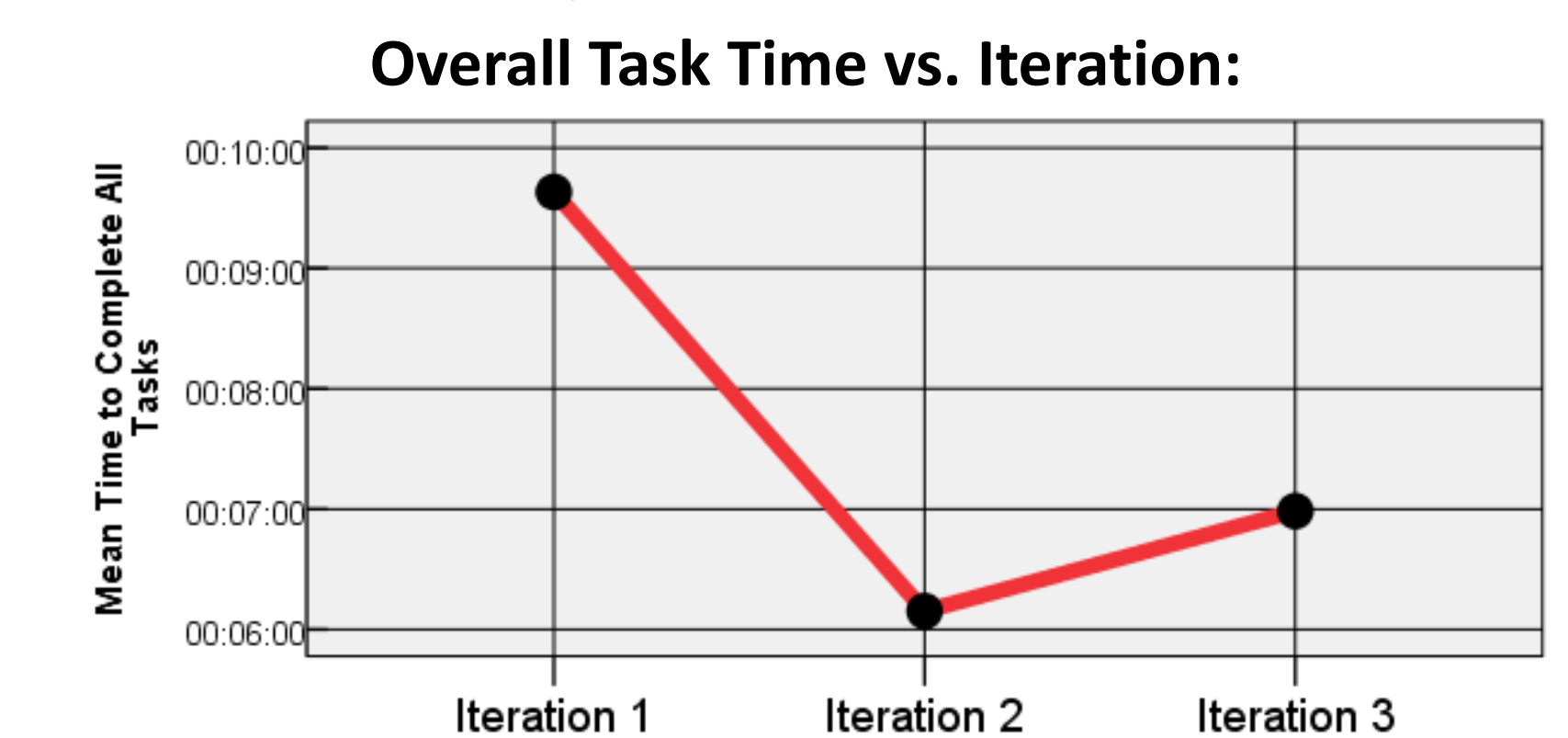
Individual Task Time vs. Iteration:
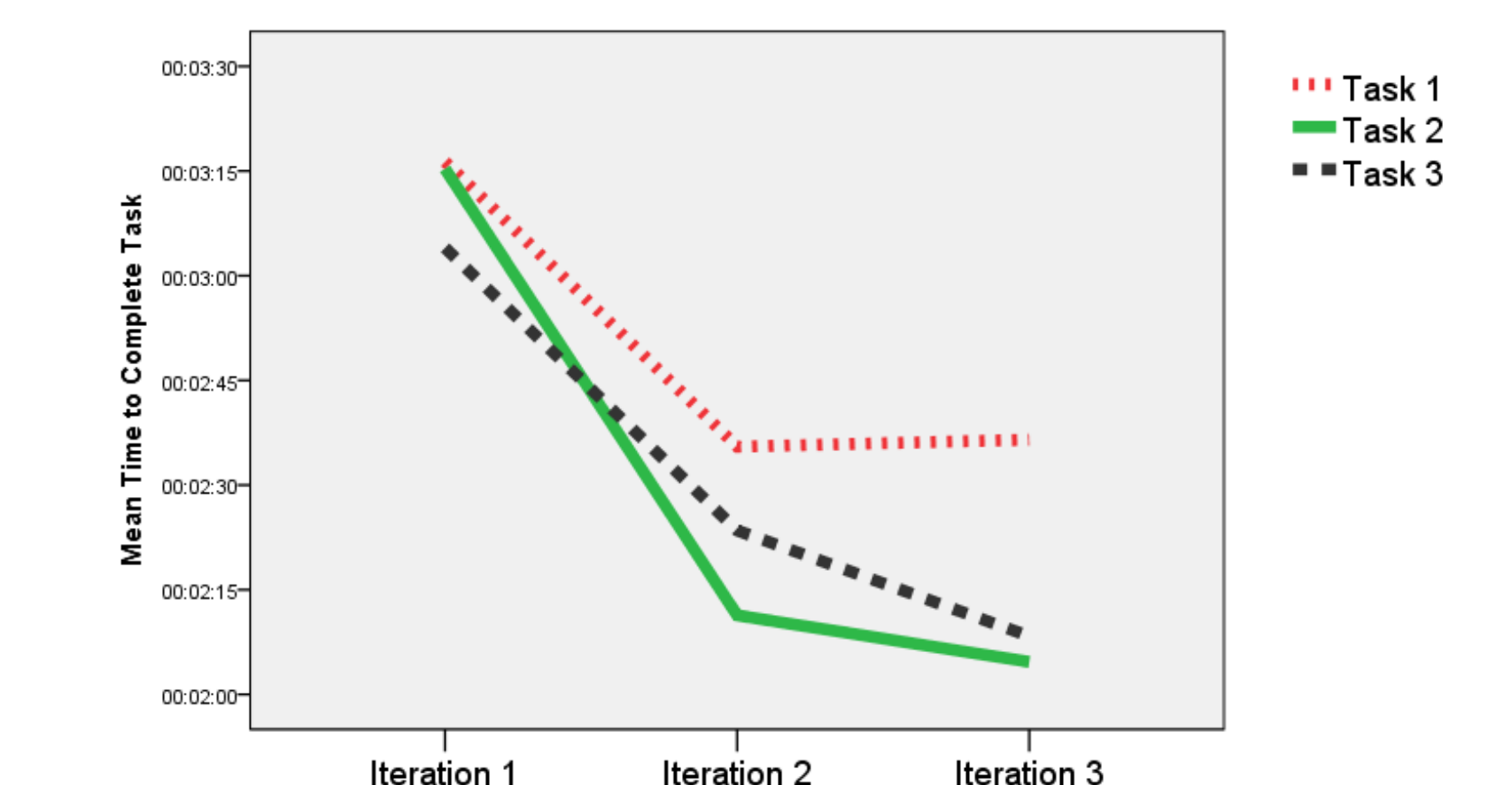
Anecdotal Results:
We found many comments from users that were not necessarily coded in the data were informative for interface development. Common observations include:
- Most users had some difficulty with the keyboard, especially mistyping due to the keyboard's sensitivity
- Many users expressed positive feedback about the step-by-step nature of the interface, though some preferred to input all information on the same page
- Multiple users verbally responded to the voice prompts before realizing speech-recognition technology was not in place on the device
- Participants almost universally indicated that they trust technology to work

Future Work:
- Experiment is planned to compare our system with off-the-shelf software, with user interaction followed by a questionnaire – to begin Summer 2013
- Barriers to technology acceptance are not limited to usefulness/ease of use – experiment will test effects of health stigma, stereotypes, and privacy concerns
- Our continuing goal is to understand and reduce barriers to adopting assistive technology for those who can benefit from it, and integrate the system more fully with the Smart Home to add more functionality to that system as well

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