Smartphone Usage by Expert Blind Users

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Accessible Smartphone

Screen reader software, e.g., TalkBack

- reads the screen contents
- supports touch-based gestures

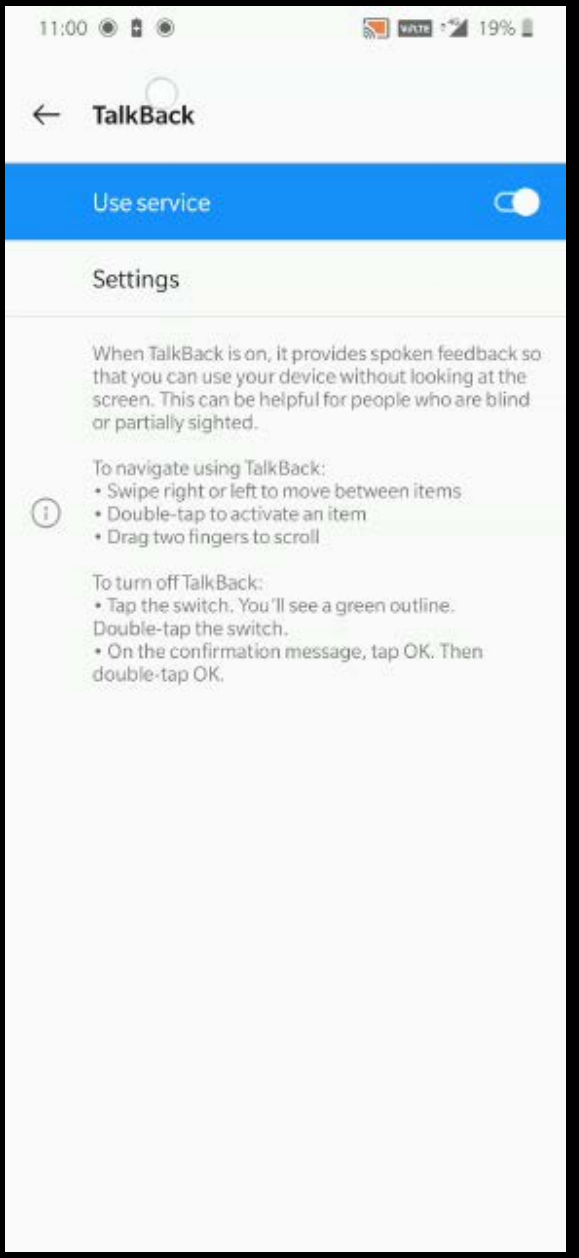
It enables the user to use the phone in an eyes-free manner.

Google TalkBack

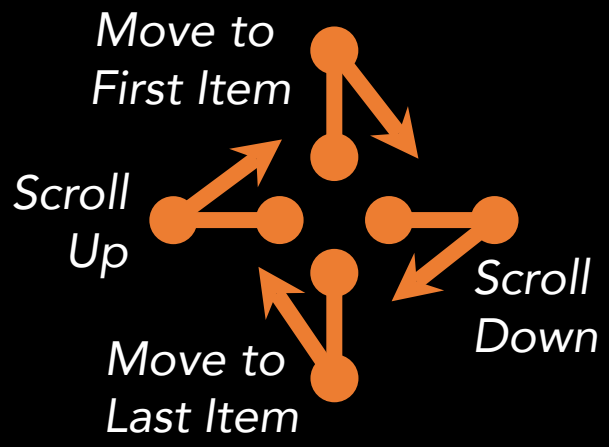
Apple VoiceOver

TalkBack Explore by Touch

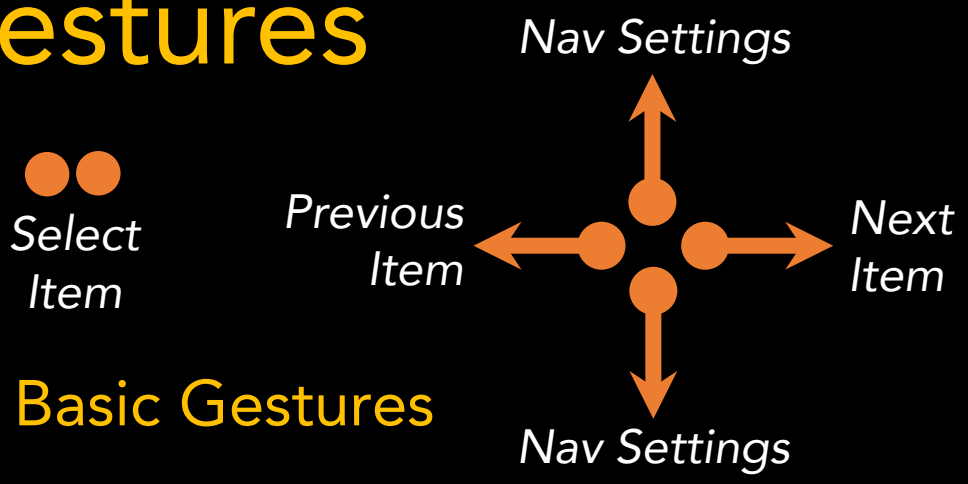
To hear which item is under the finger.



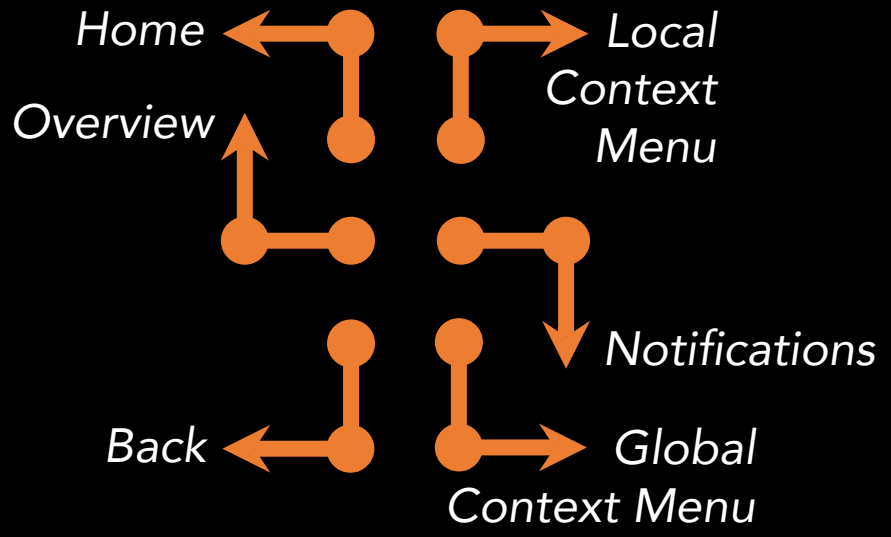
TalkBack Gestures



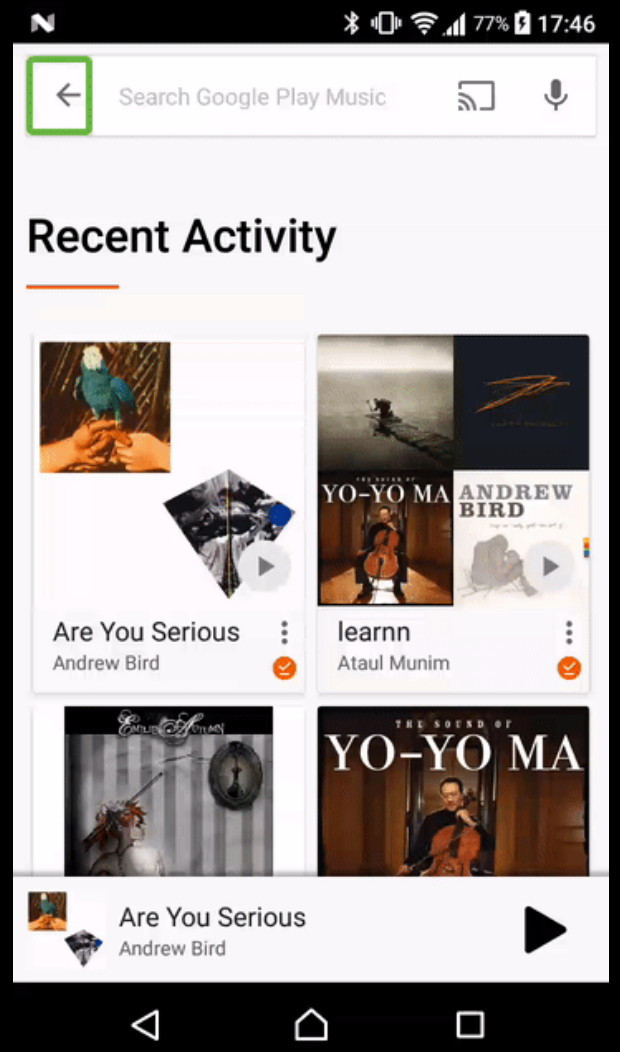
Back-and-forth Gestures



Basic Gestures



Angle Gestures



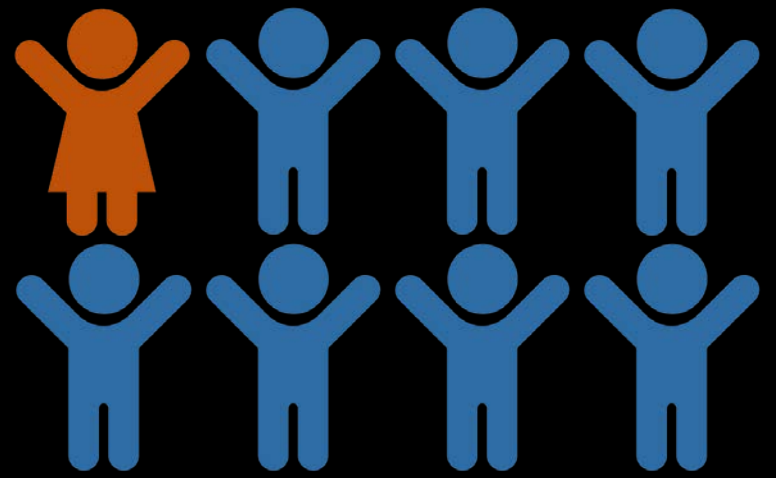
Our work

Prior work: Novice users

We focus on understanding smartphone usage pattern of expert users with vision impairments.

Study Design

Gestures	Type, length, duration, # of items
Keyboard	# of chars/words typed/deleted
Voice Input	Duration, # of chars/words transcribed
TTS	# of chars/words processed
Screen events	Lock/unlock, method
Battery	Charging on/off, battery level
Call	Type, duration
App usage	Package name, app event type



Age: 31.6±1.5 yrs
TalkBack Exp: 8±2.9 yrs

Using a smartphone for 5+ years.

Semi-structured interview

Data: 209 days | 976 hours

Speed Equality

Participants wanted to be really fast in interacting with their phones.

"Speed is crucial... I will use anything that can help me get done things faster" – P3.

"help in achieving time equality with a sighted user." – P4.

Gesture

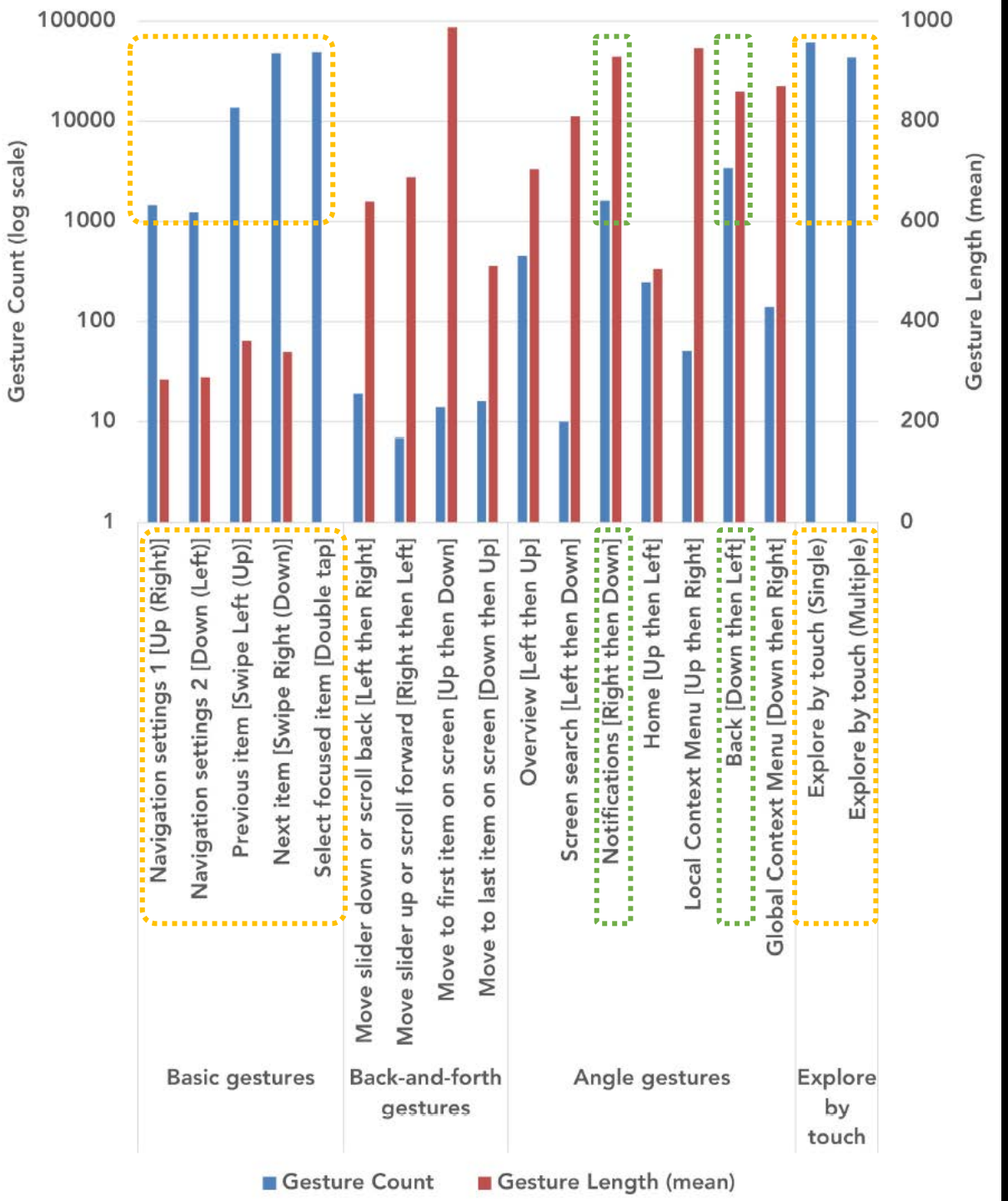
Top-3 Overall

Explore by touch
Double-tap (Select item)
Swipe right (Next item)

Top-4 in Angle & Back-and-forth

Back
Notifications
Overview
Home

Back Home Overview



Explore by Touch + Gestures

Novice	Explore by touch
Intermediate	Gestures (avoiding explore by touch)
Expert	Explore by touch in combination with gestures

"I know the location of the app, so I directly click that location. If I miss, I do max one left or right swipe to reach the correct app." - *P3.*

Learning TalkBack

Google TalkBack: “For all gestures, use a single motion, a steady speed, and even finger pressure.”

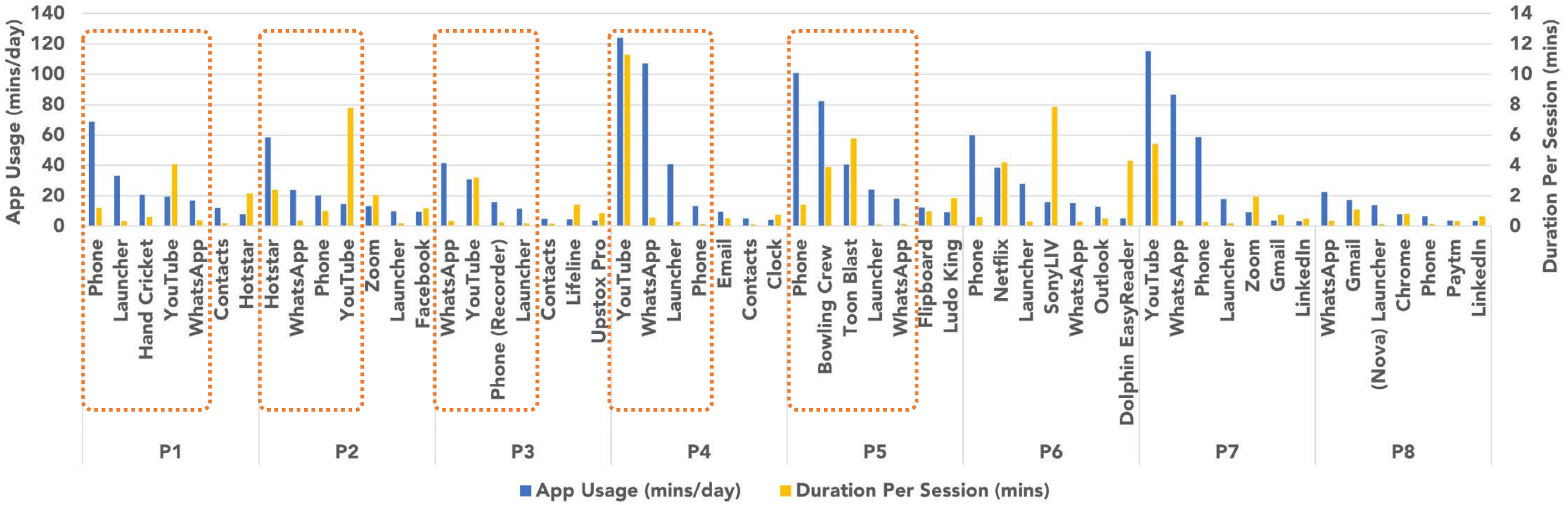
“Learning even the simplest gesture is hard. How much pressure to apply? How to move finger? From where to where?” – P3

Learning by experimentation:
“Starting afresh just using the tutorial, well... is not possible, as the person may not even be familiar with terms like ‘swipe’.” - P2.

Help from sighted friends and family members.

Steep learning curve of 3-6 months.

App Usage



WhatsApp (42.1 mins/day)
Phone (41.7)
YouTube (39.5)

Voice Input

Text Entry

"For formal messages, I prefer to type using keyboard... If its a long, informal message, I use STT (speech to text) for typing. As informal messages doesn't have to be super accurate, STT is much faster... " - P7.

Google Assistant

"I do use it (Google Assistant) to call someone, as its easier than finding people in contact." – P6

Miscellaneous

Gesture Mapping Updates	Must not be updated!
Security and Privacy	Shoulder surfing; fingerprint as password.
Battery	Anxiousness due to low battery
TTS engines	Using a combination of TTS
Unlabeled Buttons	Labeling themselves, but not scalable.
Etc	Etc

Conclusion

Accessibility-first apps

Continuous TalkBack Learning

Accessible Hardware

Thank You!

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