

# A study of the relation of mobile device attributes with the user-perceived quality of Android apps

**Ehsan Noei**, Mark D. Syer, Ying Zou, Ahmed E. Hassan, and Iman Keivanloo

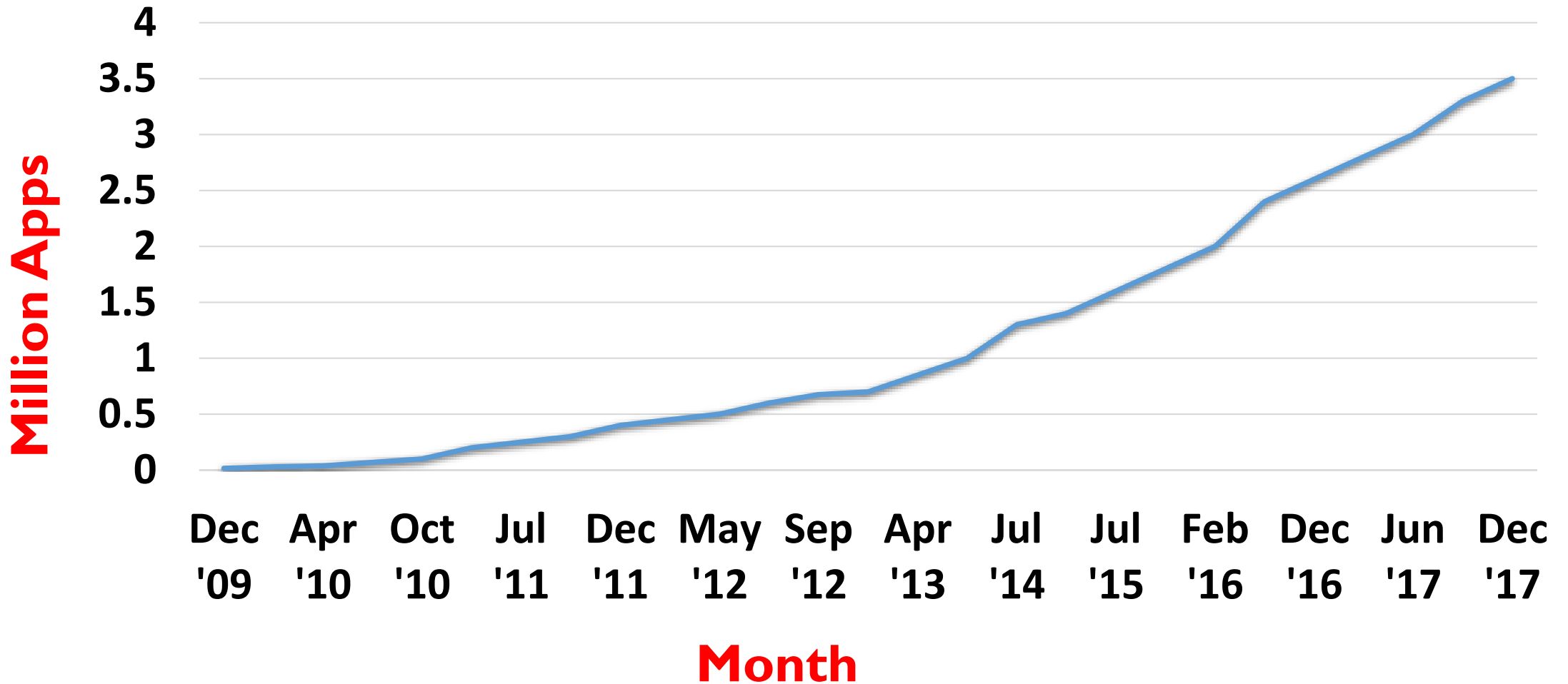




Different mobile **devices** are available in the market.



The number of mobile **apps** continues to rise.





A middle-aged man with brown hair, wearing a dark grey suit, a light blue shirt, and a red and blue striped tie, is shown from the chest up. He is holding a black smartphone to his ear with his right hand, which has a gold ring on the ring finger. His mouth is wide open in a shout, and his facial expression is one of intense anger or frustration. A black speech bubble with a white outline is positioned to the left of his head, containing the text "Stupid App!". The background is a plain, light grey.

***Stupid App!***

Users rely on **star-ratings** when choosing a new app.



RQ1)

Do **devices** have a relationship with the user-perceived quality of Android apps?

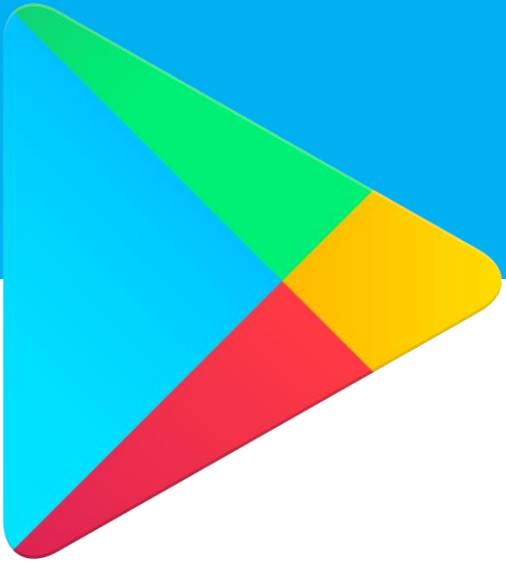
RQ2)

Which **device attributes** share the most significant relationships with the user-perceived quality?

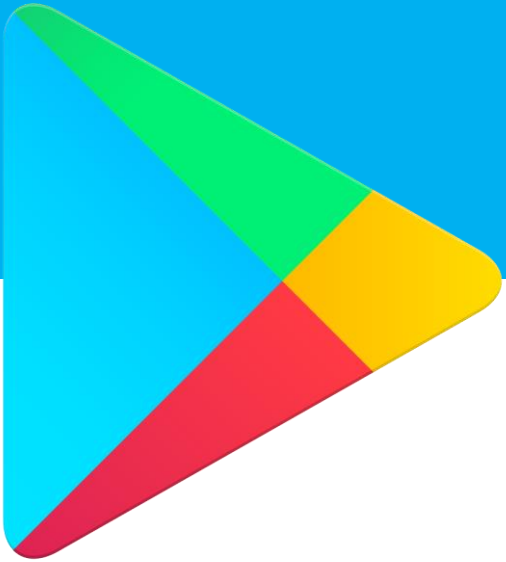
RQ3)

Do device attributes have a **stronger** relationship with the user-perceived quality than app attributes?

# Data Collection



**Google Play Store**



**Google Play Store**

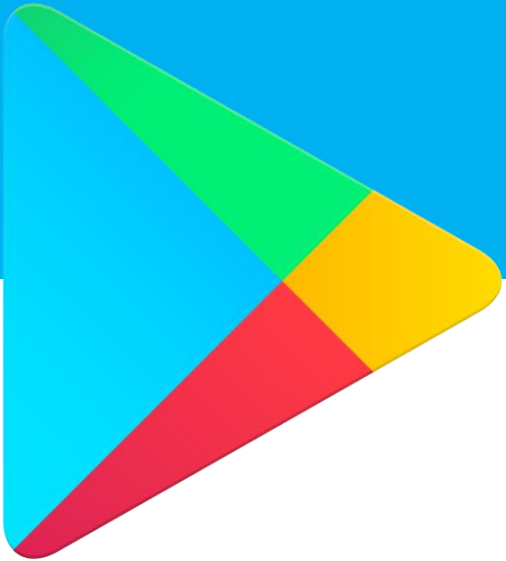


**User-reviews**



**APK Files**





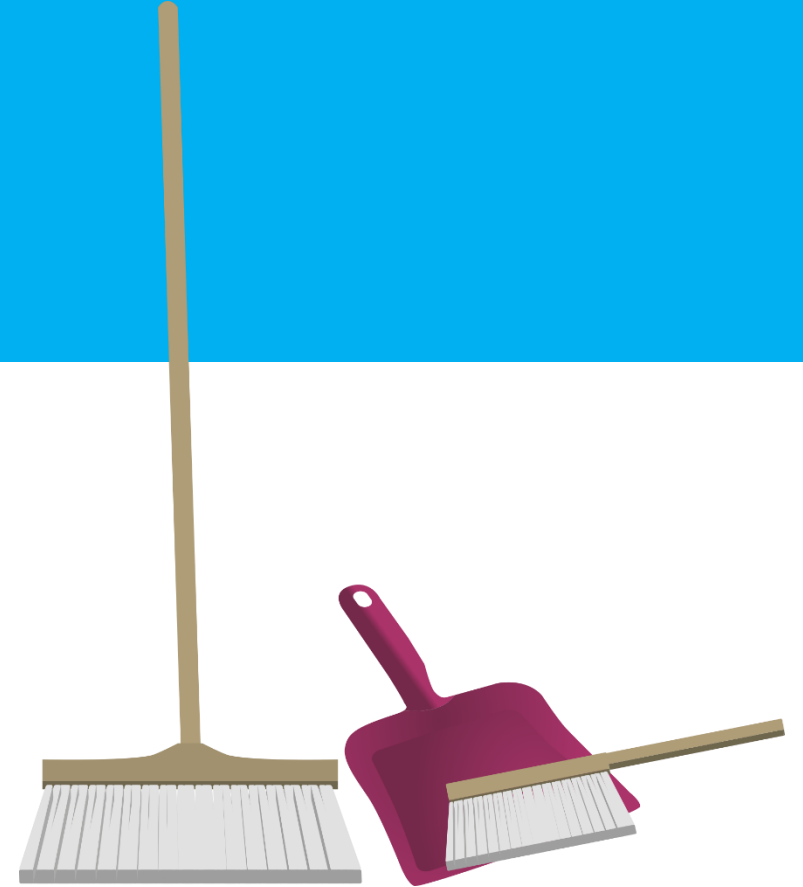
**Google Play Store**



**User-reviews**



**APK Files**

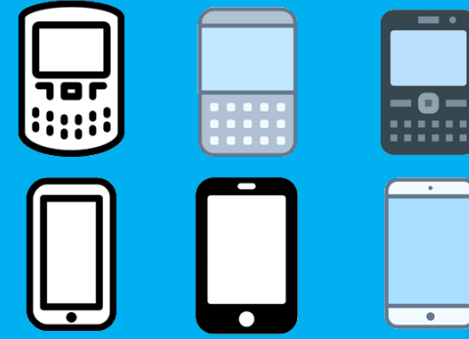




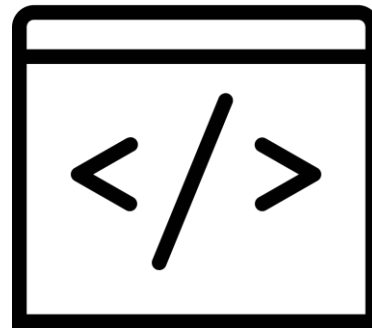
**Google Play Store**



**150,373  
star-ratings**



**30 mobile devices**

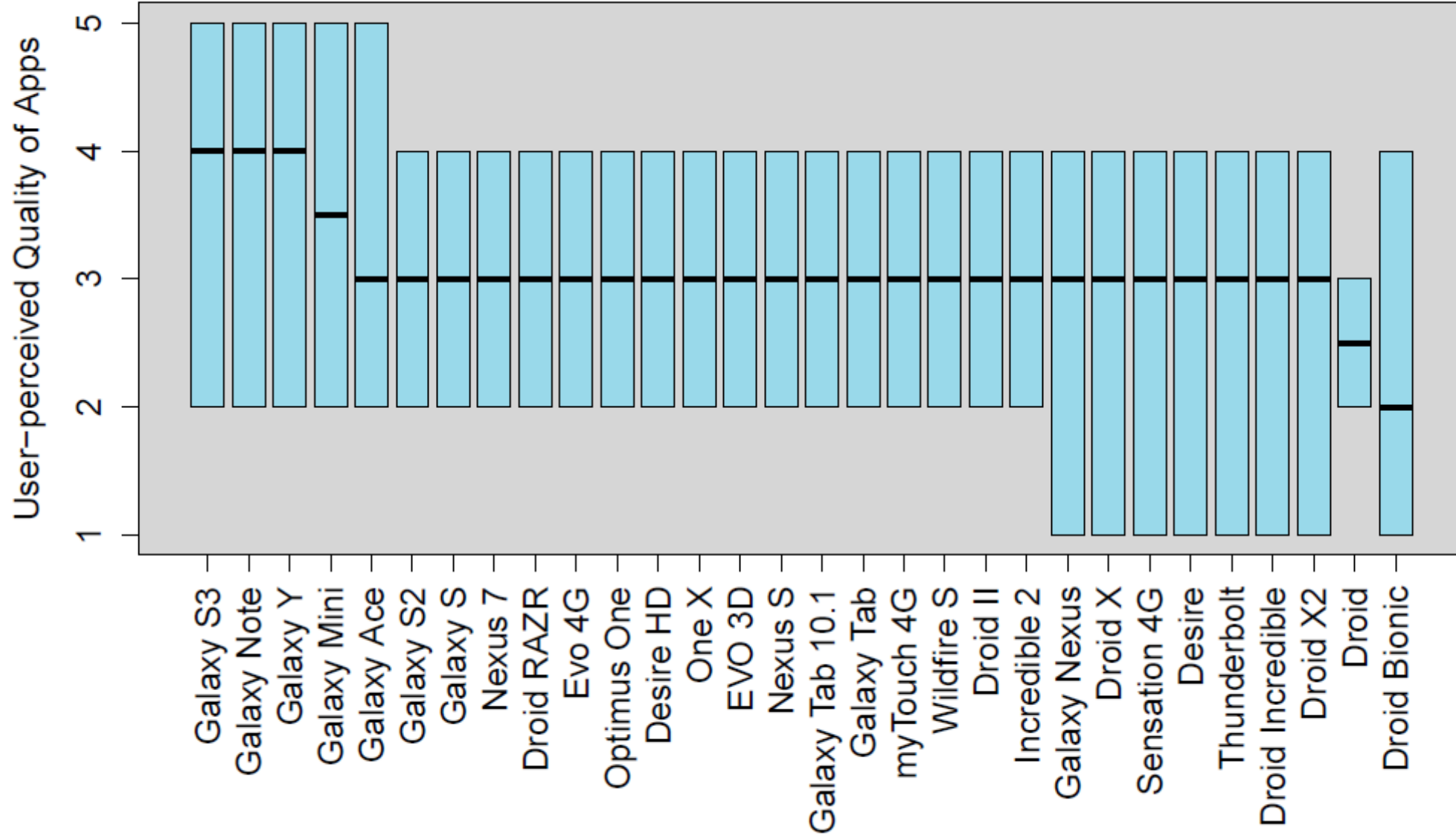


**Bytecode of 280 Apps**

**RQ1) Do **devices** have a relationship with the **user-perceived quality** of Android apps?**

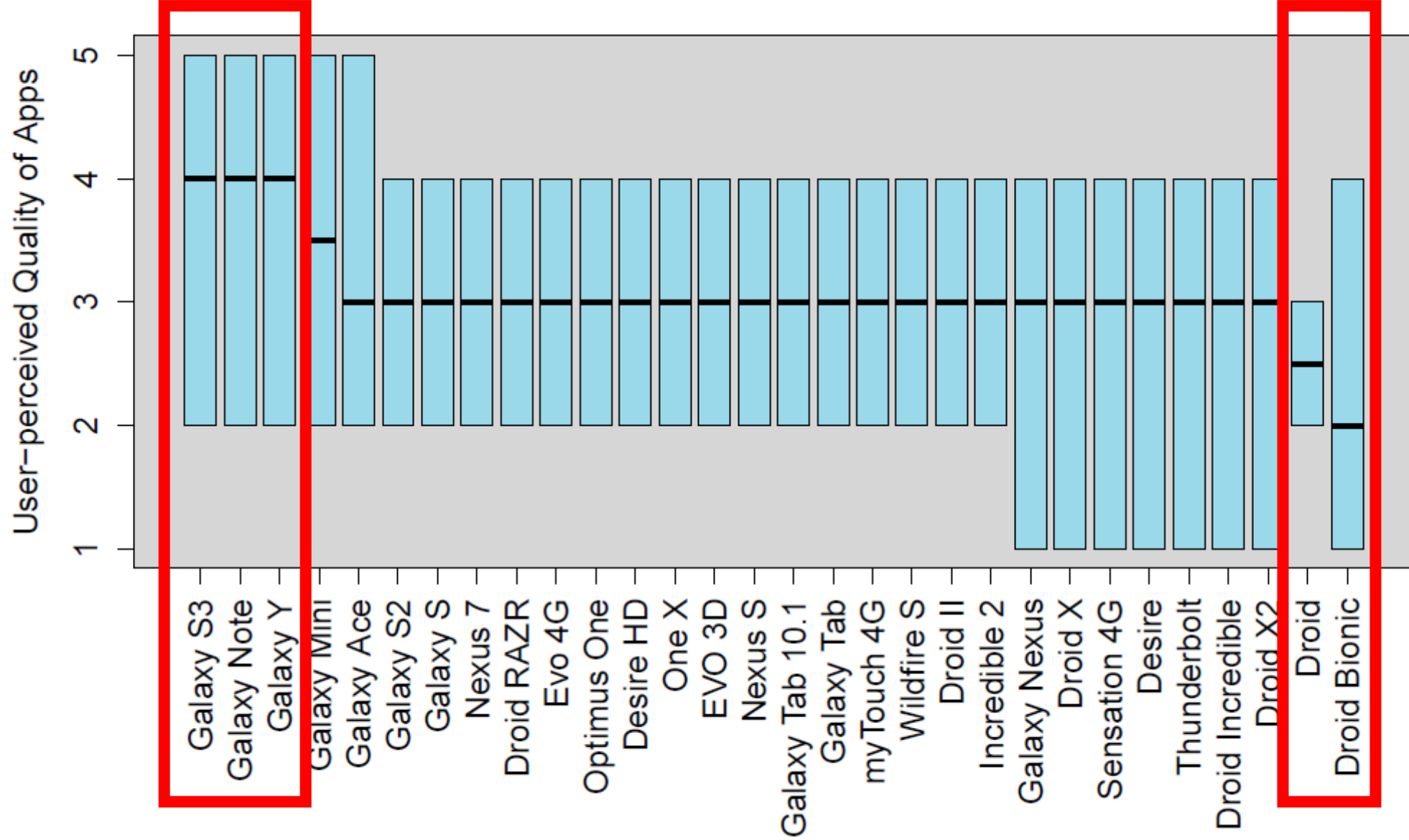


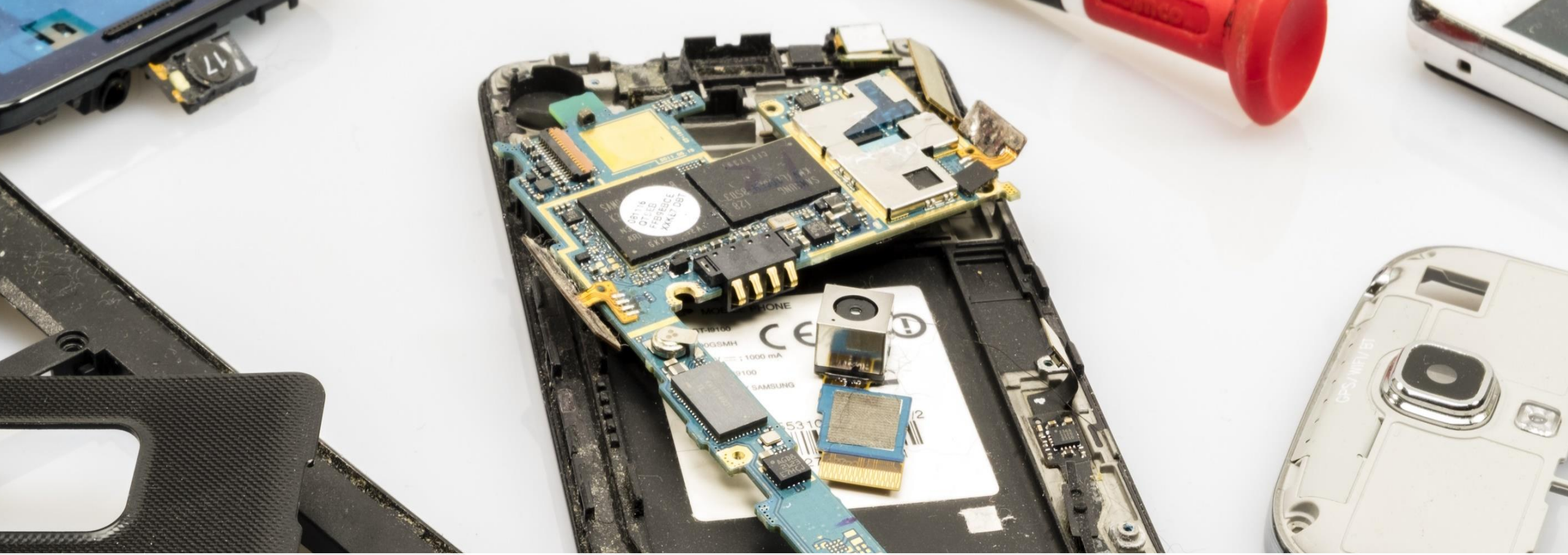
The user-perceived quality of **apps** **varies** across devices.





The user-perceived quality of **apps** **varies** across devices.





**RQ2) Which device attributes share the most significant relationships with the user-perceived quality?**

## Mixed effects model

Dependent variable

Independent variables

Mixed effect variables

Star-ratings

Device attributes

App and device

## Device Attributes

Display Size

Resolution

OS Version

CPU

GPU

Internal RAM

Internal ROM

Camera

Talk Time

etc.



# Mixed effects model

Dependent variable

Independent variables

Mixed effect variables

Star-ratings

Device attributes

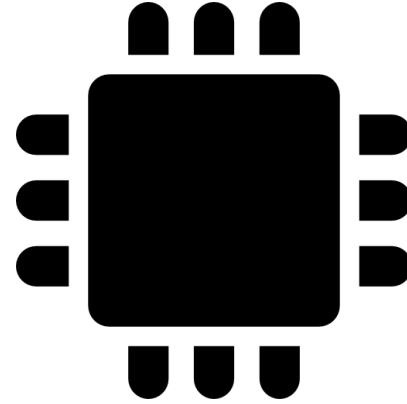
App and device



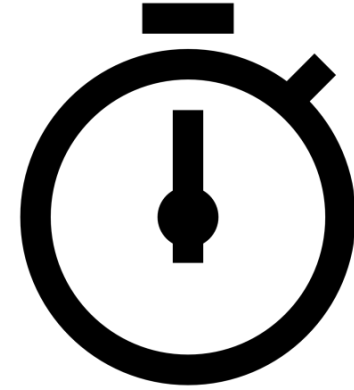
OS Version



Display  
Resolution



CPU



Standby Time



Camera



GPU



Battery

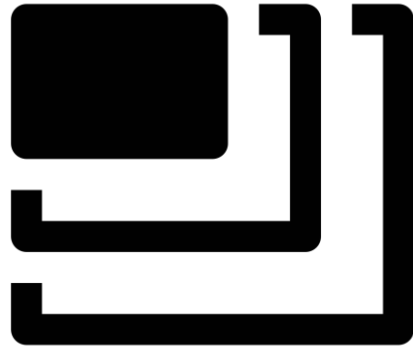


Device Size

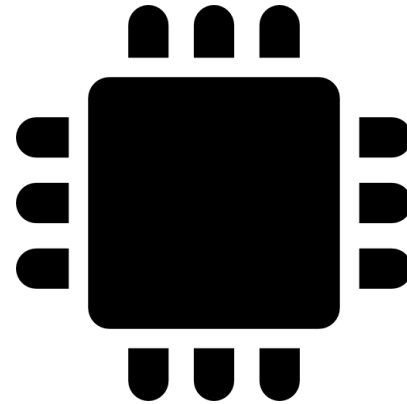
Device attributes share a **significant** relationship with the user-perceived quality.



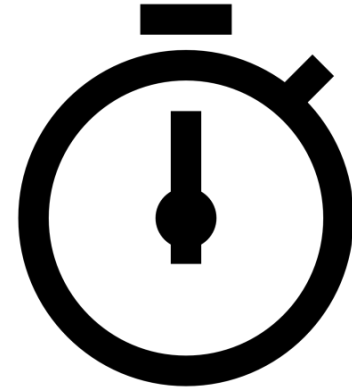
OS Version



Display  
Resolution



CPU

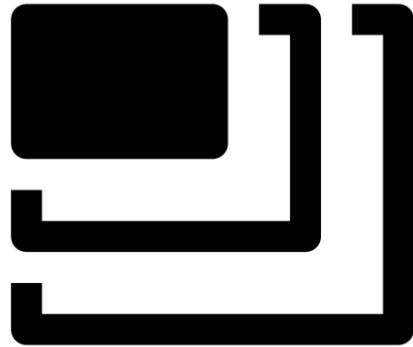


Standby Time

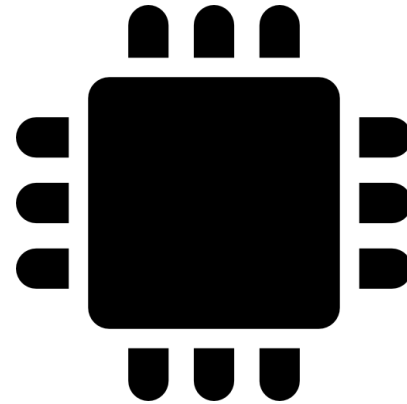
Having a **better** characteristic of an attribute **does not** necessarily share a positive relationship with the user-perceived quality of apps.



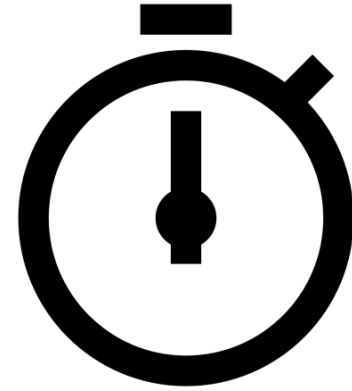
OS Version



Display  
Resolution



CPU



Standby Time







## Mixed effects model

Dependent variable

Independent variables

Mixed effect variables

Star-ratings

Device attributes + App attributes

App and device

# Mixed effects model

Dependent variable

Independent variables

Mixed effect variables

Star-ratings

Device attributes + App attributes

App and device

## Device Attributes

Display Size

Resolution

OS Version

CPU

GPU

Internal RAM

Internal ROM

Camera

Talk Time

etc.

## App Attributes

LOC

#Methods

WMC

Installation Package Size

UI Depth

#UI Nodes

#Inputs

#Outputs

#Activities

etc.



# Mixed effects model

Dependent variable

Independent variables

Mixed effect variables

Star-ratings

Device attributes + App attributes

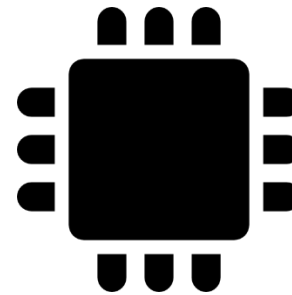
App and device



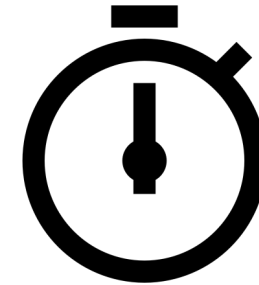
OS Version



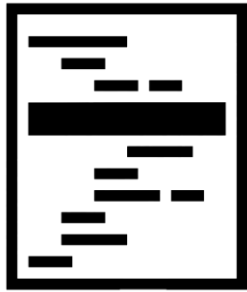
Display  
Resolution



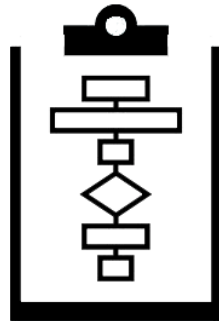
CPU



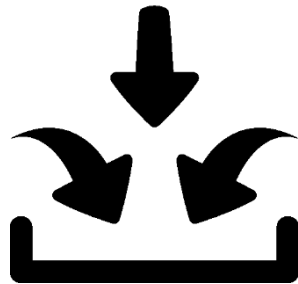
Standby Time



LOC



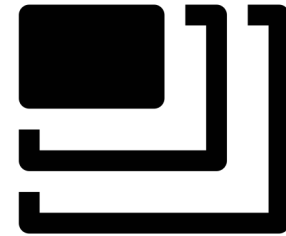
WMC



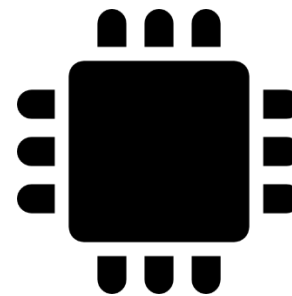
#Inputs



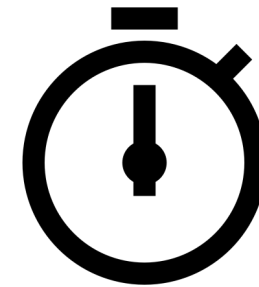
OS Version



Display  
Resolution



CPU

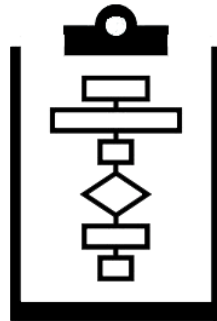


Standby Time

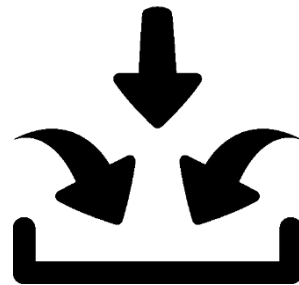
**Both** the app and the device attributes have significant relationships with the user-perceived quality.



LOC



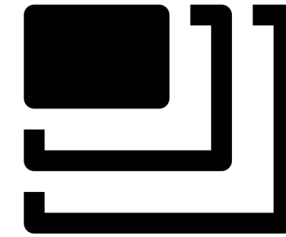
WMC



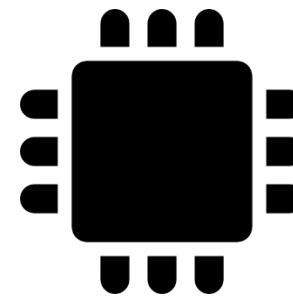
#Inputs



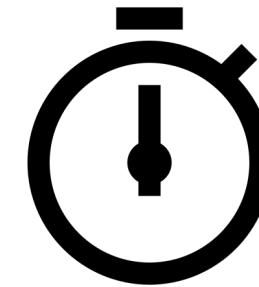
OS Version



Display  
Resolution



CPU



Standby Time

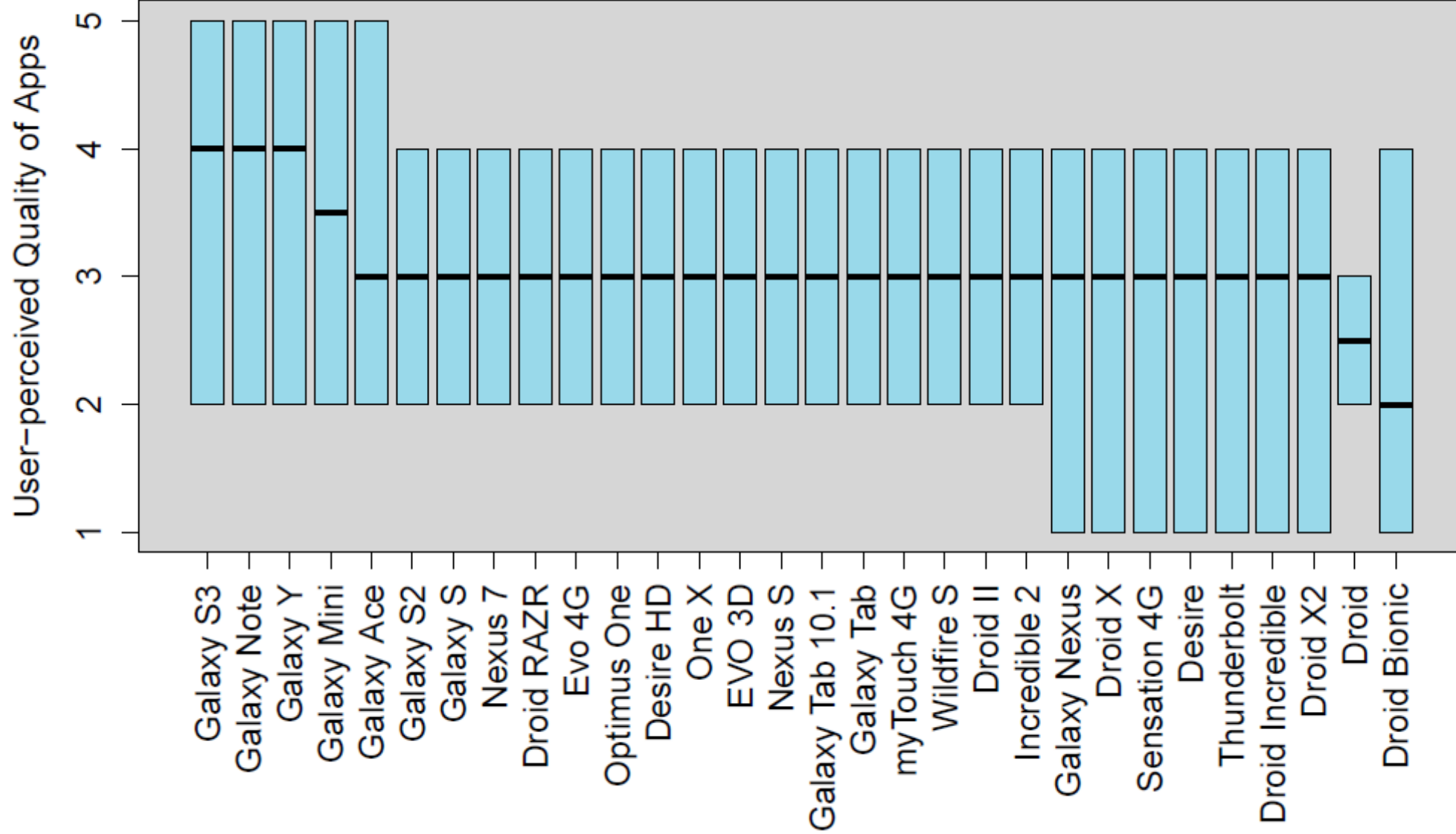
**Some device** attributes have stronger relationships with the user-perceived quality than some app attributes.

Attribute		Effect
LOC	***	↘
WMC	***	↘
#Inputs	*	↗
APK Size		↗
OS Version	***	↘
Resolution	**	↘
CPU	*	↗
Standby Time	*	↗
Photo Size (MP)	+	↘
Internal ROM	+	↘

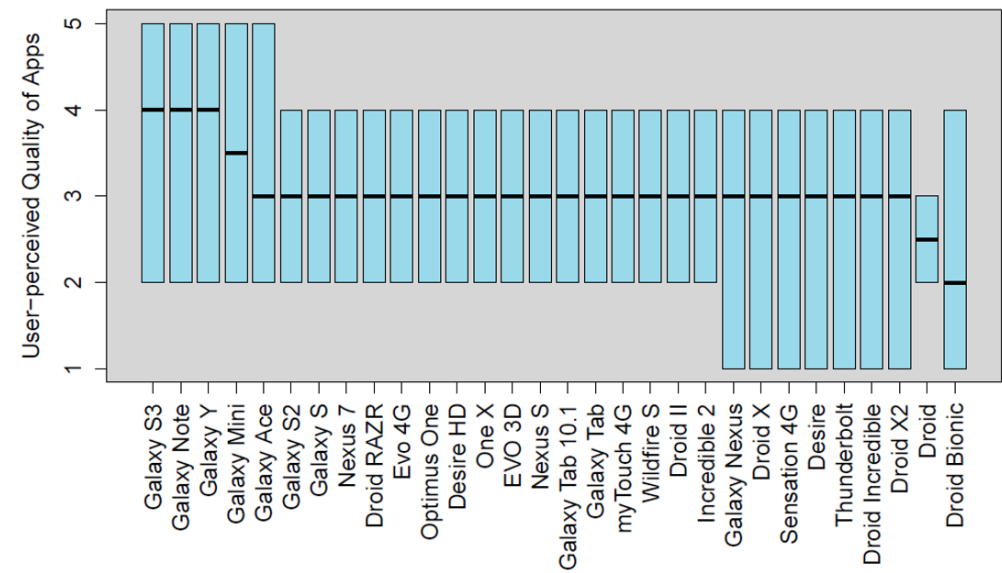




The user-perceived quality of apps **varies** across devices.



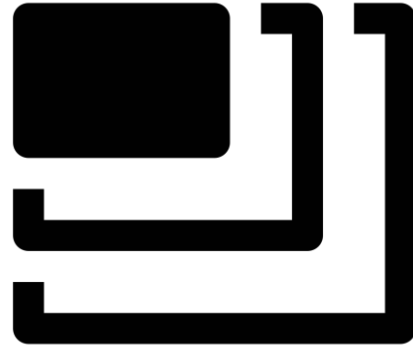
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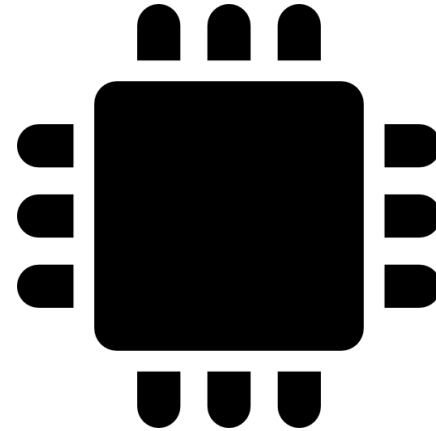
Having a **better** characteristic of an attribute **does not** necessarily share a positive relationship with the user-perceived quality of apps.



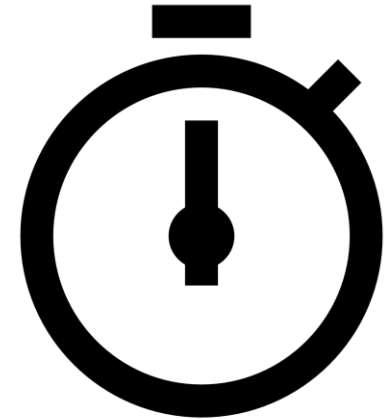
OS Version



Display  
Resolution



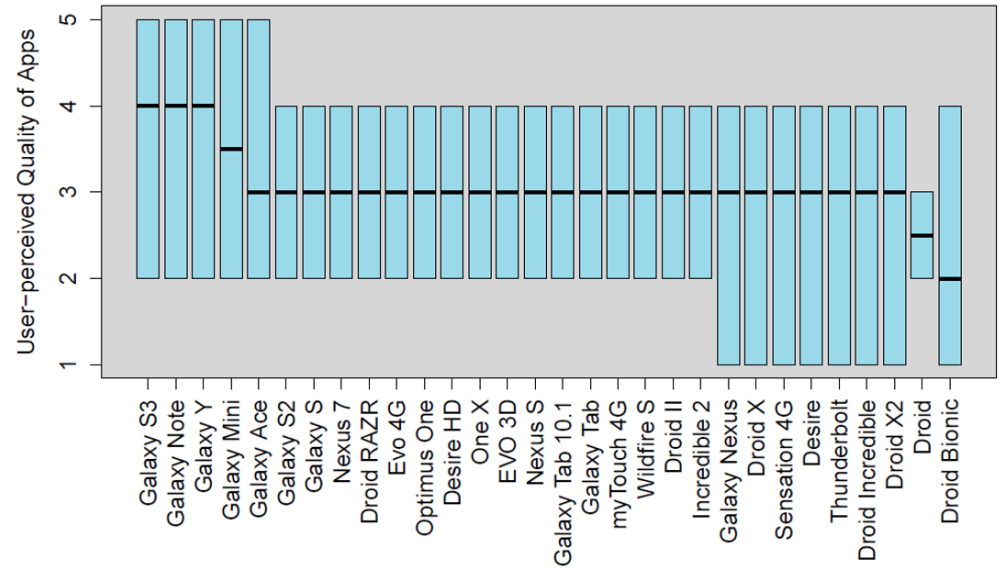
CPU



Standby Time



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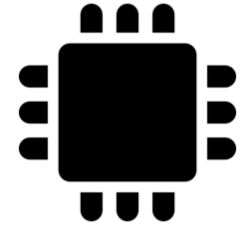
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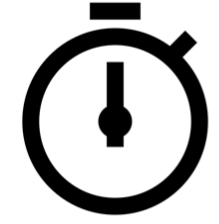
OS Version



Display Resolution



CPU



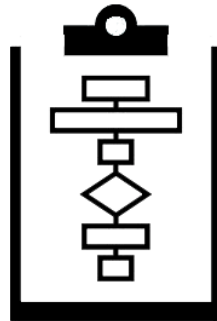
Standby Time



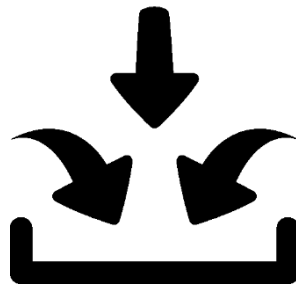
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LOC



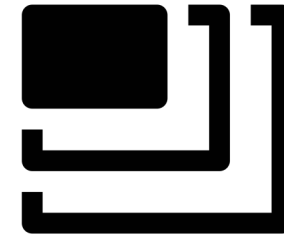
WMC



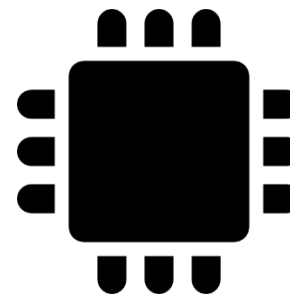
#Inputs



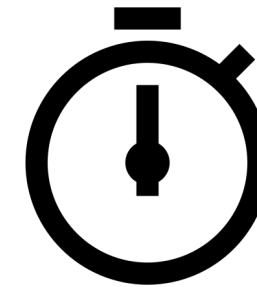
OS Version



Display  
Resolution

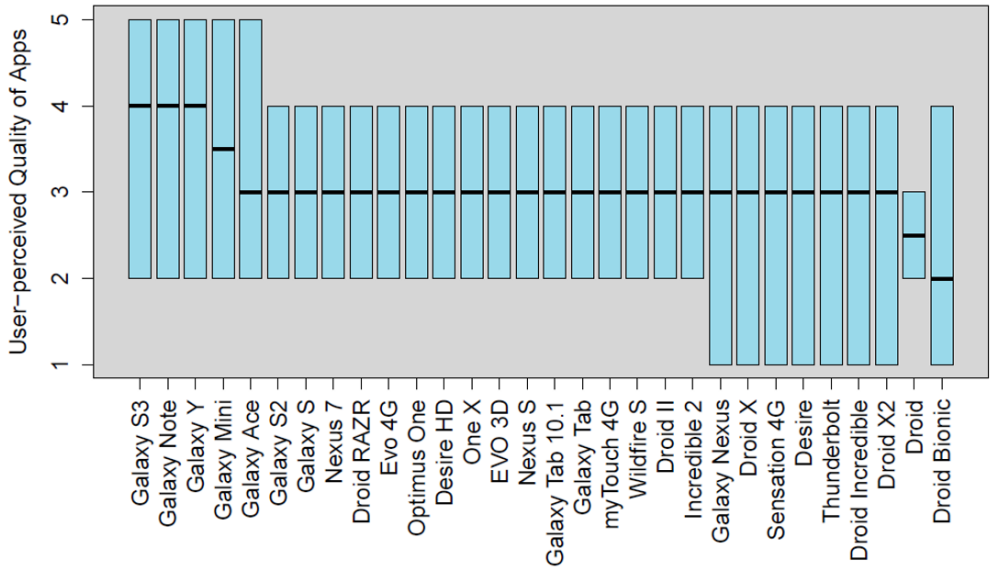


CPU



Standby Time

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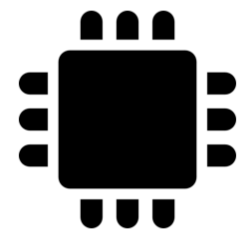
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OS Version



Display Resolution



CPU



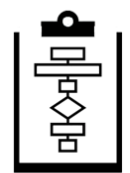
Standby Time



**Both** the app and the device attributes have significant relationships with the user-perceived quality.



LOC



WMC



#Inputs



OS Version



Display Resolution



CPU



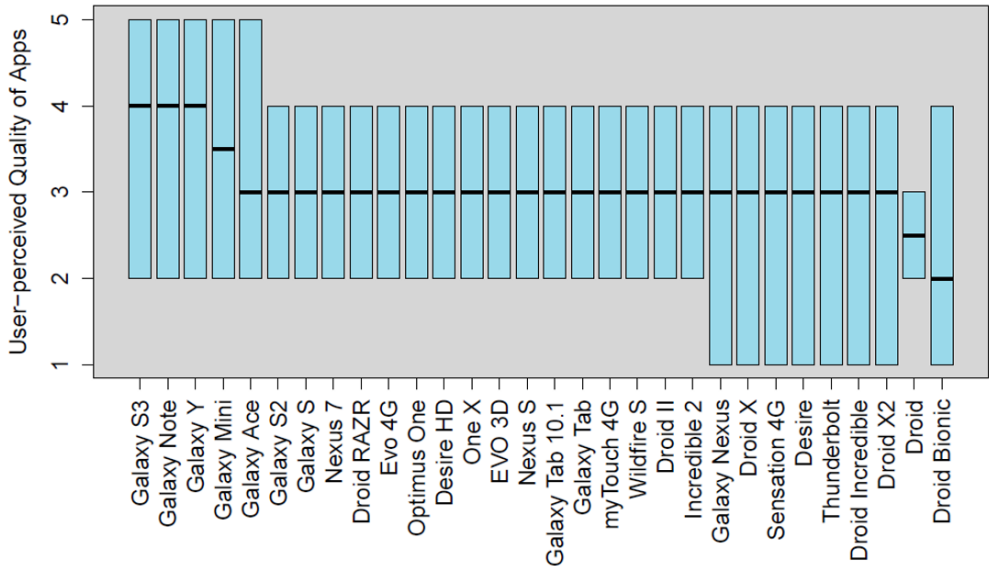
Standby Time



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Attribute		Effect
LOC	***	↘
WMC	***	↘
#Inputs	*	↗
APK Size		↗
OS Version	***	↘
Resolution	**	↘
CPU	*	↗
Standby Time	*	↗
Photo Size (MP)	+	↘
Internal ROM	+	↘

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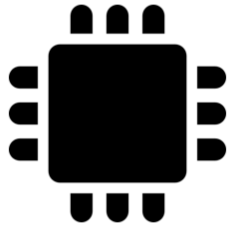
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OS Version



Display Resolution



CPU



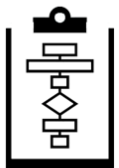
Standby Time



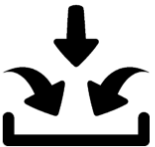
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LOC



WMC



#Inputs



OS Version



Display Resolution



CPU



Standby Time

**Some device** attributes have stronger relationships with the user-perceived quality than some app attributes.

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LOC	***	↘
WMC	***	↘
#Inputs	*	↗
APK Size		↗
OS Version	***	↘
Resolution	**	↘
CPU	*	↗
Standby Time	*	↗
Photo Size (MP)	+	↘
Internal ROM	+	↘