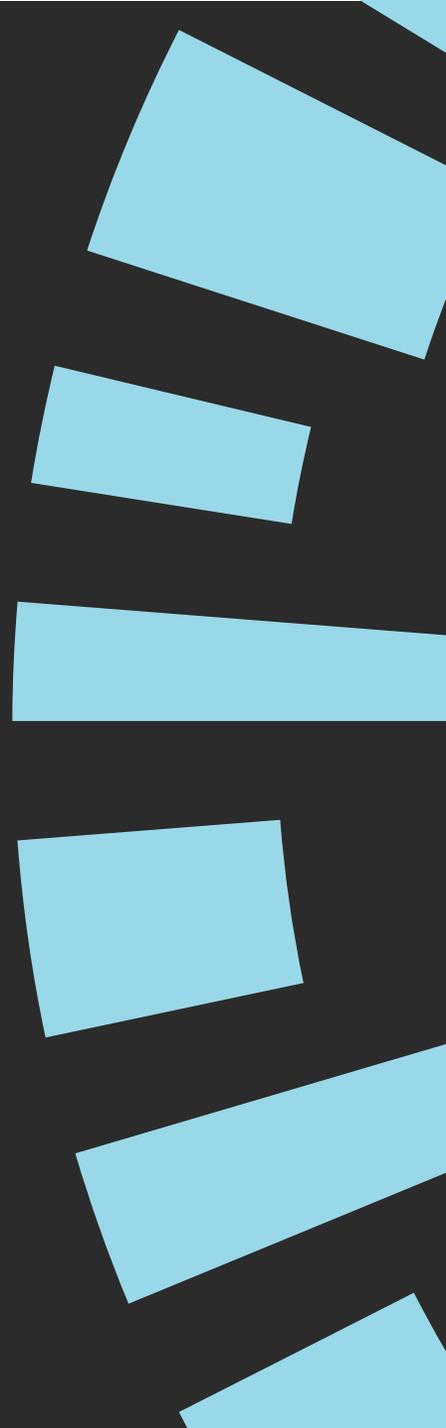


The Power of Words:

A Comprehensive Analysis of Rationales and
Their Effects on Users' Permission Decisions

*Yusra Elbitar, **Alexander Hart**, Sven Bugiel*

Network and Distributed System Security Symposium 2025





Part I

Everything is a message





How we send messages to people

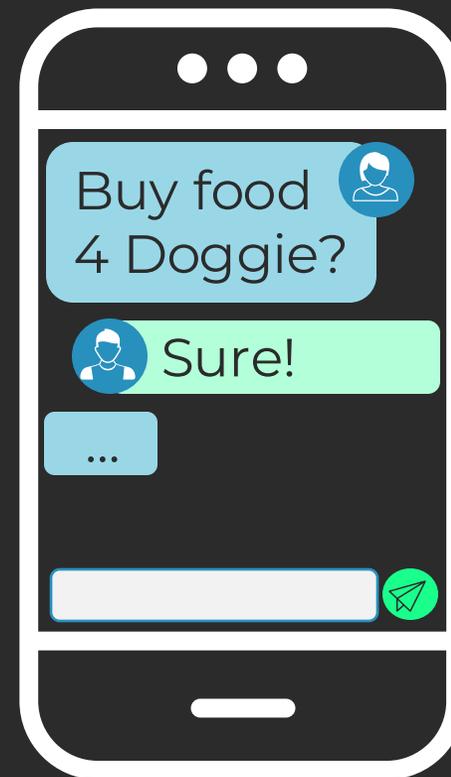


How we send messages to people





How we send messages to people





How we **also** send messages to people



How we **also** send messages to people





How we **also** send messages to people



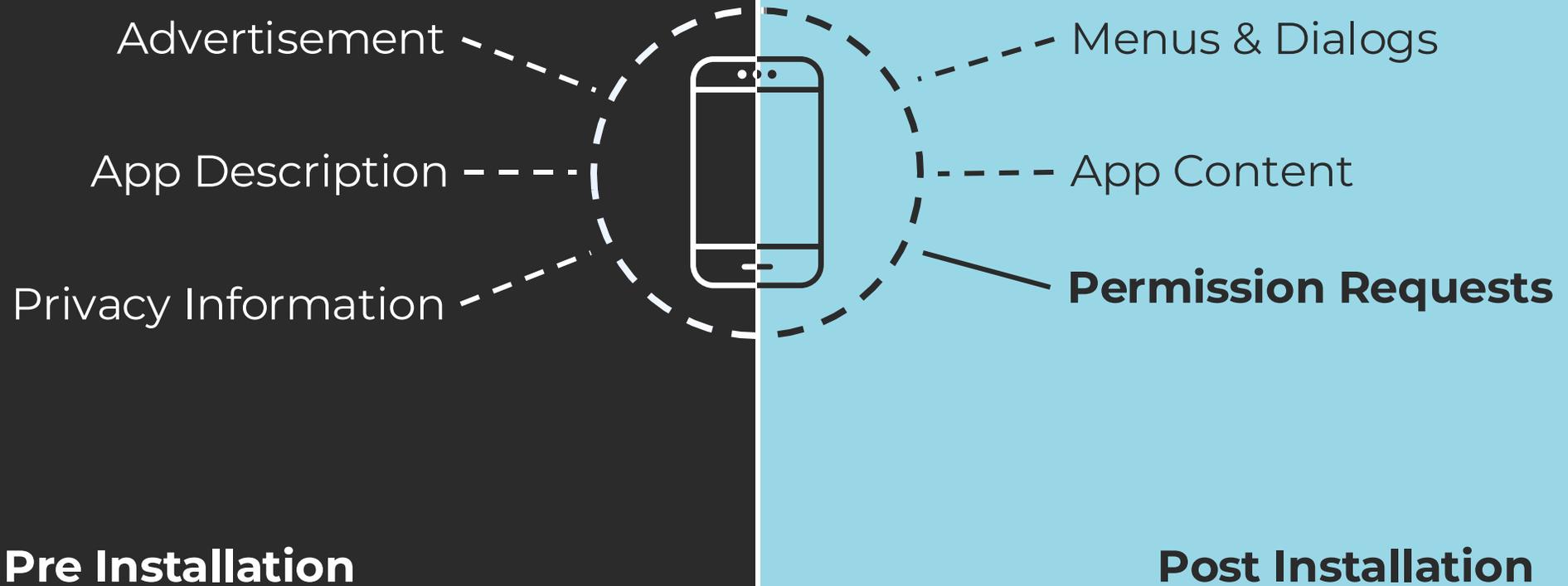


How we **also** send messages to people





Messages in the smartphone app lifecycle





Sample rationale



Why do we need permissions?

We need Storage permission to save images and documents.

Allow



Sample rationale

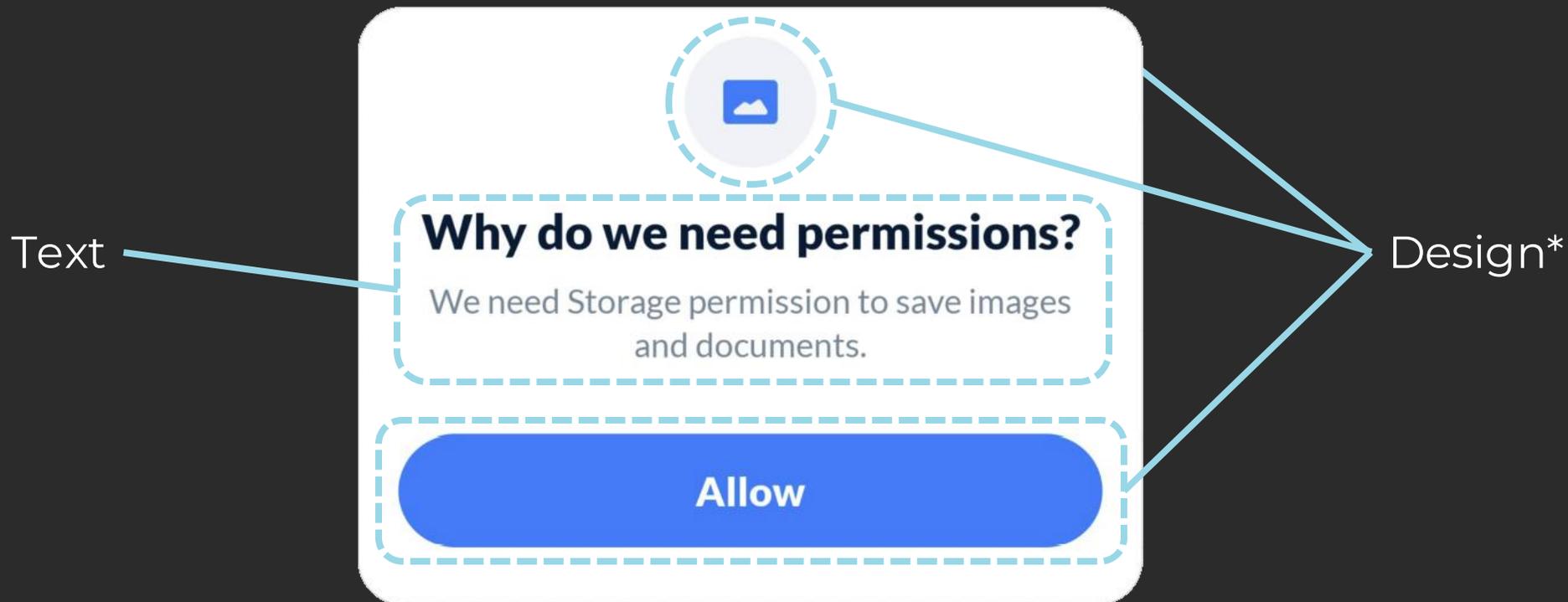
Text

Why do we need permissions?
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Allow



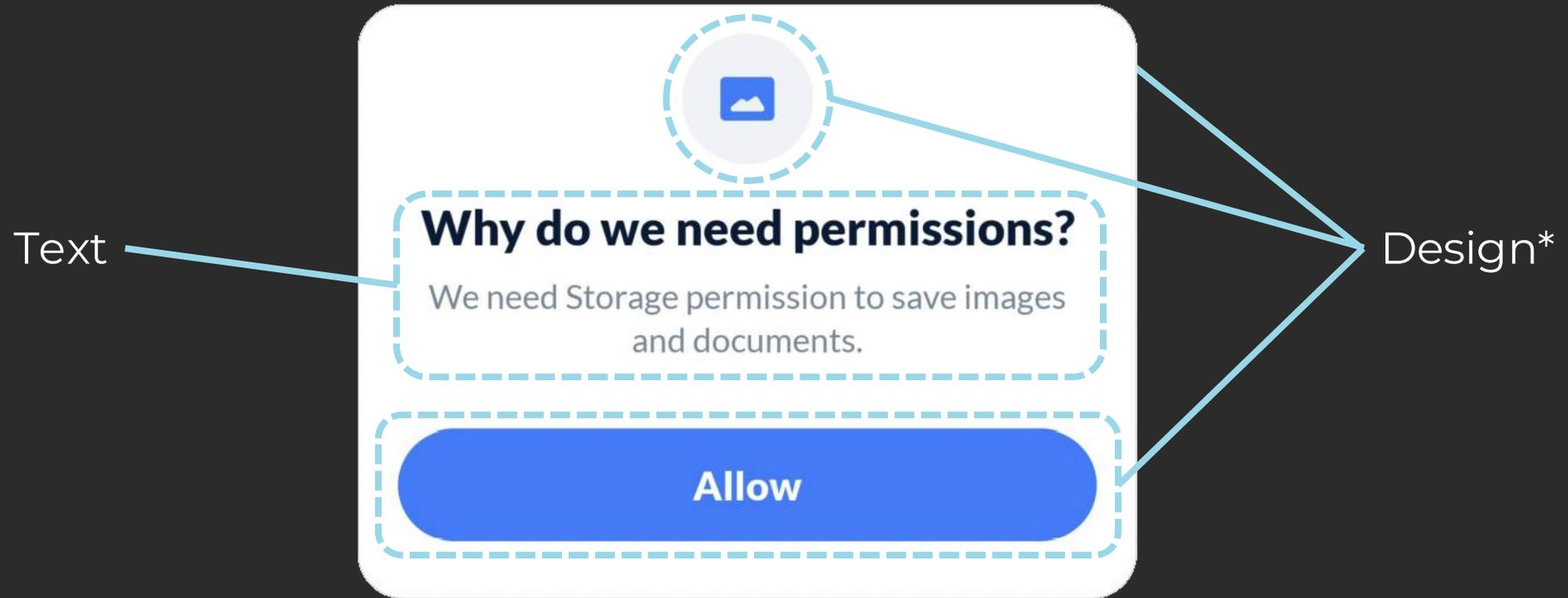
Sample rationale





Sample rationale

 Timing



* Please refer to the paper for our analysis about the design.

About Timing:
Y. Elbitar, M. Schilling, T. T. Nguyen, M. Backes, and S. Bugiel,
"Explanation beats context: The effect of timing & rationales on
users' runtime permission decisions," in Proc. 30th USENIX Security
Symposium (SEC'21), 2021.



Best practices

Explain why your app needs the permission

The permissions dialog shown by the system when you call

`requestPermissions()` says what permission your app wants, but doesn't say why. In some cases, the user might find that puzzling. It's a good idea to explain to the user why your app wants the permissions before you call `requestPermissions()`.

Avoid vague phrases such as *to offer a better user experience* when explaining why the app requires access. (Users are highly skeptical of vague promises and often suspect that they cover nefarious schemes.)



Open questions

How do developers actually ask for runtime permissions?



Phrasing can vary greatly

“Without camera permission, the app cannot work correctly.”

“Please allow access to your camera. Without this permission, the app cannot scan your documents. We do not collect or transfer any personal data outside your phone.”



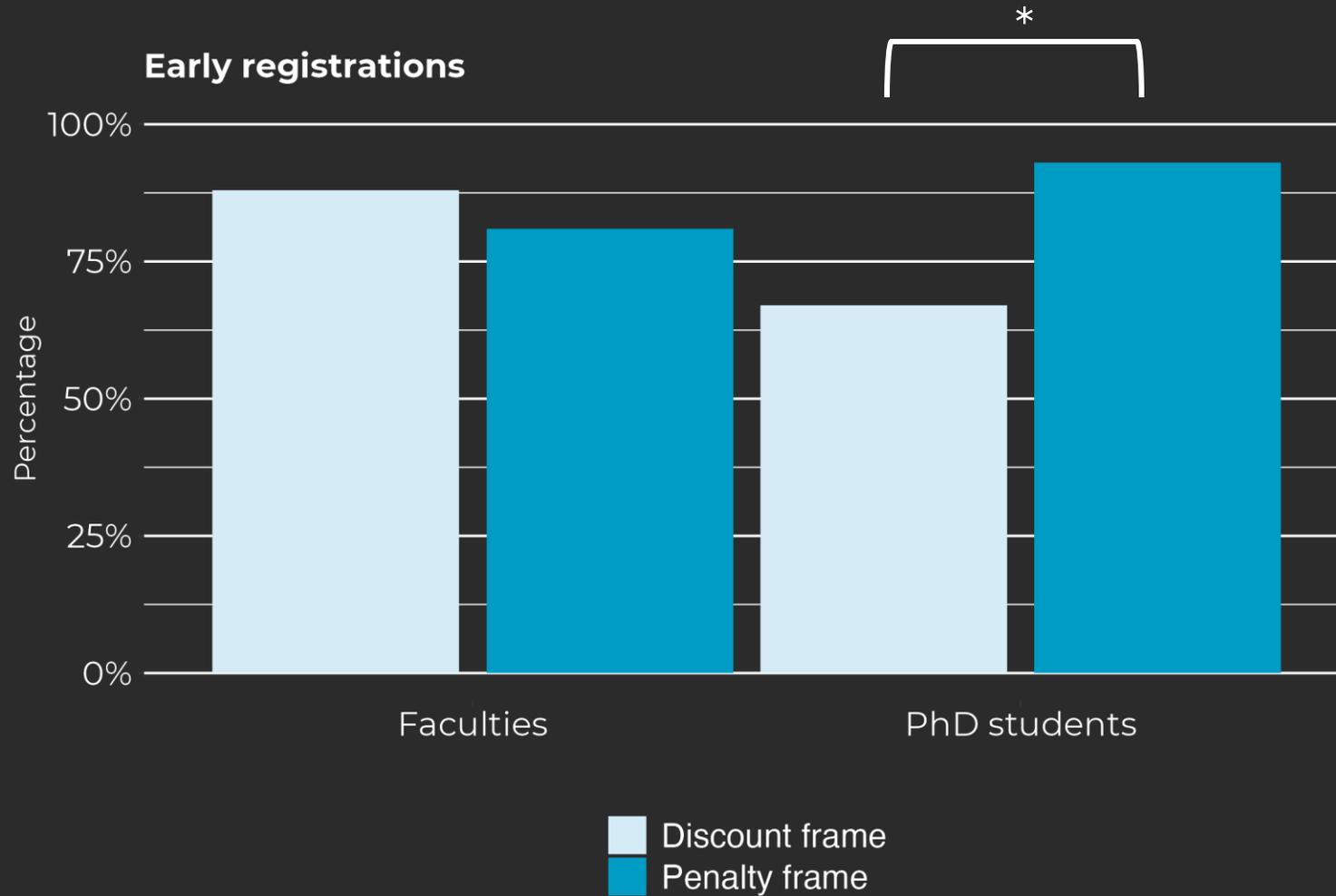
Phrasing can make a difference

“We take this opportunity to remind you that the discounted conference fee for early registration is available until 10 July 2006 .”

“We take this opportunity to remind you that the conference fee will include a penalty for late registration after 10 July 2006.”



Phrasing can make a difference



S. Gächter, H. Orzen, E. Renner, and C. Starmer, "Are experimental economists prone to framing effects? A natural field experiment," *Journal of Economic Behavior & Organization*, vol. 70, issue 3, pp. 443-446, 2009



Open questions

How do developers actually ask for runtime permissions?

How does rationale phrasing impact users' decisions & experience?



Part II

*Messages developers leave
(in Android Apps)*





Investigation Design

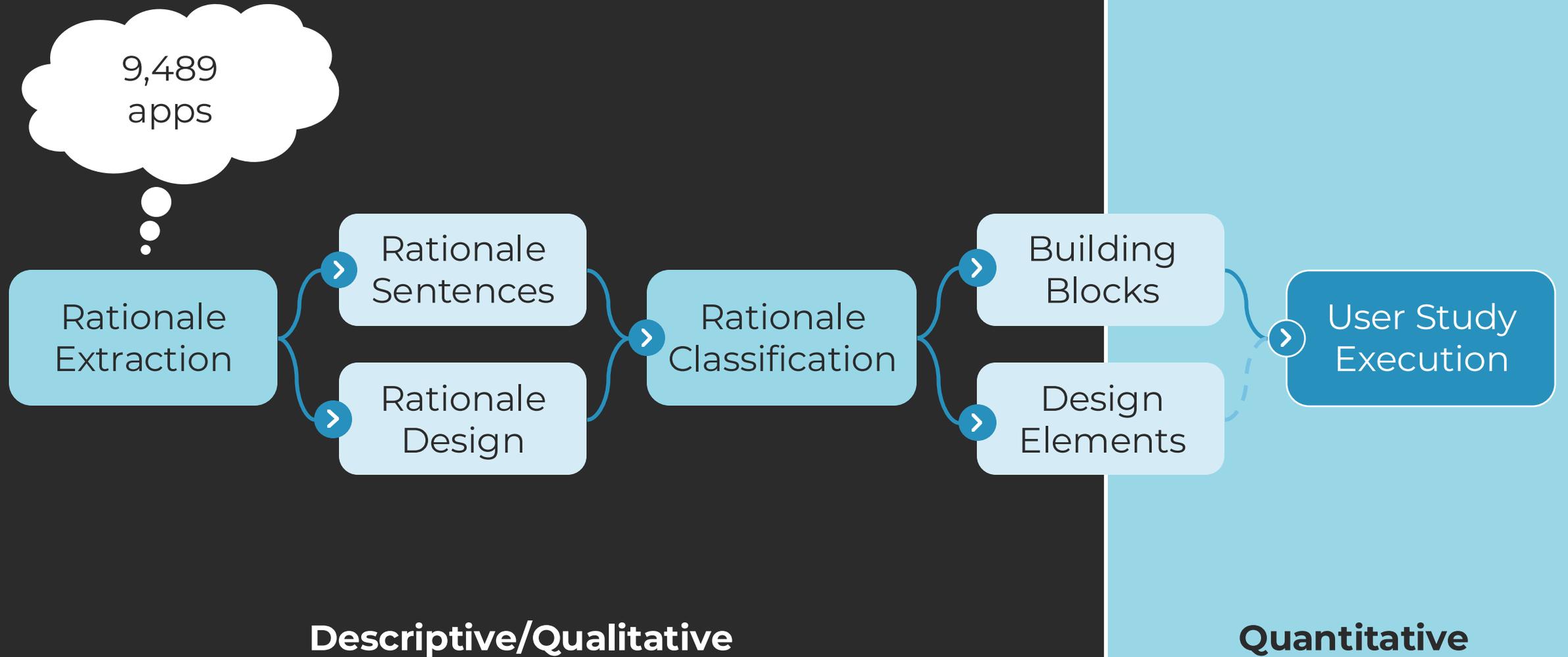


Descriptive/Qualitative

Quantitative

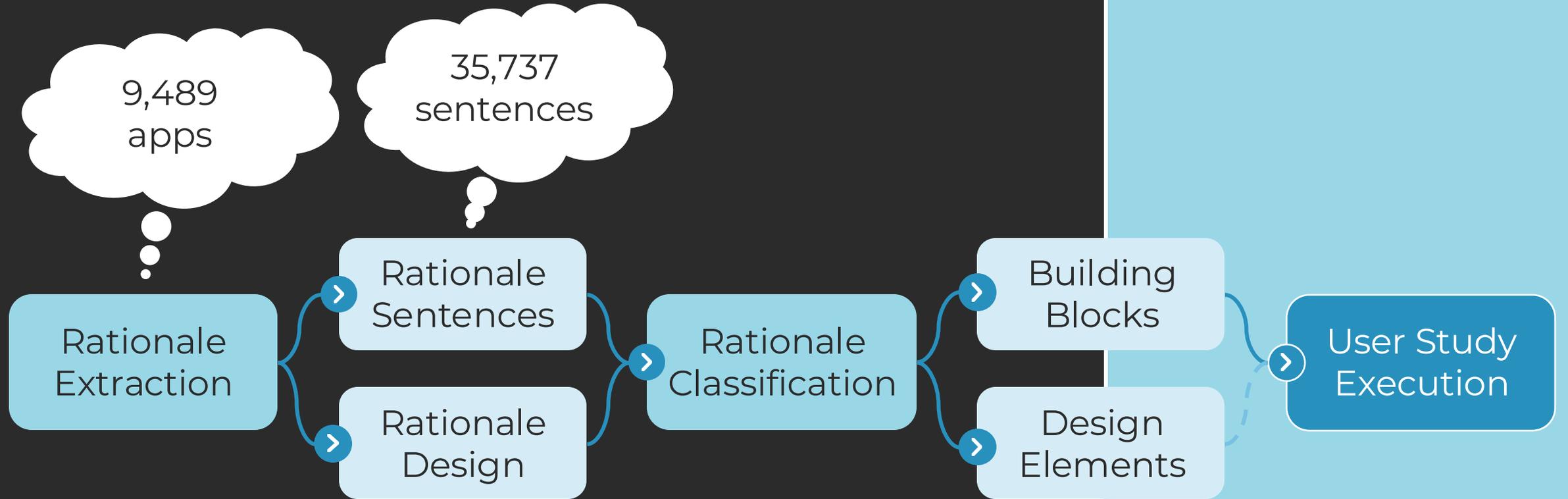


Investigation Design





Investigation Design

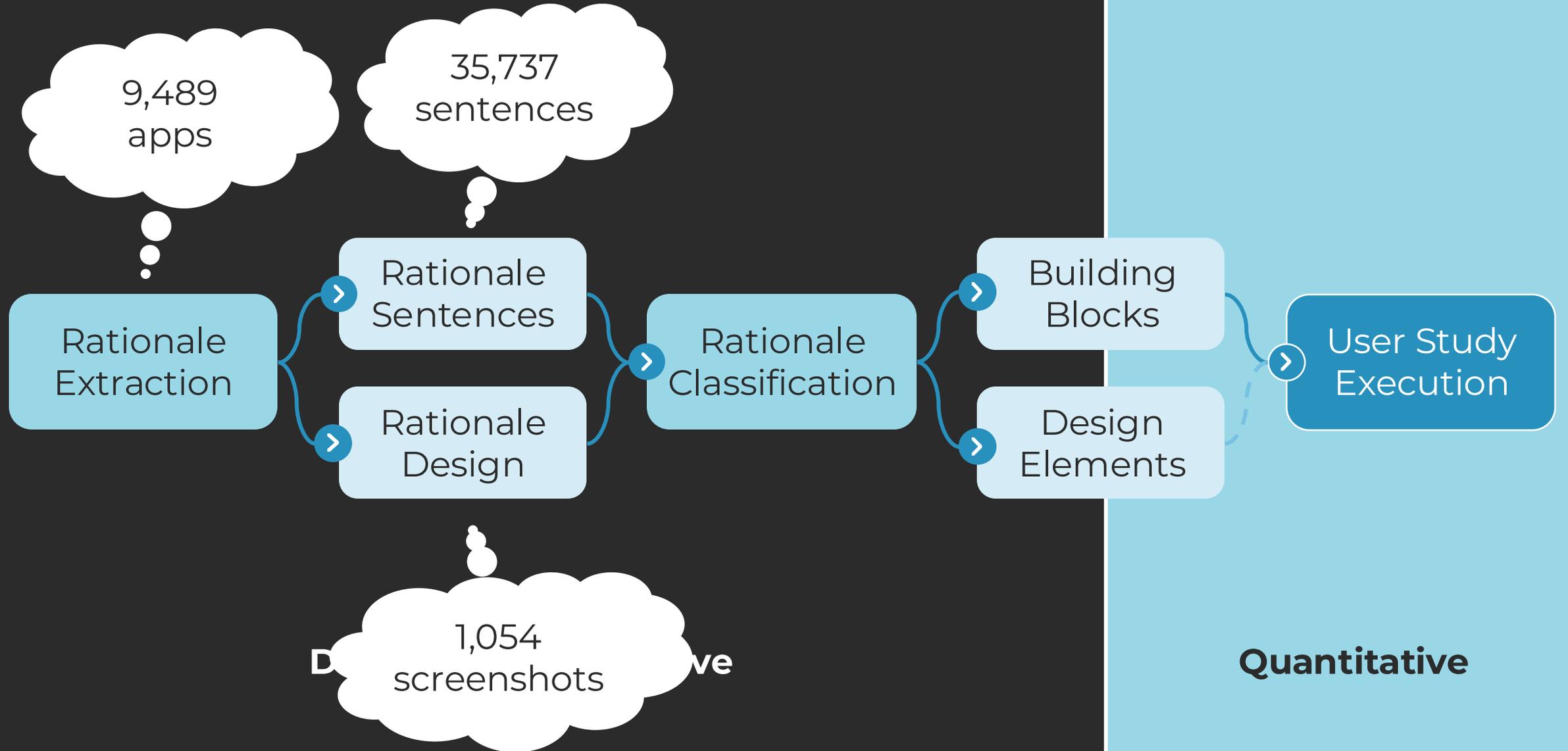


Descriptive/Qualitative

Quantitative

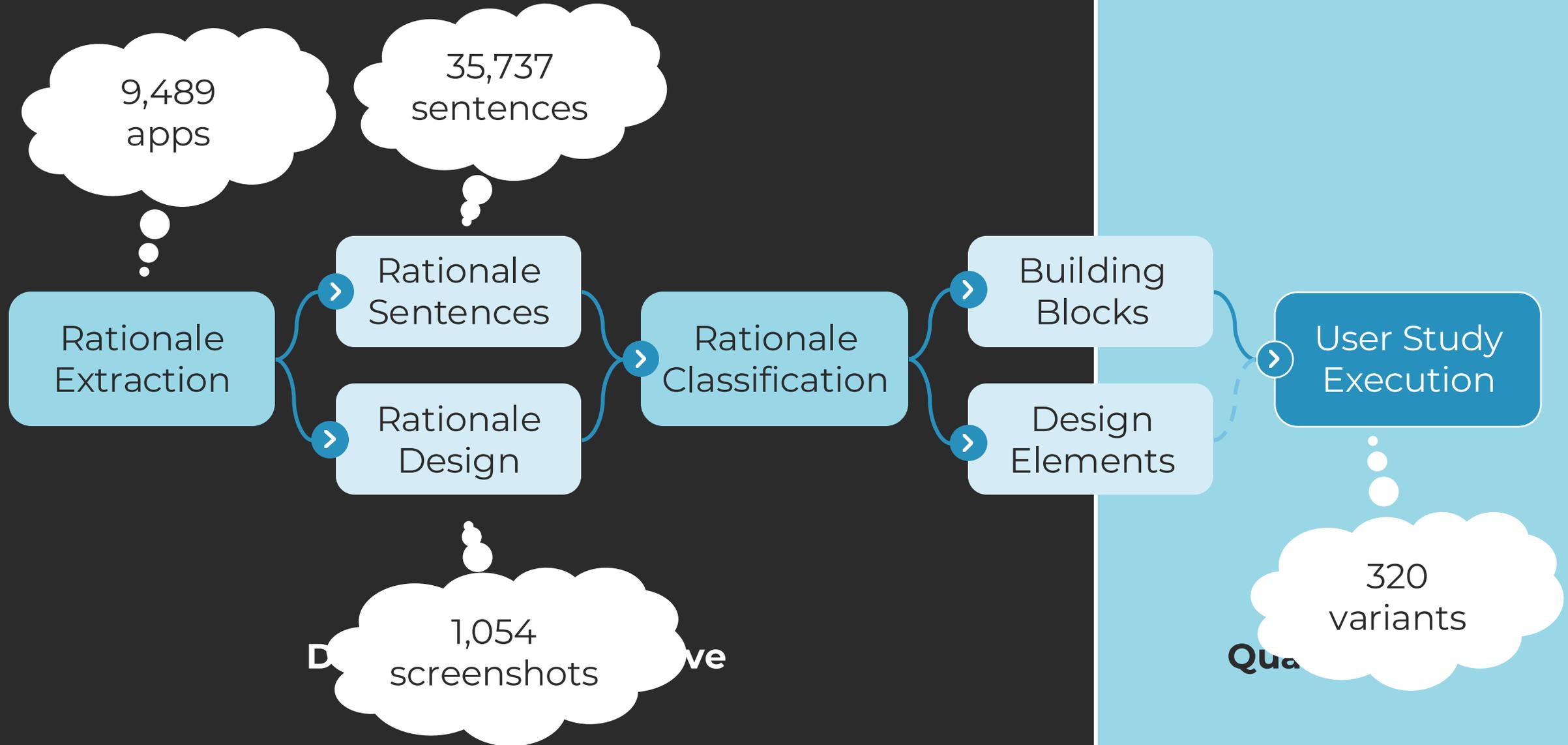


Investigation Design



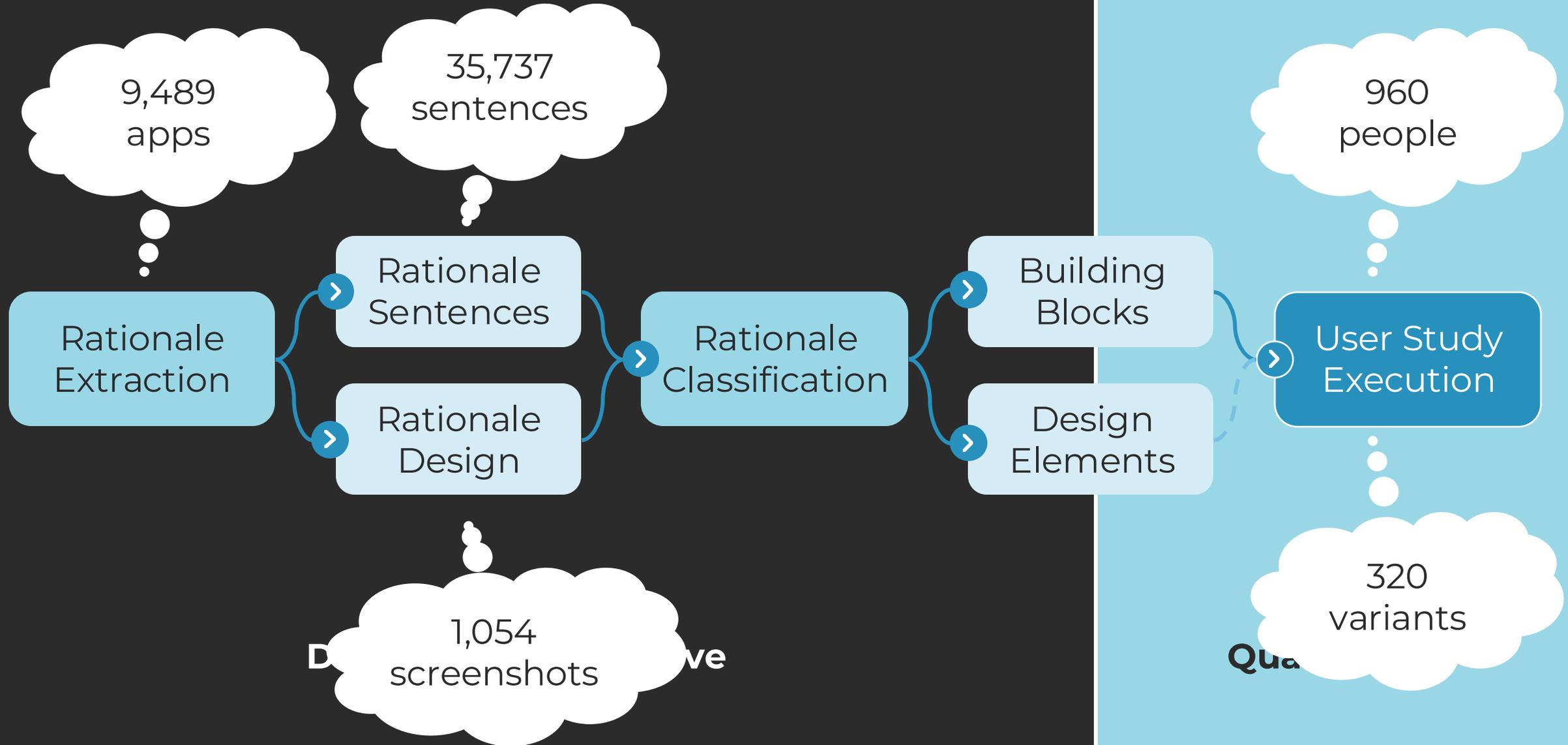


Investigation Design





Investigation Design





Rationale Building Blocks

We would like access to your storage. Without this permission, you cannot attach photos.



Rationale Building Blocks

▼ Perspective

We would like access to your storage. Without this permission, you cannot attach photos.



Rationale Building Blocks

▼ Perspective

▼ Politeness

We would like access to your storage. Without this permission, you cannot attach photos.



Rationale Building Blocks

▼ Perspective

▼ Politeness

▼ Permission

We would like access to your storage. Without this permission, you cannot attach photos.



Rationale Building Blocks

▼ Perspective

▼ Politeness

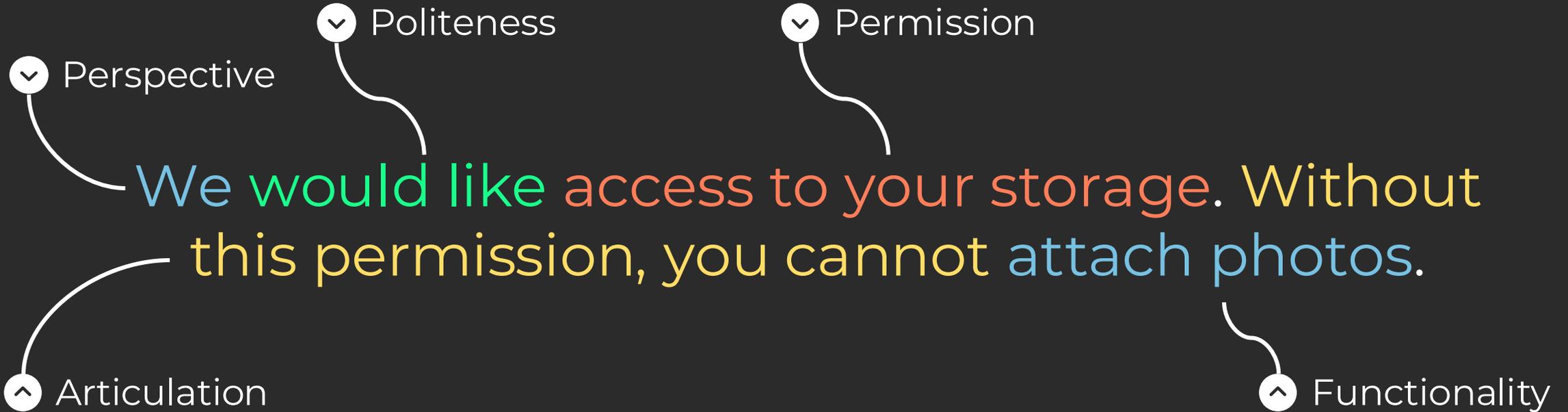
▼ Permission

We would like access to your storage. Without this permission, you cannot attach photos.

▲ Articulation

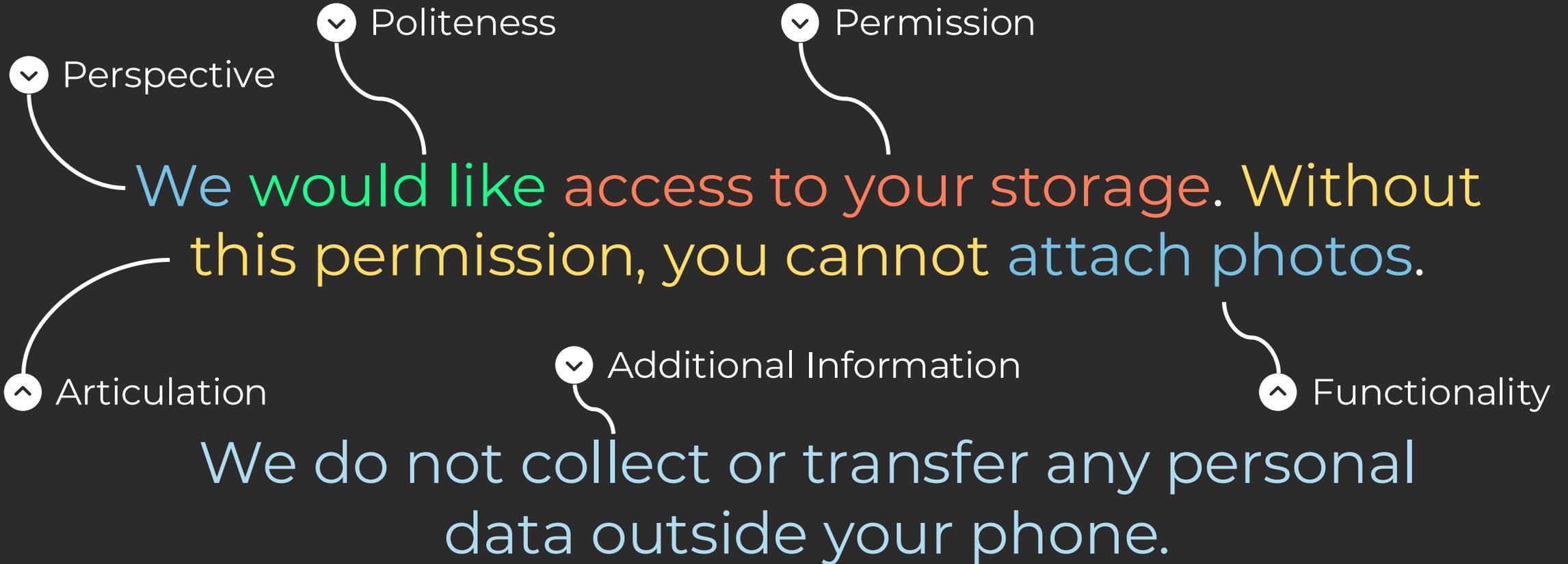


Rationale Building Blocks



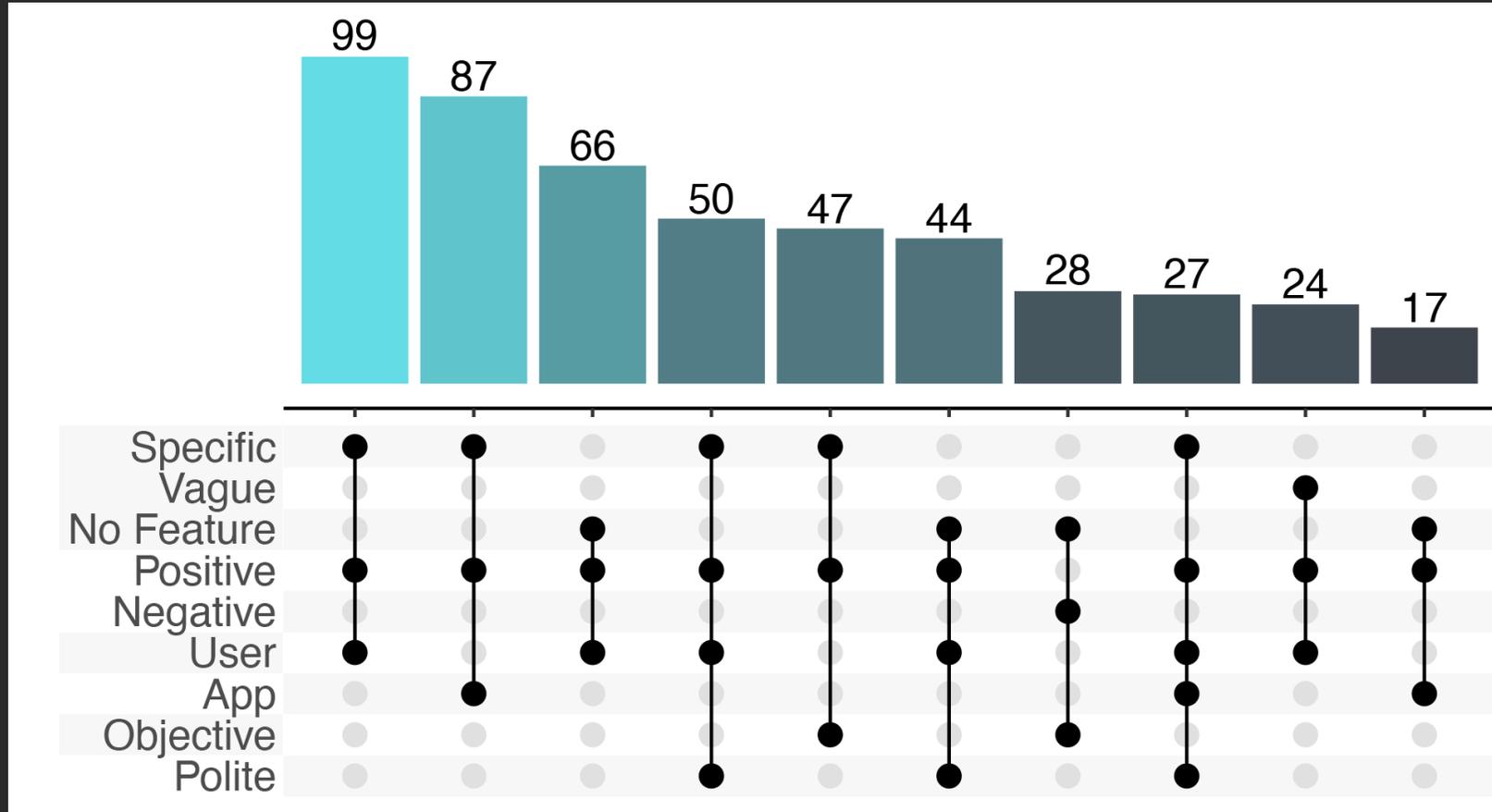


Rationale Building Blocks





Building block analysis





Part III

The power of words

sudo

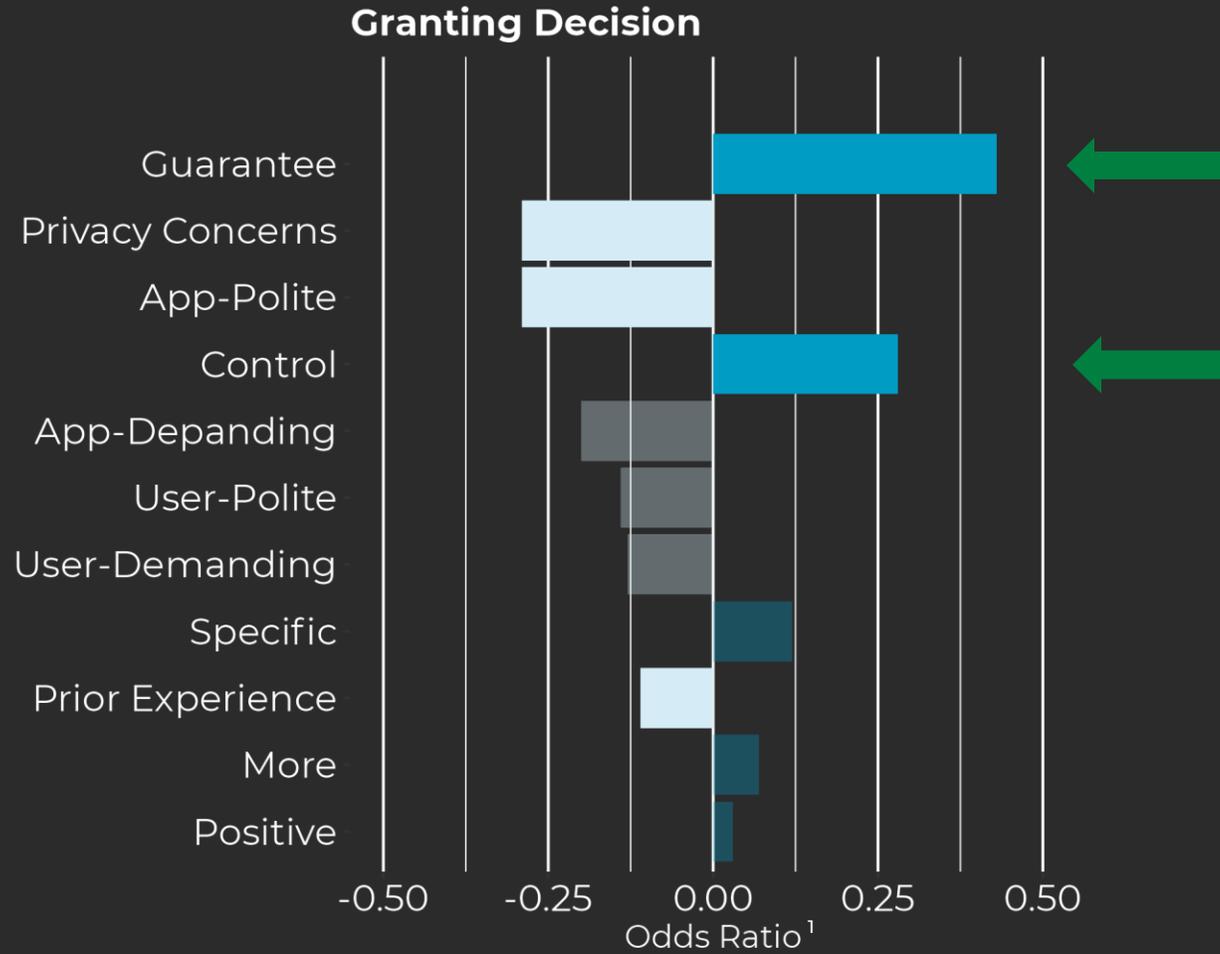
grant

storage

permission



Building block effects

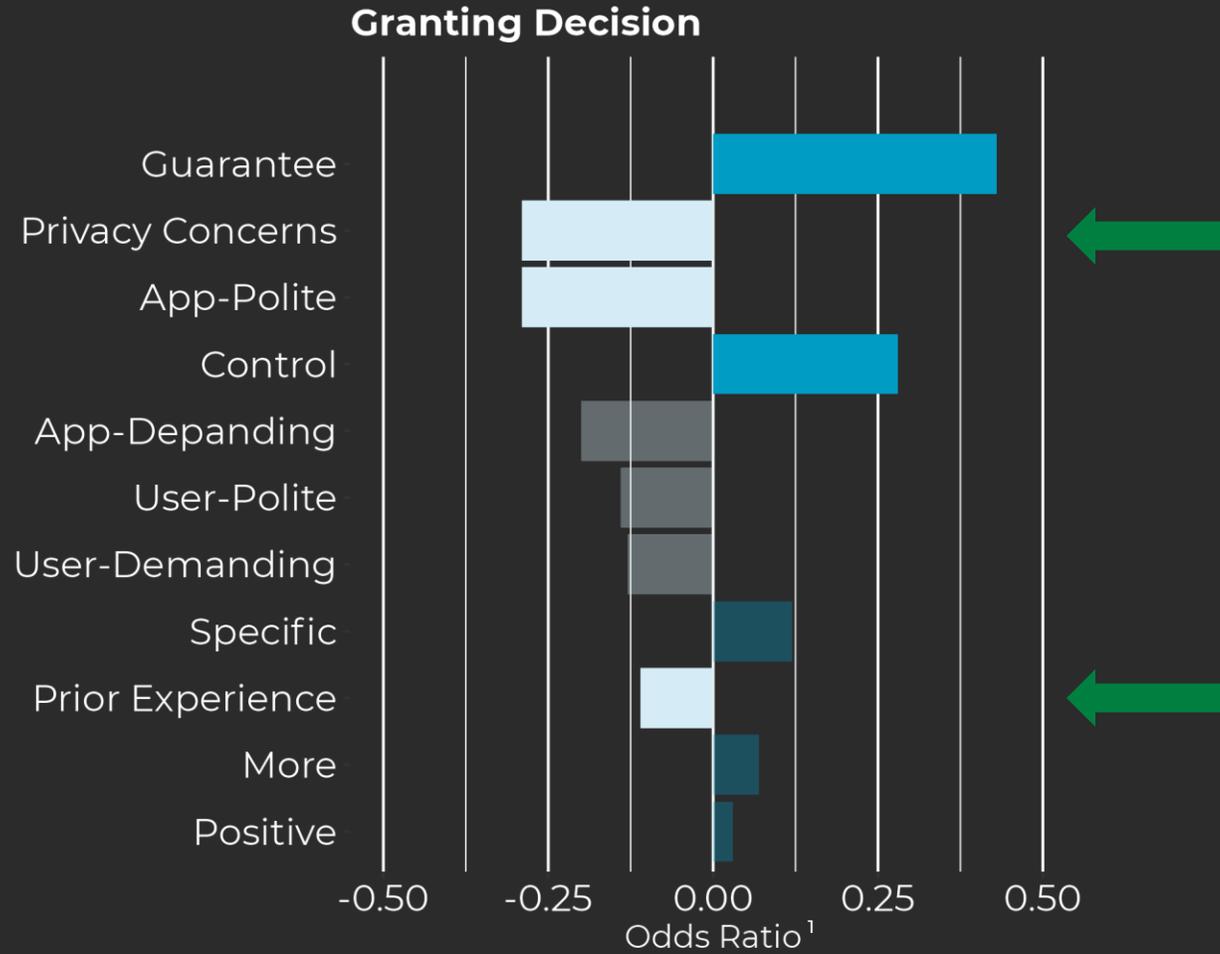


N=960

¹Odds Ratios centered on 1 | ² Unstandardized values



Building block effects

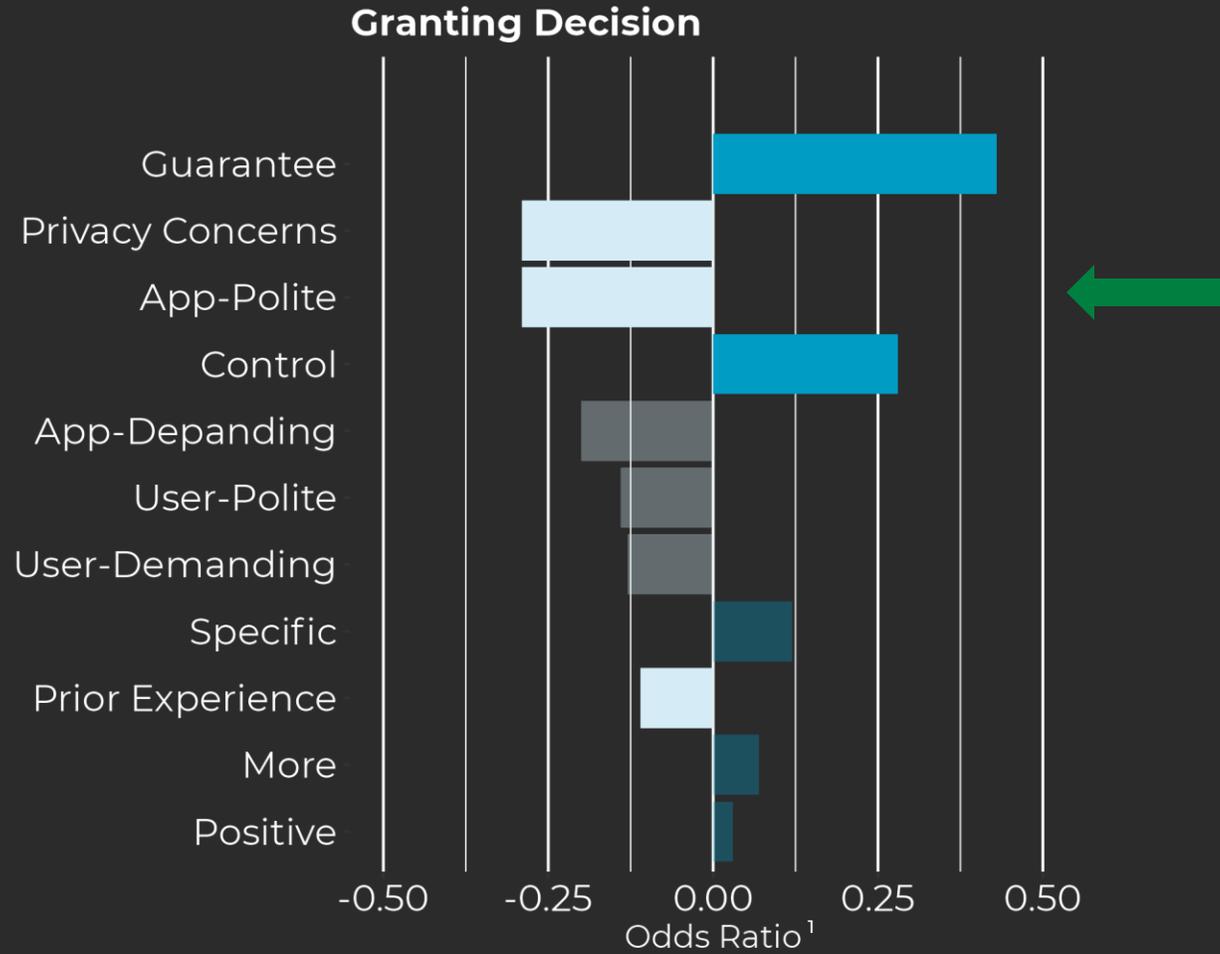


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Building block effects



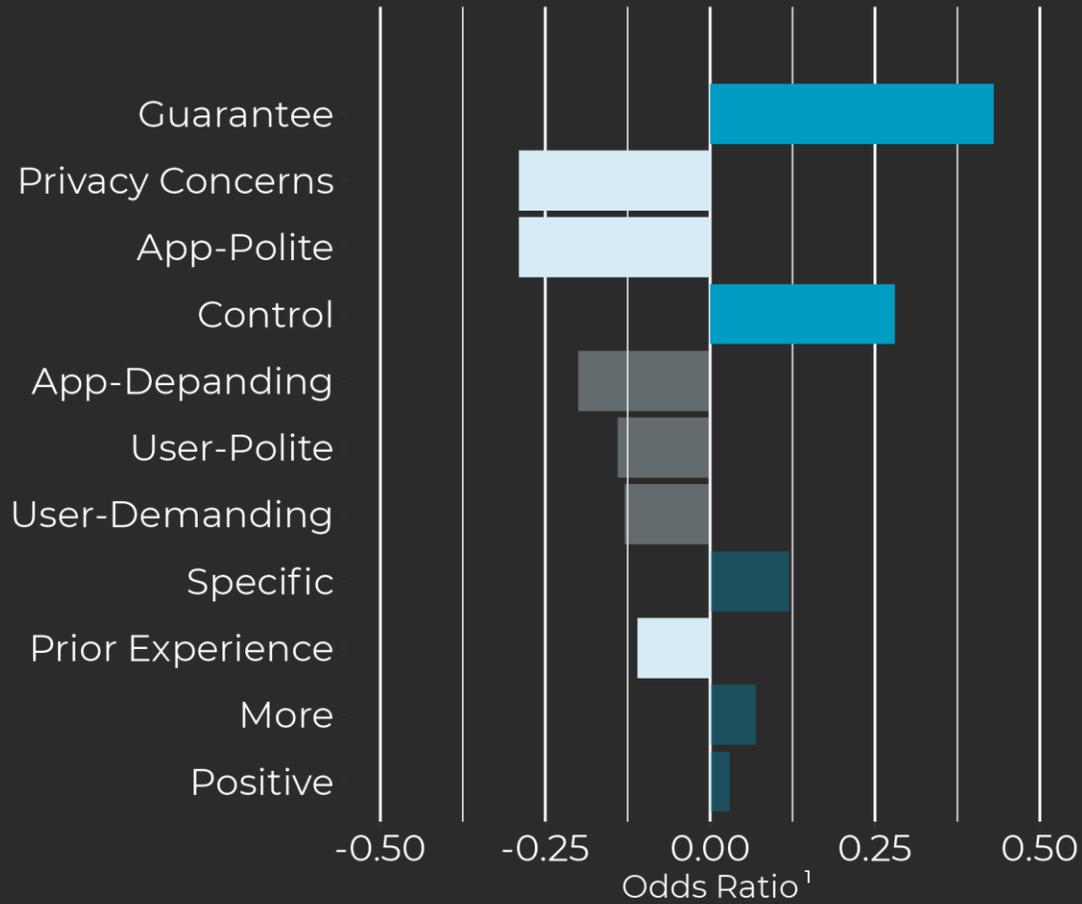
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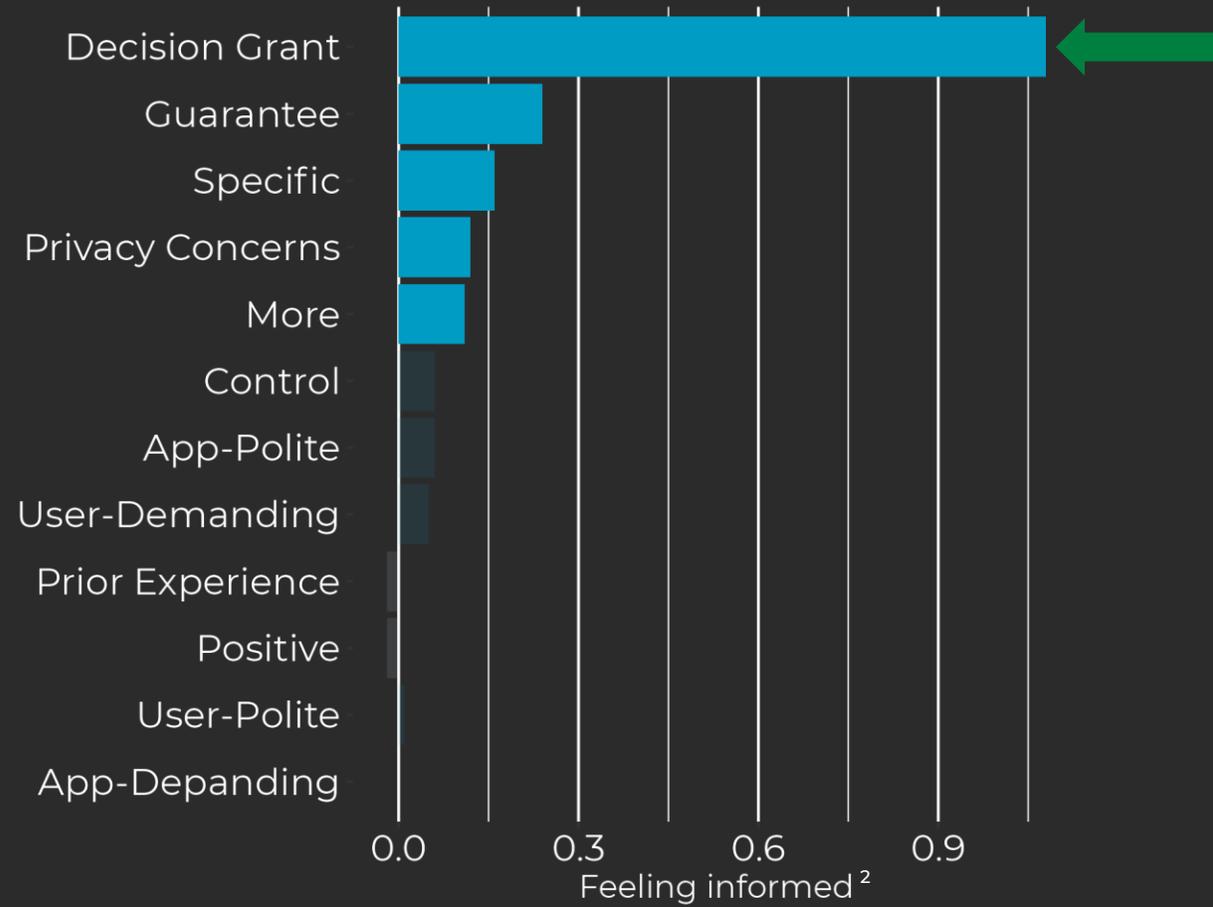


Building block effects

Granting Decision



Feeling Informed



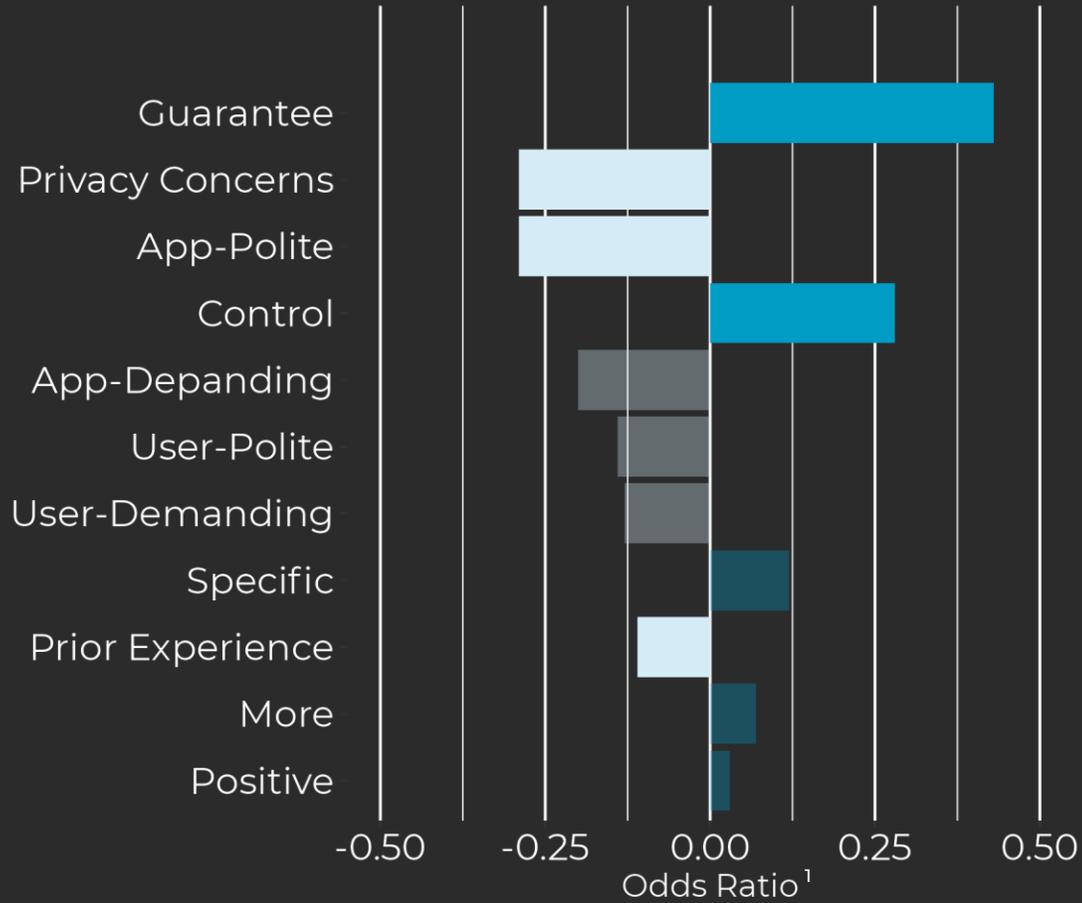
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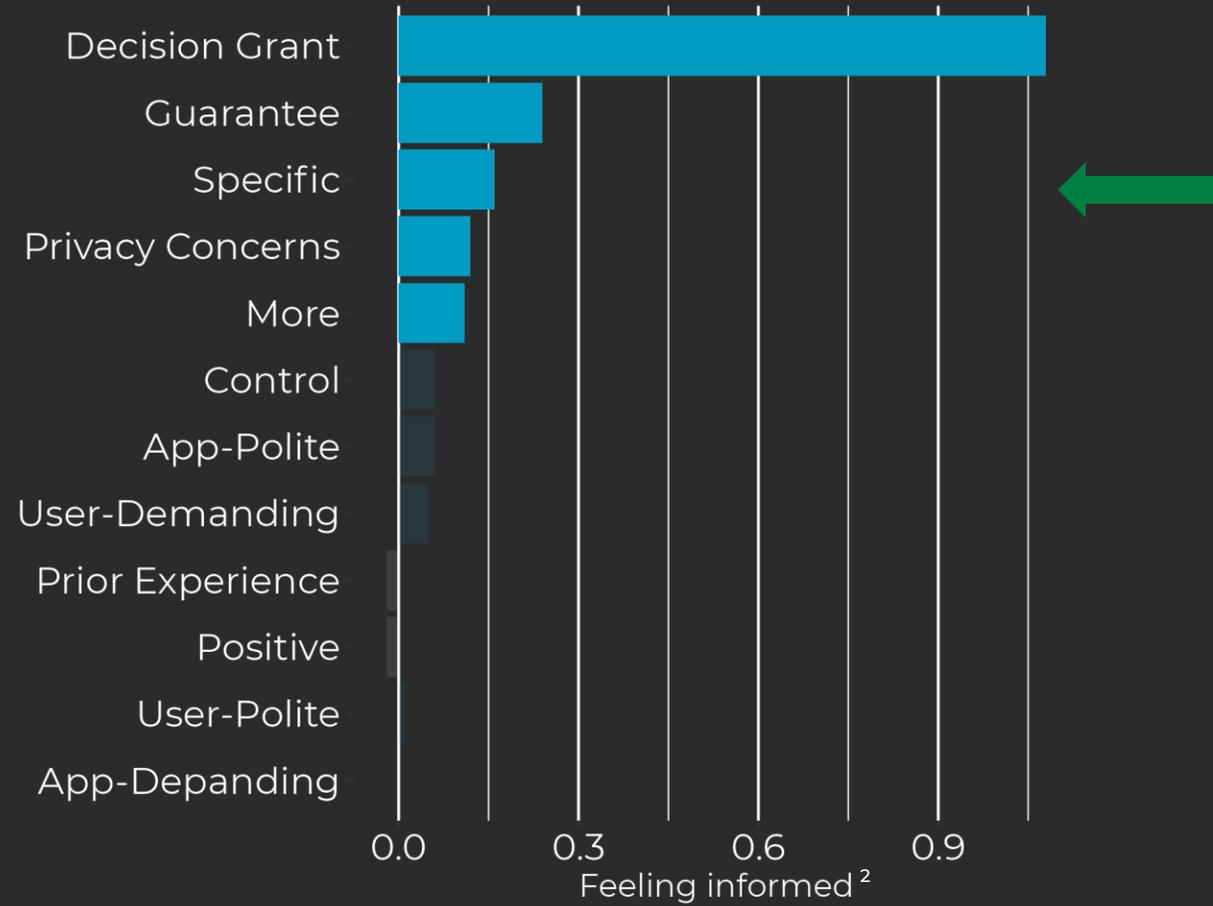


Building block effects

Granting Decision



Feeling Informed

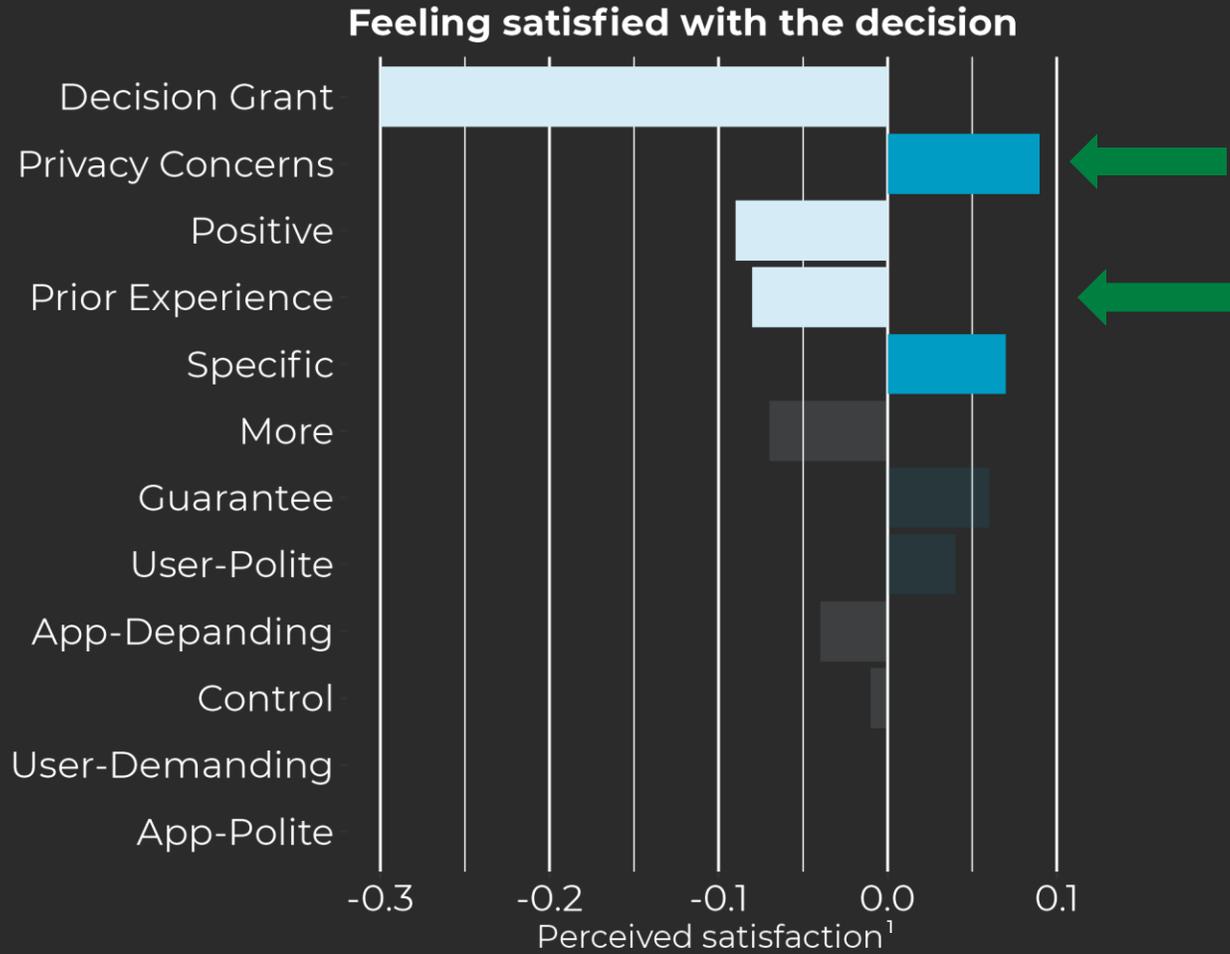


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Building block effects

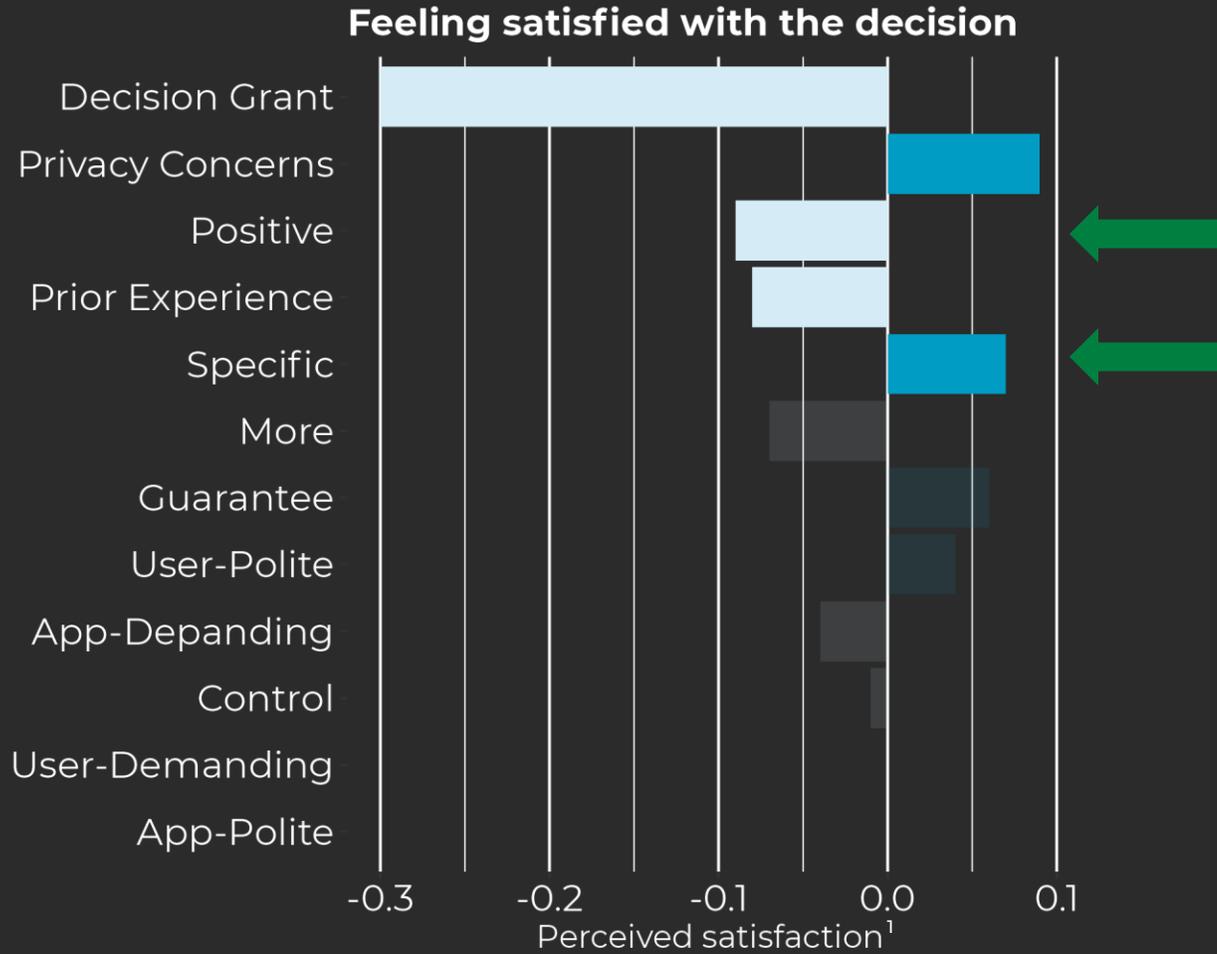


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Building block effects

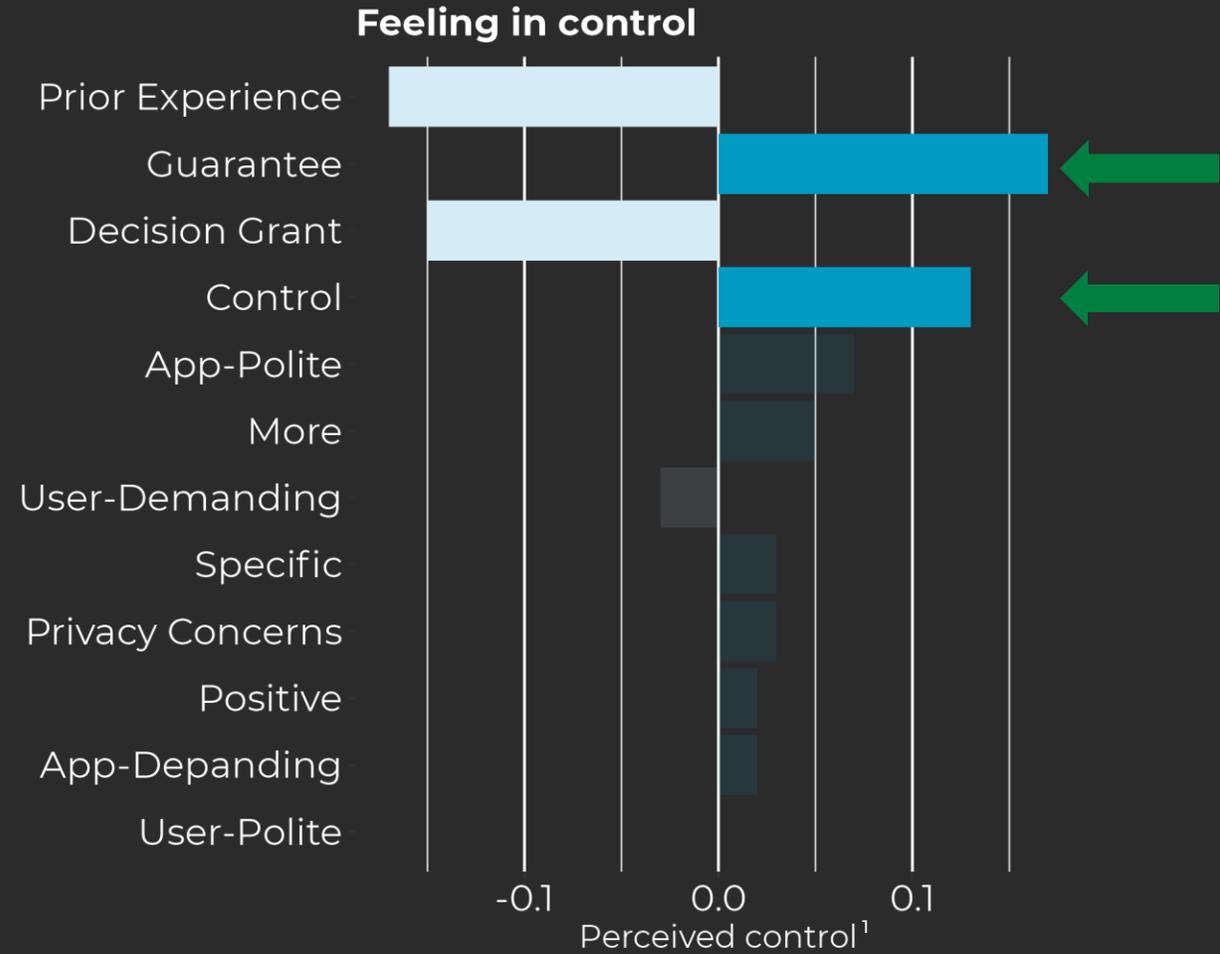
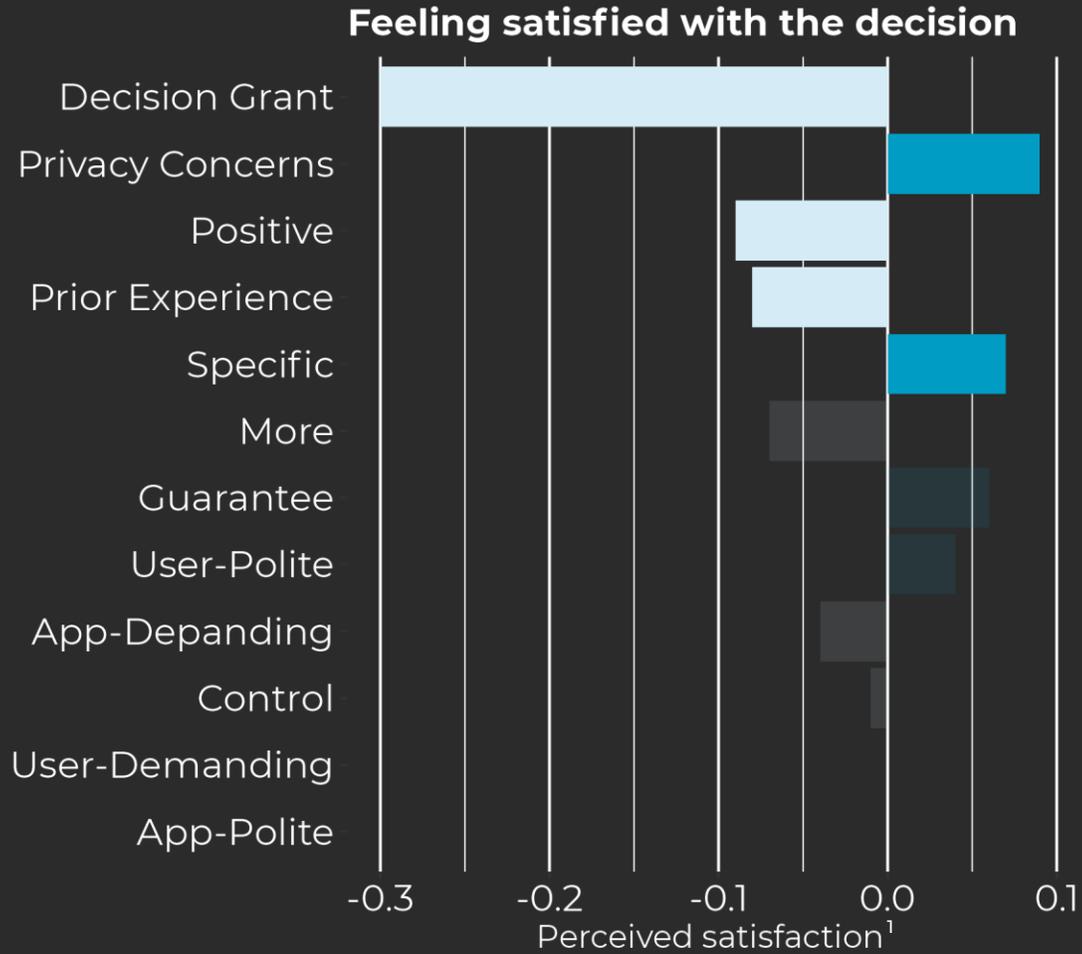


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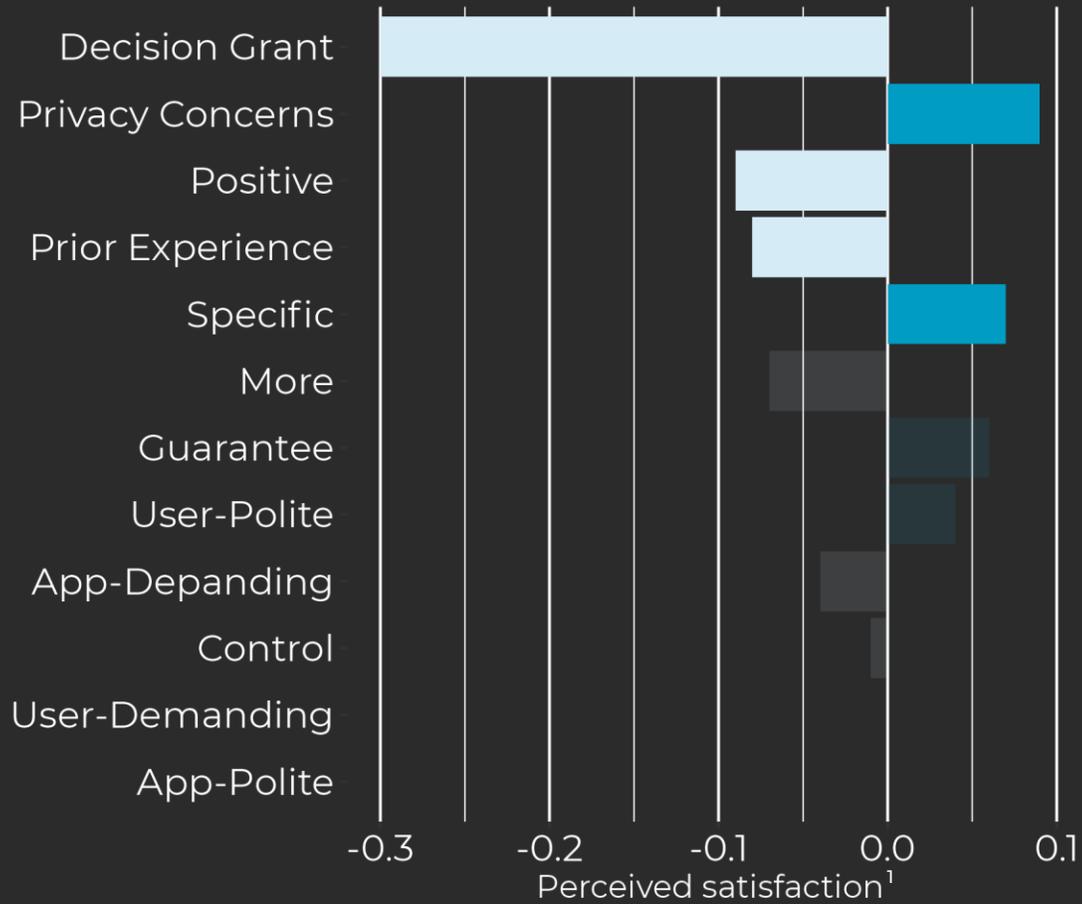
N=960

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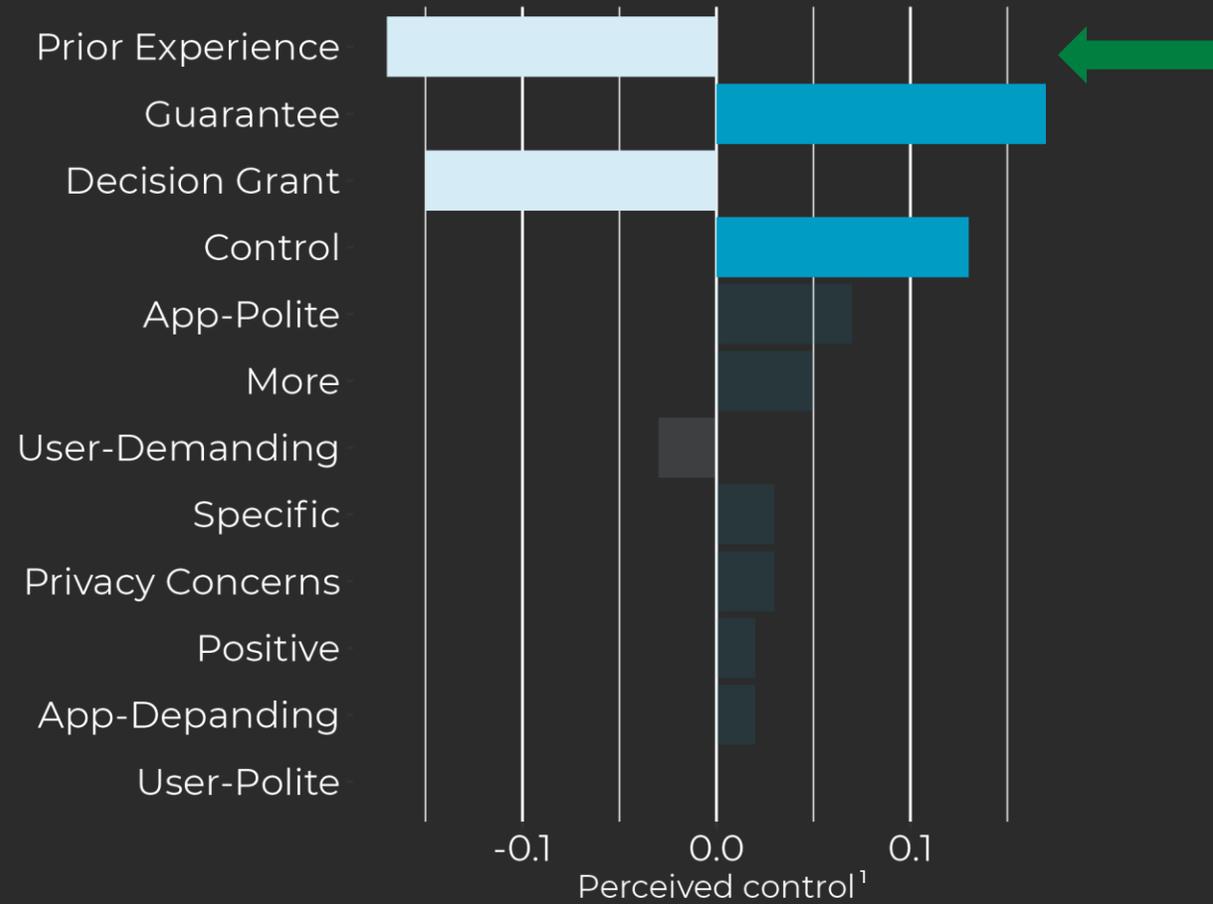


Building block effects

Feeling satisfied with the decision



Feeling in control



N=960

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Effects Summary



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The **granting decision is a significant correlate** of user perception.



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The **granting decision is a significant correlate** of user perception.

In isolation, the effects of changing building blocks **are rather small.**

Adding multiple influential **building blocks** can significantly **affect the user experience.**

Privacy concerns and prior experience with privacy incidents **play a significant role** in user perception.



Influential Building Blocks

I. **Be specific but phrase it negatively**

“Without this permission, the location sharing cannot be used.”



Influential Building Blocks

I. **Be specific but phrase it negatively**

“Without this permission, the location sharing cannot be used.”

II. **Assure users what the permission will not be used for**

“We do not collect or transfer any personal data outside your phone.”



Influential Building Blocks

III. Highlight the reversibility of permission decisions.

“You can change permissions from device settings anytime.”



Influential Building Blocks

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“You can change permissions from device settings anytime.”

IV. Provide supplemental information

“For more information, see the privacy policy on our website.”



Bottom Line

* in our analyzed sample.



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Developers seem to **adhere to existing guidelines to some extent** (about 17—73%*), depending on the recommendation.

Developers show a **great diversity** in how they phrase permission rationales.

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Developers seem to **adhere to existing guidelines to some extent** (about 17—73%*), depending on the recommendation.

Developers show a **great diversity** in how they phrase permission rationales.

Differences in (sensible) permission rationale phrasing **can significantly affect the perception and confidence** of users.

Permission rationale phrasing can significantly **contribute to a positive user experience** regarding security & privacy decisions.

* in our analyzed sample.



Future Directions



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Do **other intrapersonal factors** influence the trustworthiness of permission rationales?



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How can we **incorporate specific phrasing advice into guidelines** to help developers leave better messages?

Can we **guide app vetting with** best practices concerning **building blocks**?



Thank you very much!



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