A Hierarchical Aspect-Sentiment Model for Online Reviews
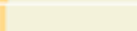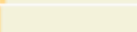
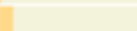**Suin Kim**, Jianwen Zhang, Zheng Chen, Alice Oh, Shixia Liu

KAIST, Republic of Korea
Microsoft Research Asia, P. R. China

Microsoft® Research

KAIST

1

Laptop Reviews

5 star: (28)
4 star: (3)
3 star: (2)
2 star: (1)
1 star: (4)

Average Customer Review
★★★★½ ([38 customer reviews](#))

Share your thoughts with other customers

Create your own review

Questions? Get fast answers from reviewers

What do you want to know about this product?

See all 3 questions & their answers   **Ask**

The most helpful favorable review | **The most helpful critical review**

18 of 21 people found the following review helpful

★★★★★ **Worth every penny!**

I purchased the newest version (Early 2013) which had the upgrade to 16GB Ram and 512GB SSD.

The notebook is extremely fast. Computer seems solid, boots in 10-15 seconds from off, sleep to ready in 4-5 seconds. It opens programs in no time flat. It is not light as an air book, but still defiantly lighter than previous models. The screen is great, bright,...

Read the full review ›

Published 4 months ago by Christopher Gustavus

› See more **5 star**, **4 star** reviews

Vs.

10 of 12 people found the following review helpful

★☆☆☆☆ **I was sent a used Macbook pro**

I ordered this computer on may 21st, received it on may 23rd. The shrink wrap on the box was intact, but when I opened it I found the charger missing. So I called customer support and they were willing to refund the amount for the charger so that I can I pick one up at the apples store, since I was leaving out of the country. I took the computer along with me to the apple...

Read the full review ›

Published 1 month ago by kohilam rangaswamy

› See more **3 star**, **2 star**, **1 star** reviews

‹ Previous | 1 2 3 4 | Next ›   **Most Helpful First** | Newest First

18 of 21 people found the following review helpful

★★★★★ **Worth every penny!**, February 27, 2013

By **Christopher Gustavus** (North Fond du Lac, WI, US) - See all my reviews

This review is from: Apple MacBook Pro ME665LL/A 15.4-Inch Laptop with Retina Display (NEWEST VERSION) (Personal Computers)

I purchased the newest version (Early 2013) which had the upgrade to 16GB Ram and 512GB SSD.

The notebook is extremely fast. Computer seems solid, boots in 10-15 seconds from off, sleep to ready in 4-5 seconds. It opens programs in no time flat. It is not light as an air book, but still defiantly lighter than previous models. The screen is great, bright, and responsive. With heavy use I get about 5-5 1/2 hours of use on the battery.

Some peoples complaints are the new power adapter, I will agree with them, the new adapter sticks out further and gets knocked off a lot. Not having a dvd drive, not a big deal...I dont think i've used a dvd or cd in a computer in a few years! If I need to I will just have to purchase the external.

2

Laptop Reviews

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4 star: (3)
3 star: (2)
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‹ Previous | 1 2 3 4 | Next ›

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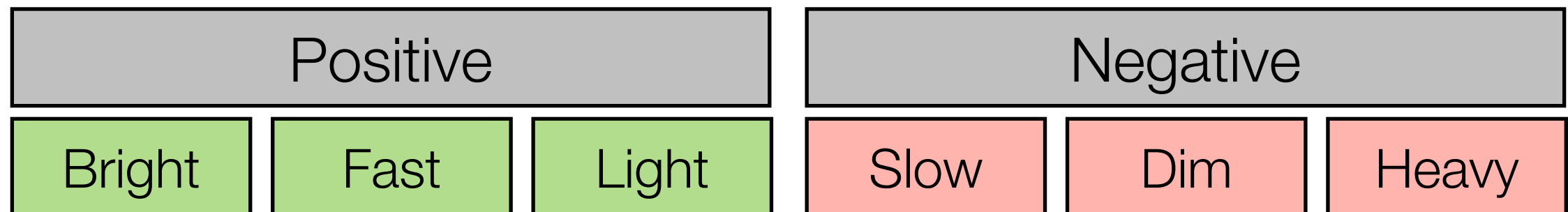responsive. With heavy use I get about 5-5 1/2 hours of use on the battery.

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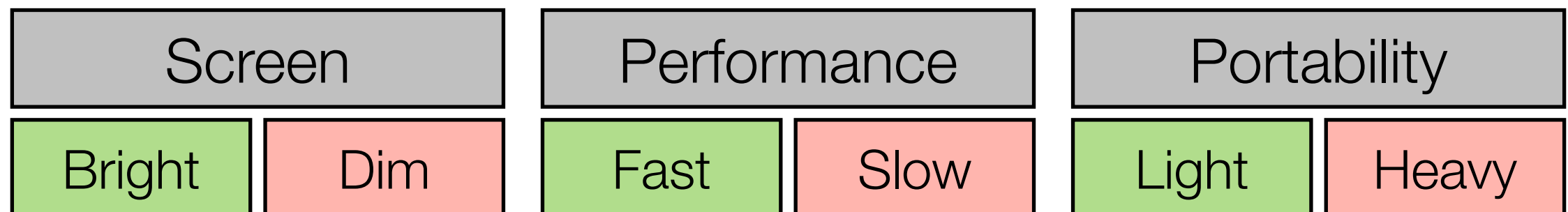
Reviews are not structurally organized

Consumers need to read through the reviews

2

Prior Work

- Flat-layer joint sentiment-aspect topic models
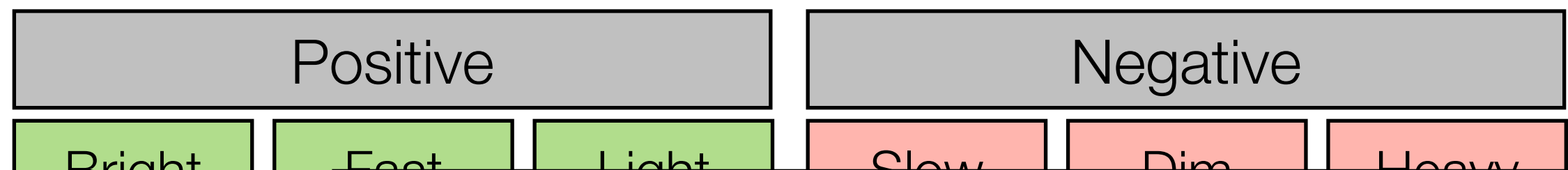
  - ASUM (Jo 2011)

  - JST (Lin 2009)

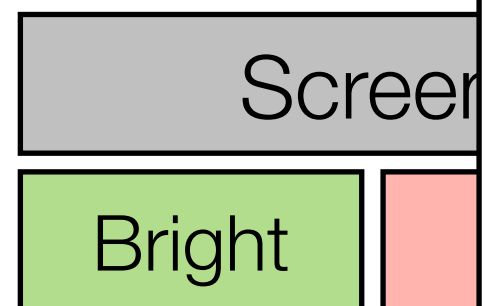| Positive			Negative		
Bright	Fast	Light	Slow	Dim	Heavy

  - Reverse JST (Lin 2012)

Screen		Performance		Portability	
Bright	Dim	Fast	Slow	Light	Heavy

3

Prior Work

- Flat-layer joint sentiment-aspect topic models

  - ASUM (Jo 2011)

  - JST (Lin 2009)

| Positive			Negative		
Bright	Fast	Light	Slow	Dim	Heavy

- Revers

Scree
Bright

Different consumers are interested in different granularities of aspects and sentiments

"I want a laptop which has a great performance, especially for a graphics card. I don't care about weight but screen should be visible quite well. And, of course, it should be rated positive overall!"
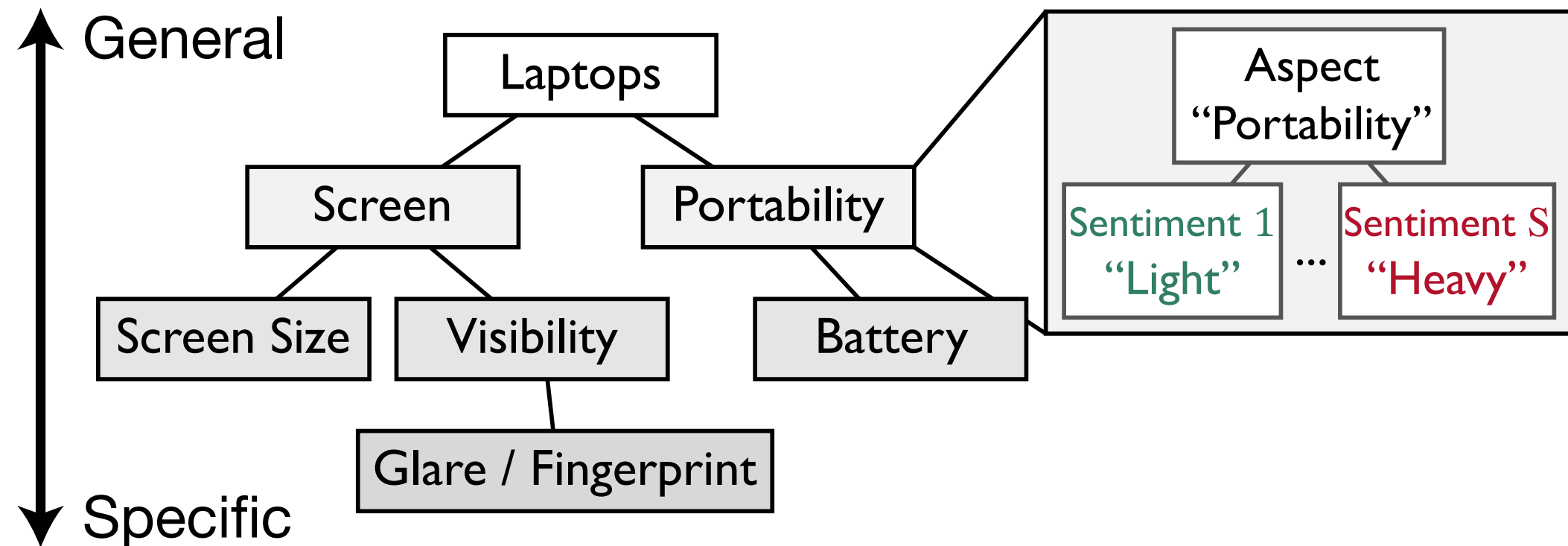
Our Solution

Aspect-Sentiment Hierarchy
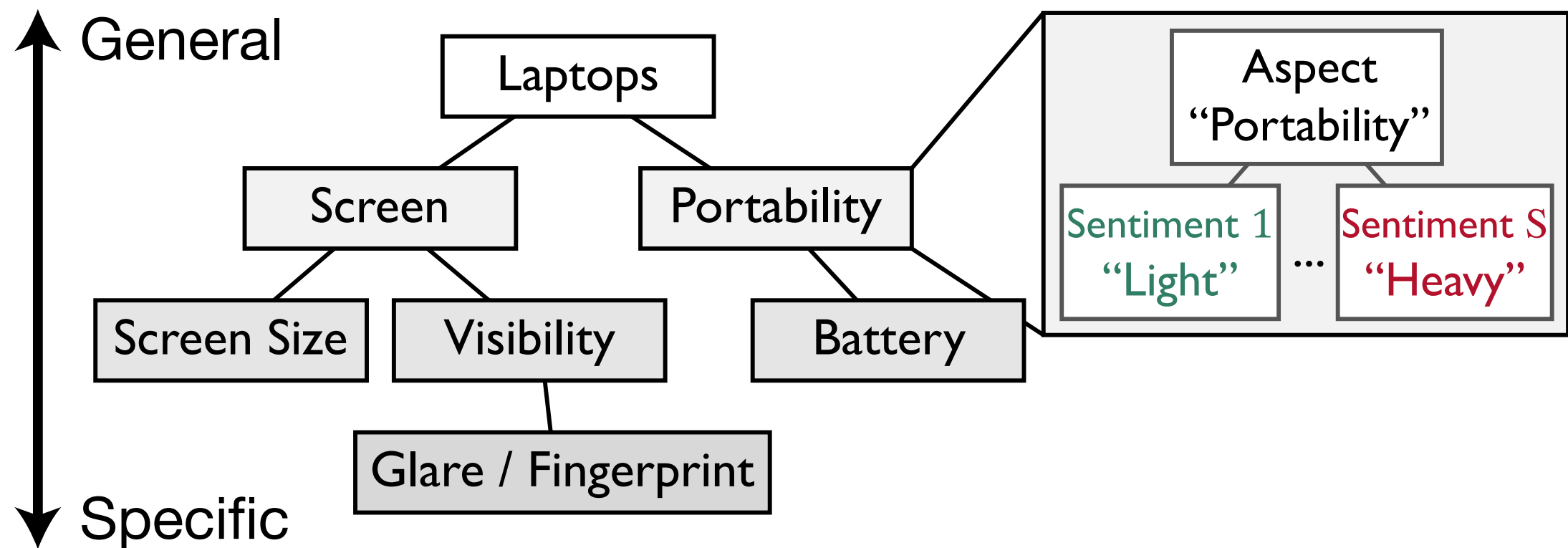
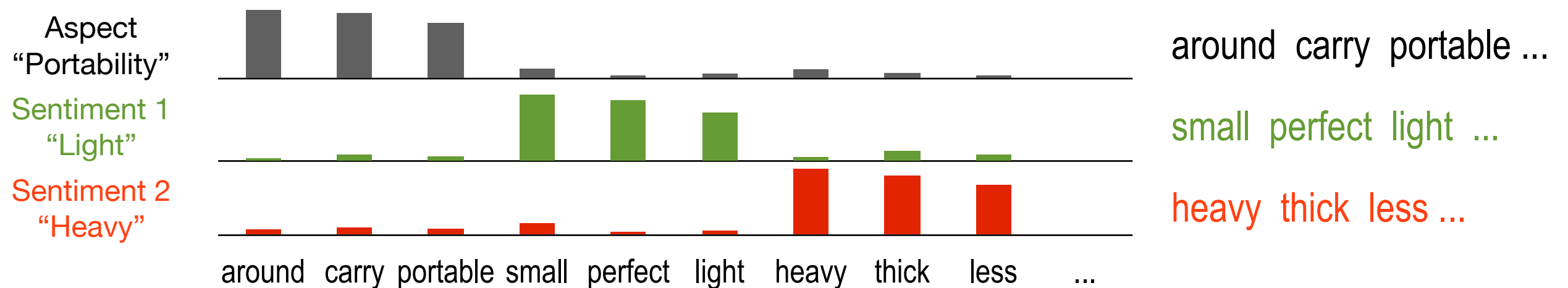Hierarchical structure of **Aspect-Sentiment Nodes**

Aspect-dependent **Sentiments**

- Aspect-sentiment nodes are tree structured

- Each aspect-sentiment node is a two-level tree: aspect and sentiments
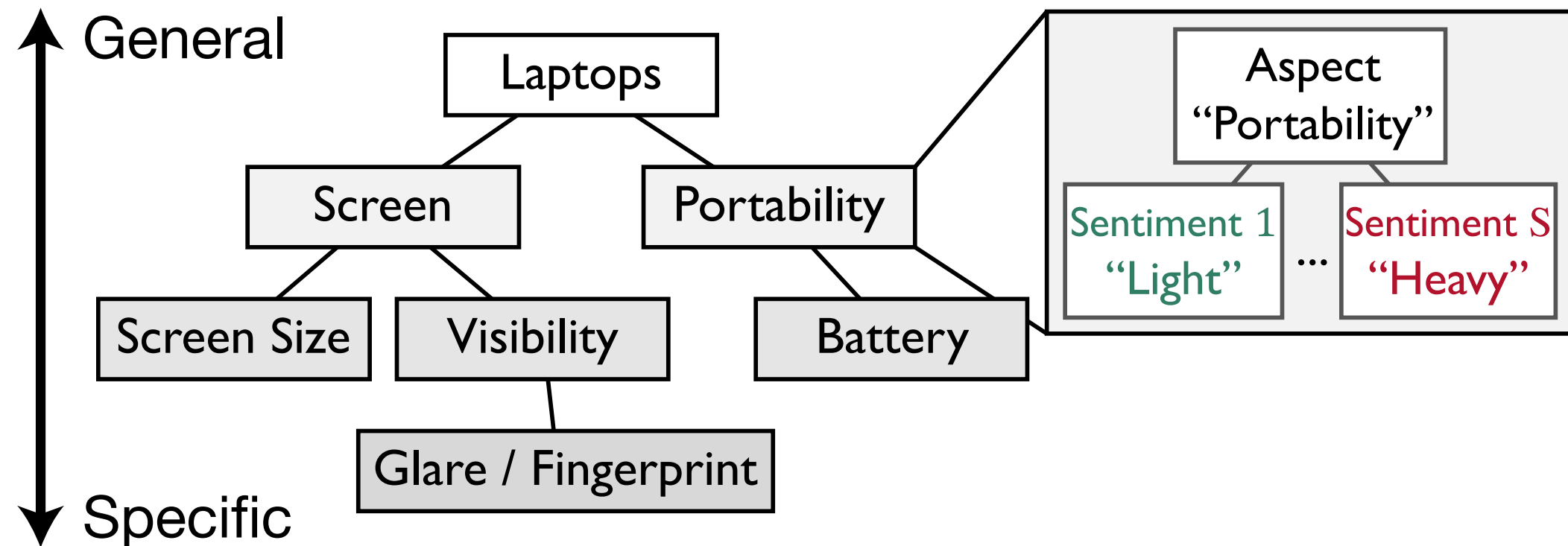
Our Solution

- Each aspect and sentiment is a multinomial distribution over words

A Bayesian nonparametric prior discovers tree structure

Our Solution

- Each aspect and sentiment is a multinomial distribution over words

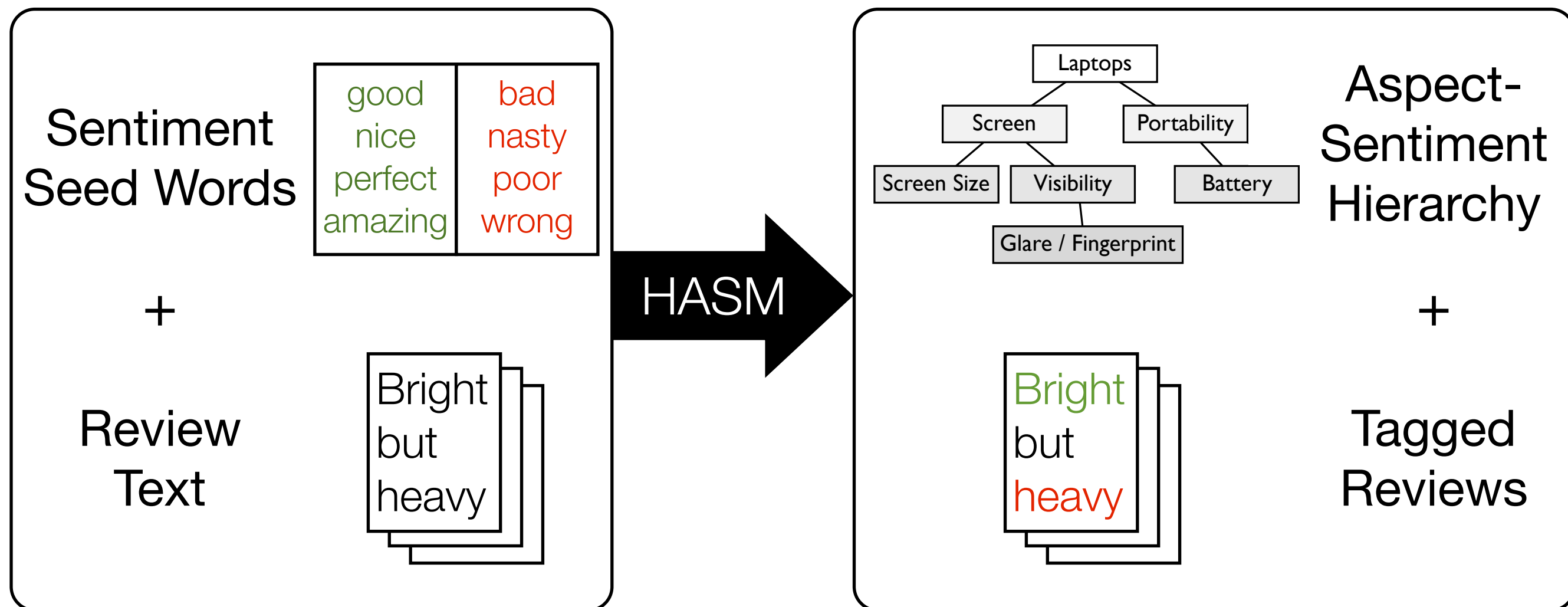**HASM:**
A new model to discover a hierarchical structure of aspect-based sentiments from unlabeled online reviews

A Bayesian nonparametric prior discovers tree structure

Hierarchical Aspect-Sentiment Model

- Automatically discovers a hierarchy of aspects and aspect-dependent sentiments

HASM: Graphical Representation
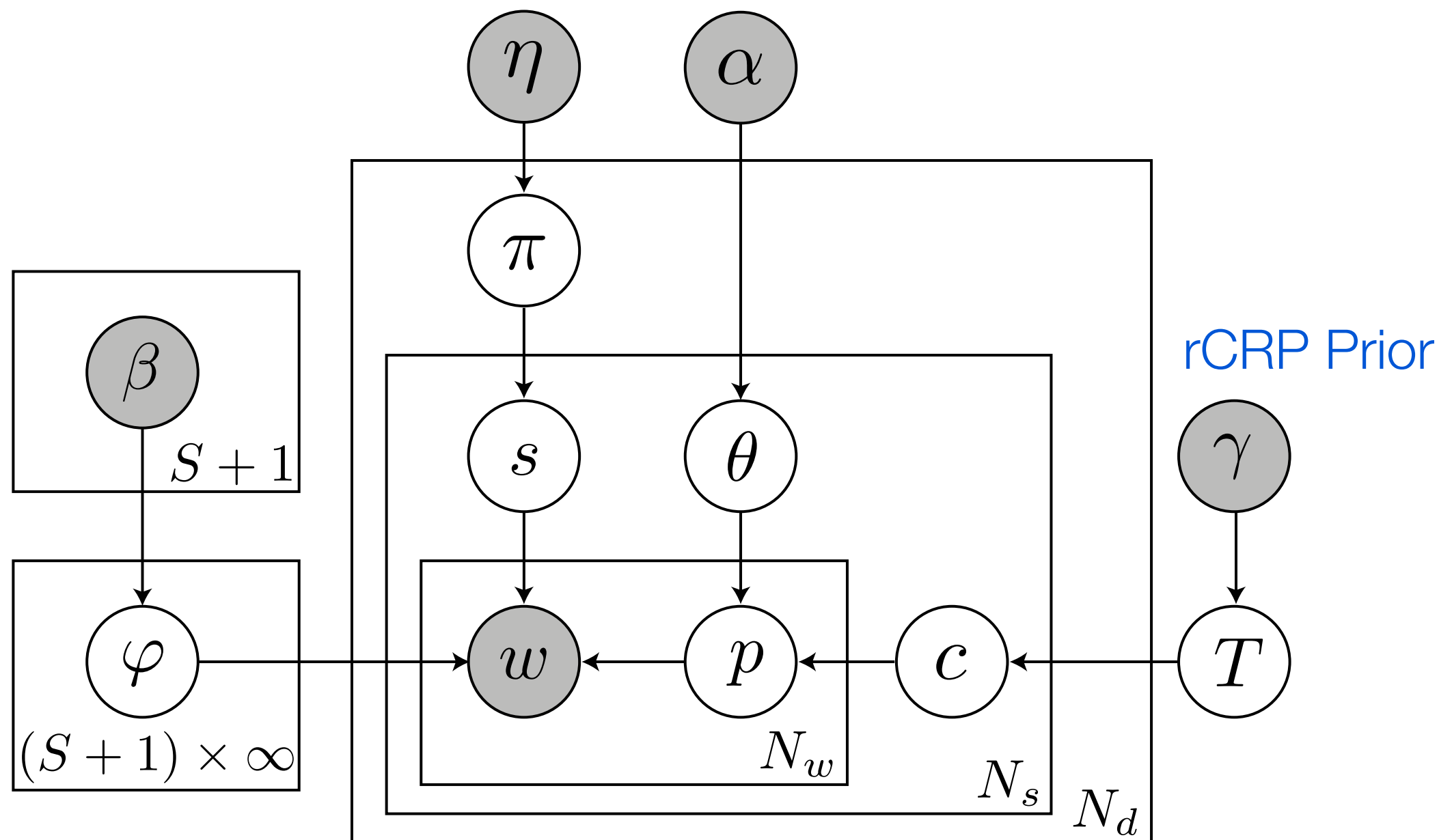
A Bayesian nonparametric topic model

HASM: Example

HASM: Example

HASM: Example

The screen is clear and the picture quality is outstanding.

Laptops

Screen

Portability

+

Screen Size

Visibility

Glare/ Fingerprint

9

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

A short battery life undermines portability.

Laptops

Screen

Portability

Screen Size

Visibility

Glare/Fingerprint

13

HASM: Example

A short battery life undermines portability.

Laptops

Screen

Portability

+

Screen Size

Visibility

Glare/Fingerprint

13

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

HASM: Example

Laptops

Screen

Portability

Screen Size

Visibility

Glare/
Fingerprint

A battery life portability

New Node

Positive

Negative

short undermines

15

HASM: Example

Laptops

(0) laptop used computer get will screen just work
(+) like windows screen great work new macbook look
(-) battery screen hour problem time windows hp drive

Performance

(0) drive gb ram hard processor
(+) graphic intel core ram cpu fast
(-) drive gb hard ram external need

Screen

(0) screen laptop look display pro
(+) like macbook display feel new
(-) glossy black see review rest feel

Battery

(0) battery laptop life hour get
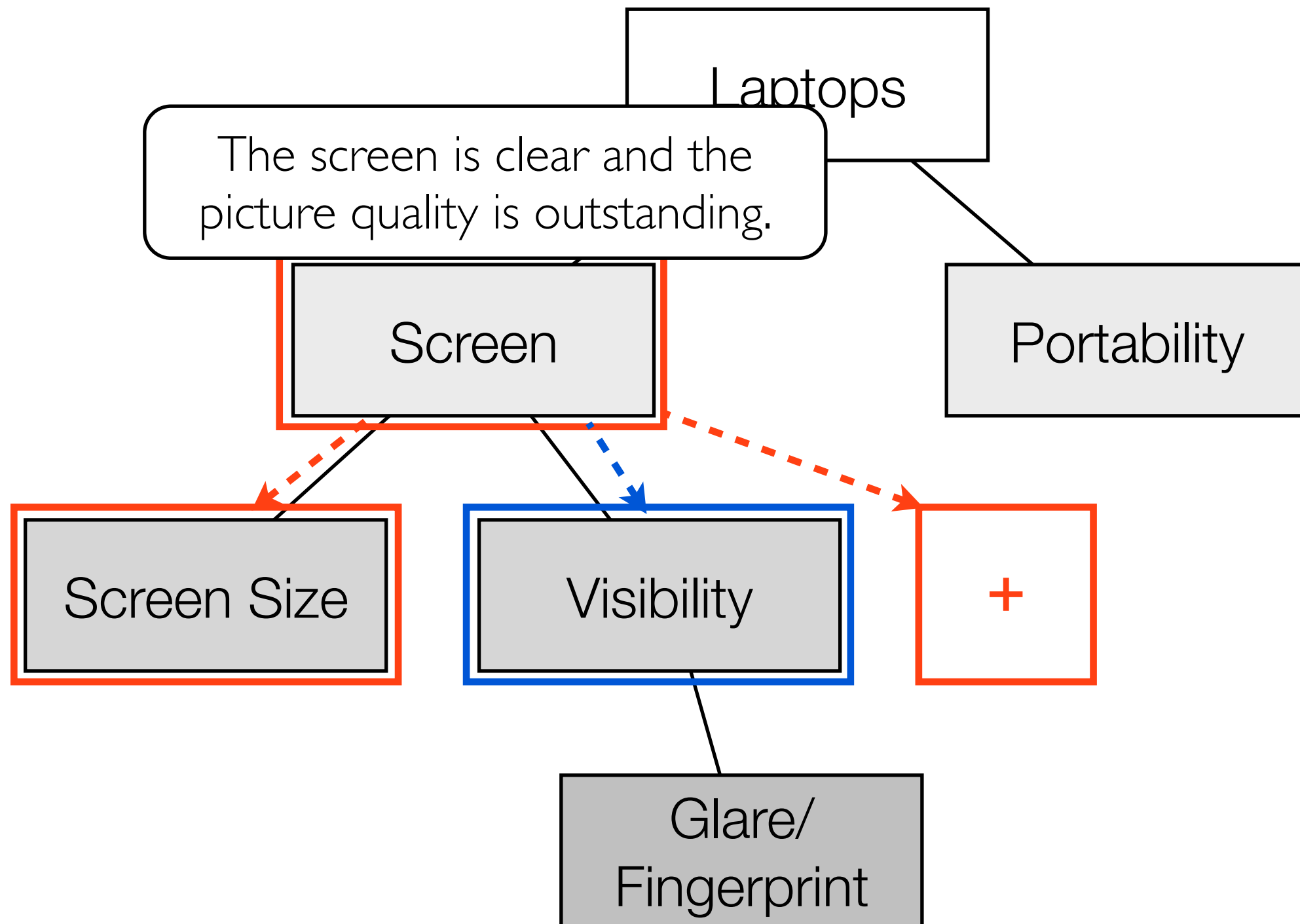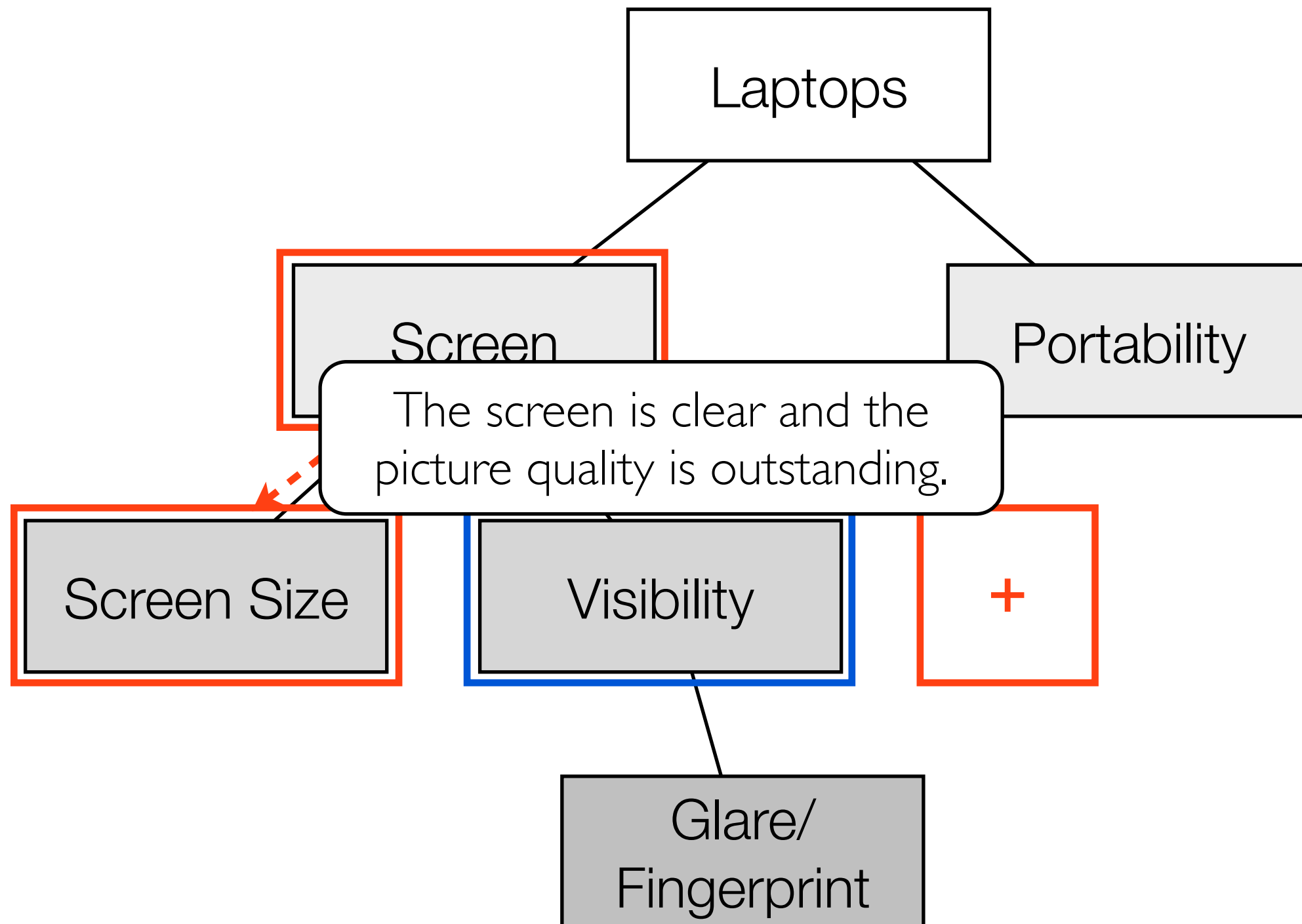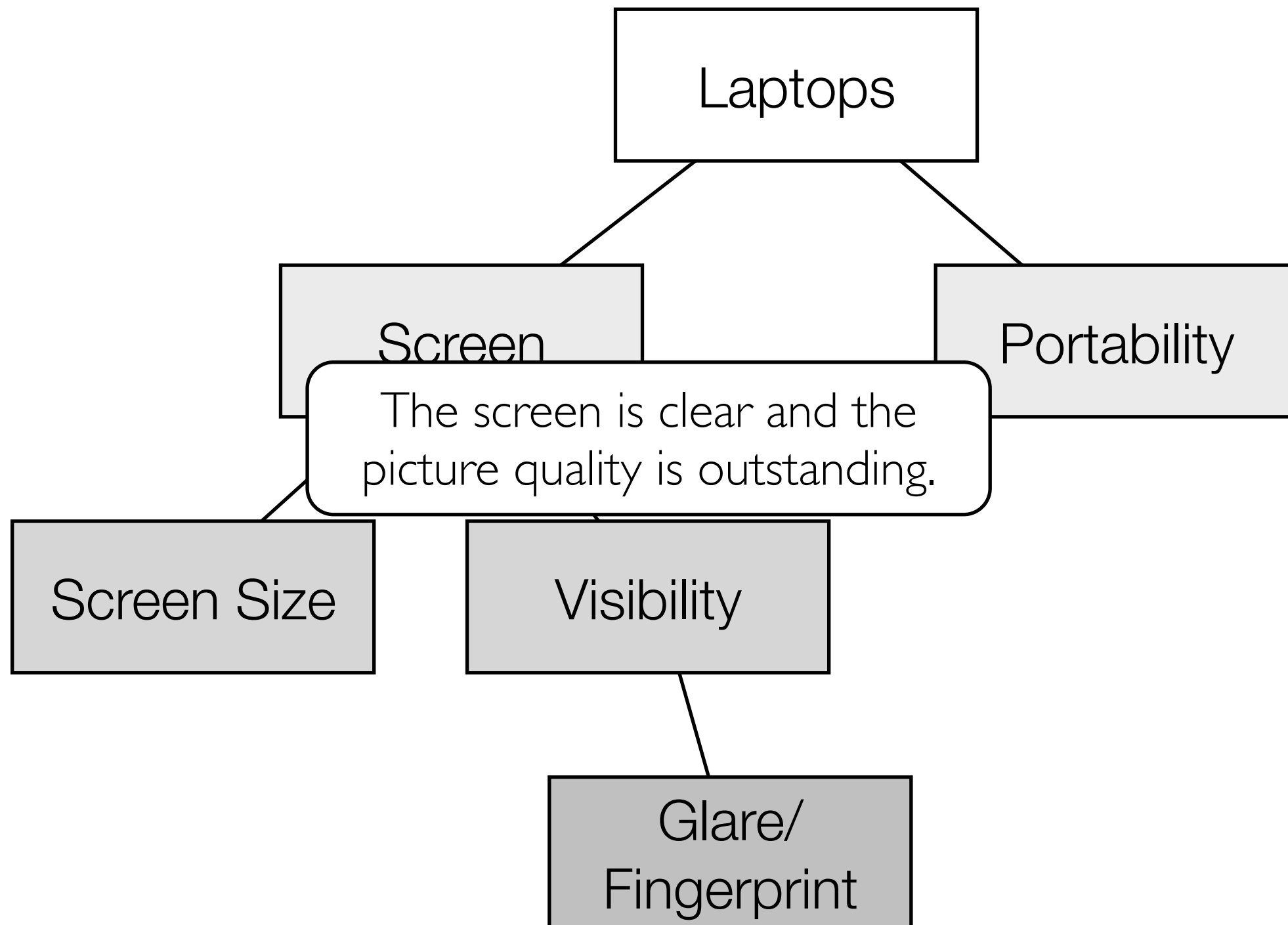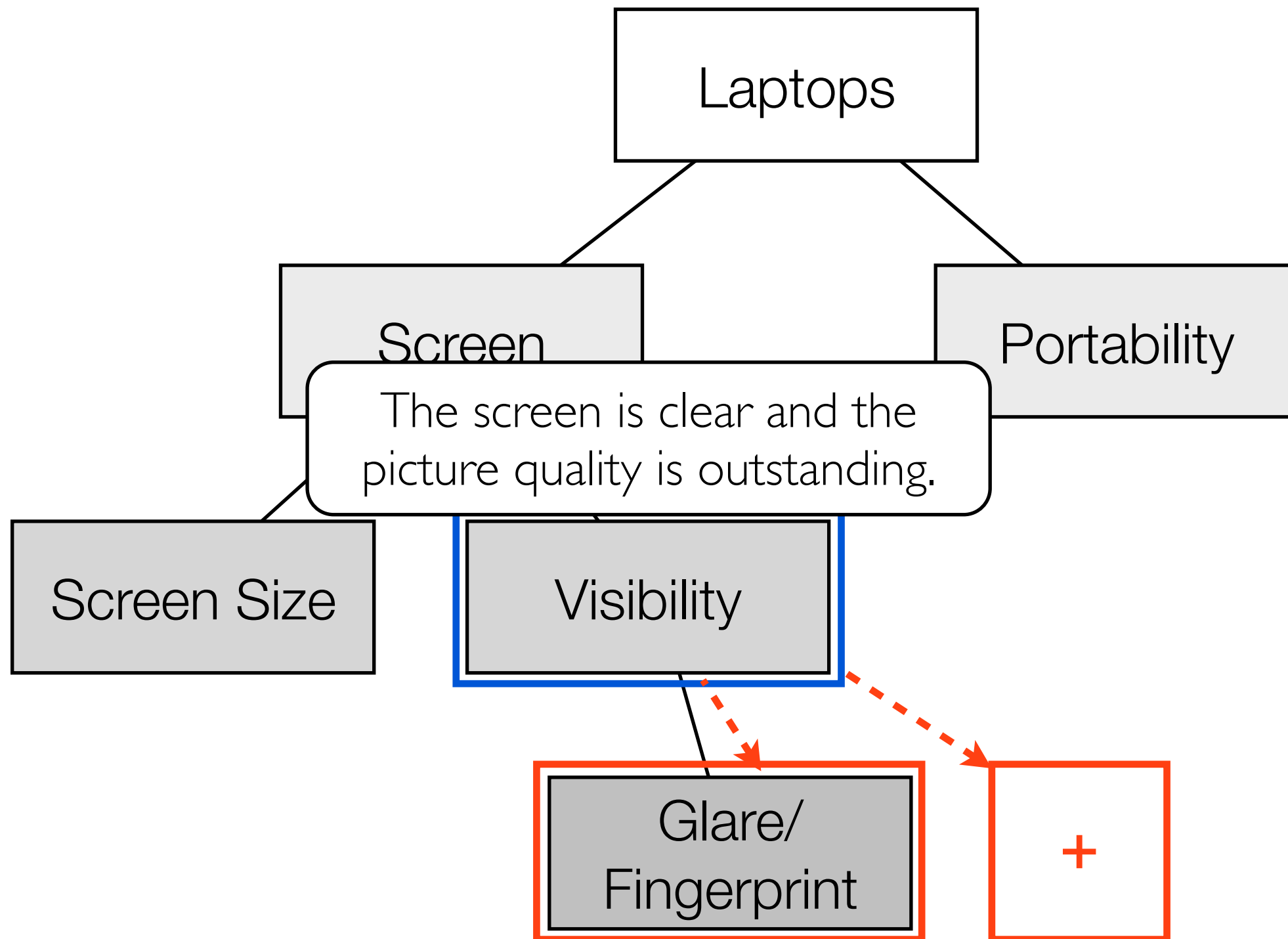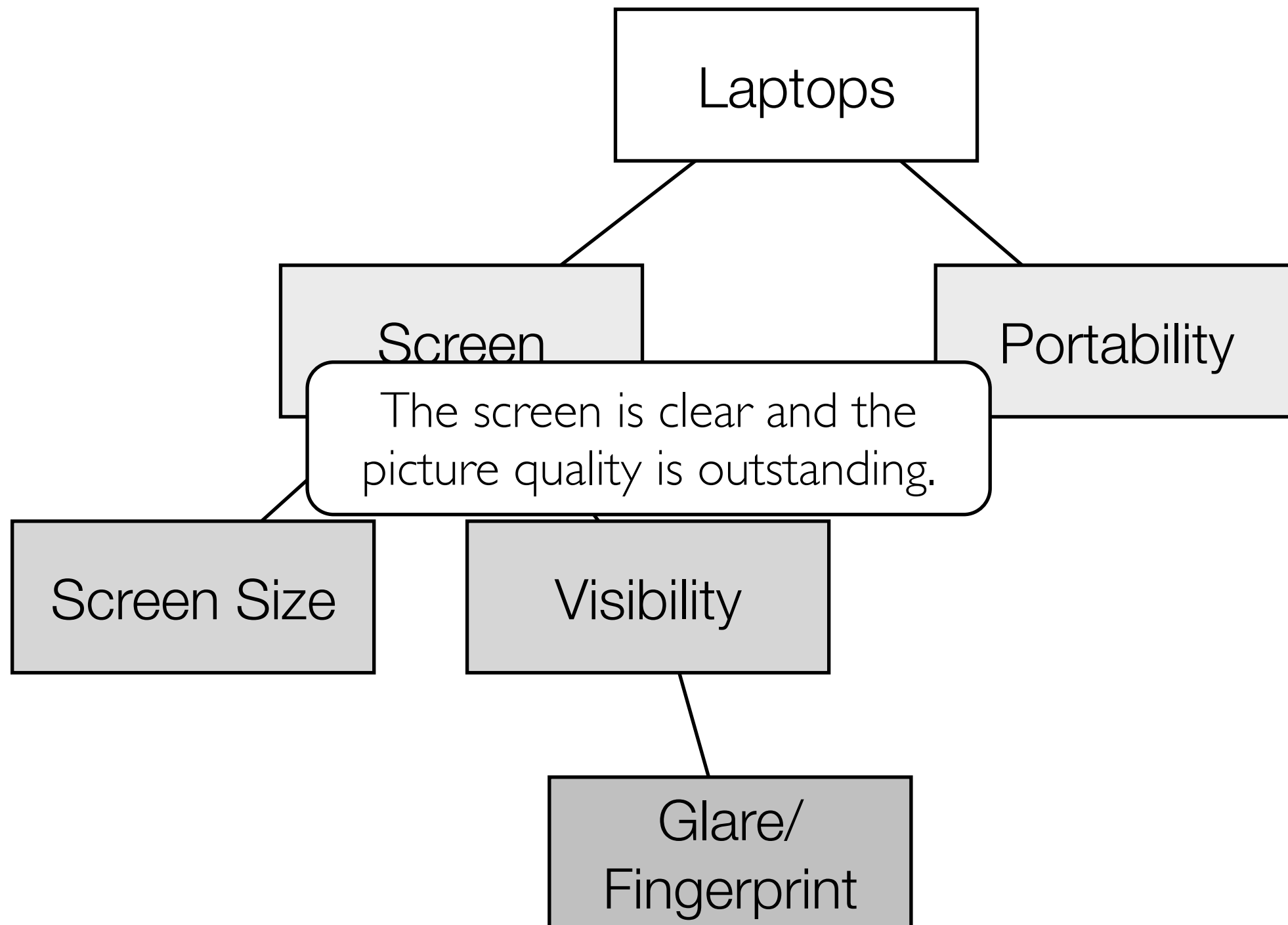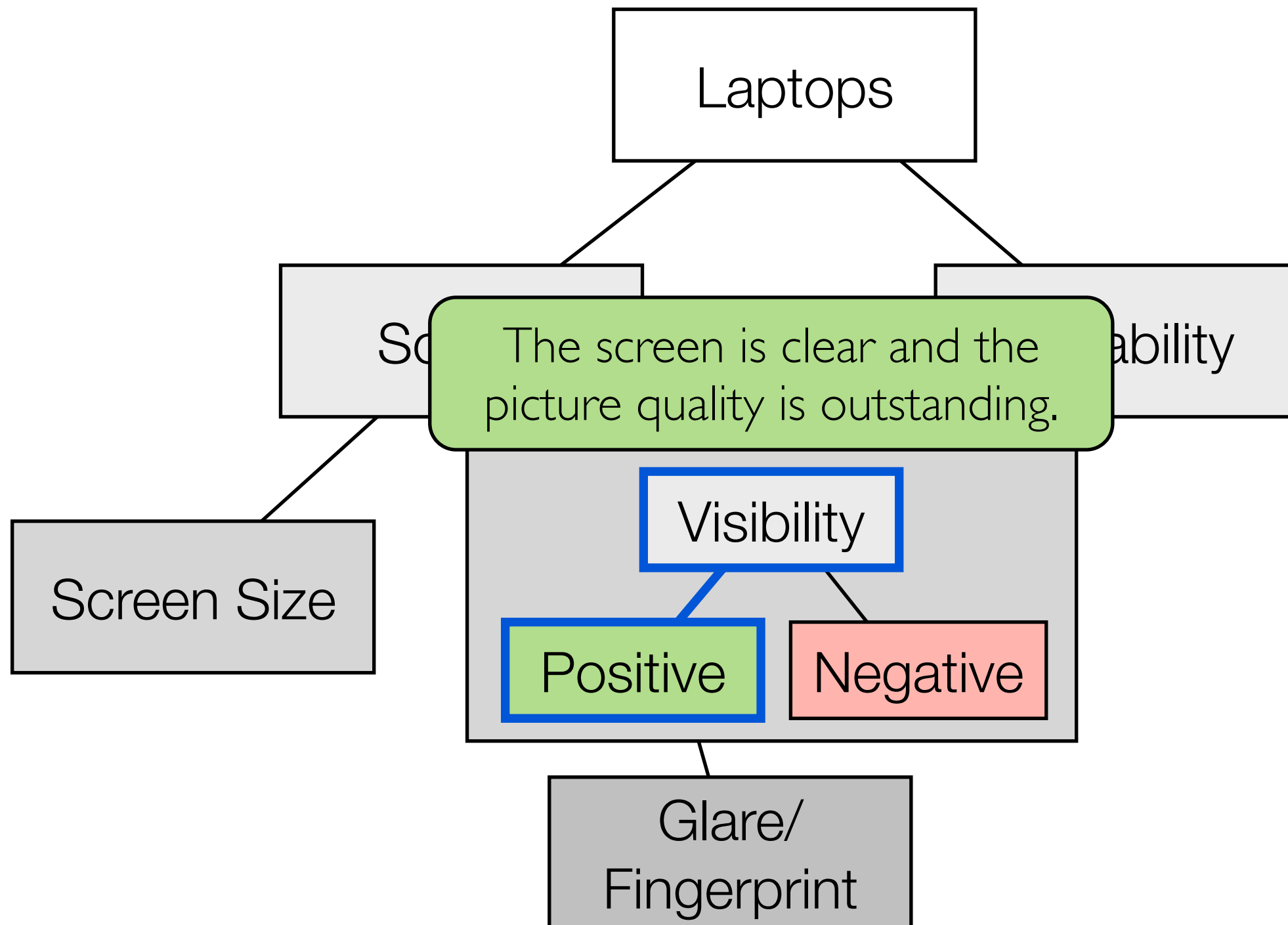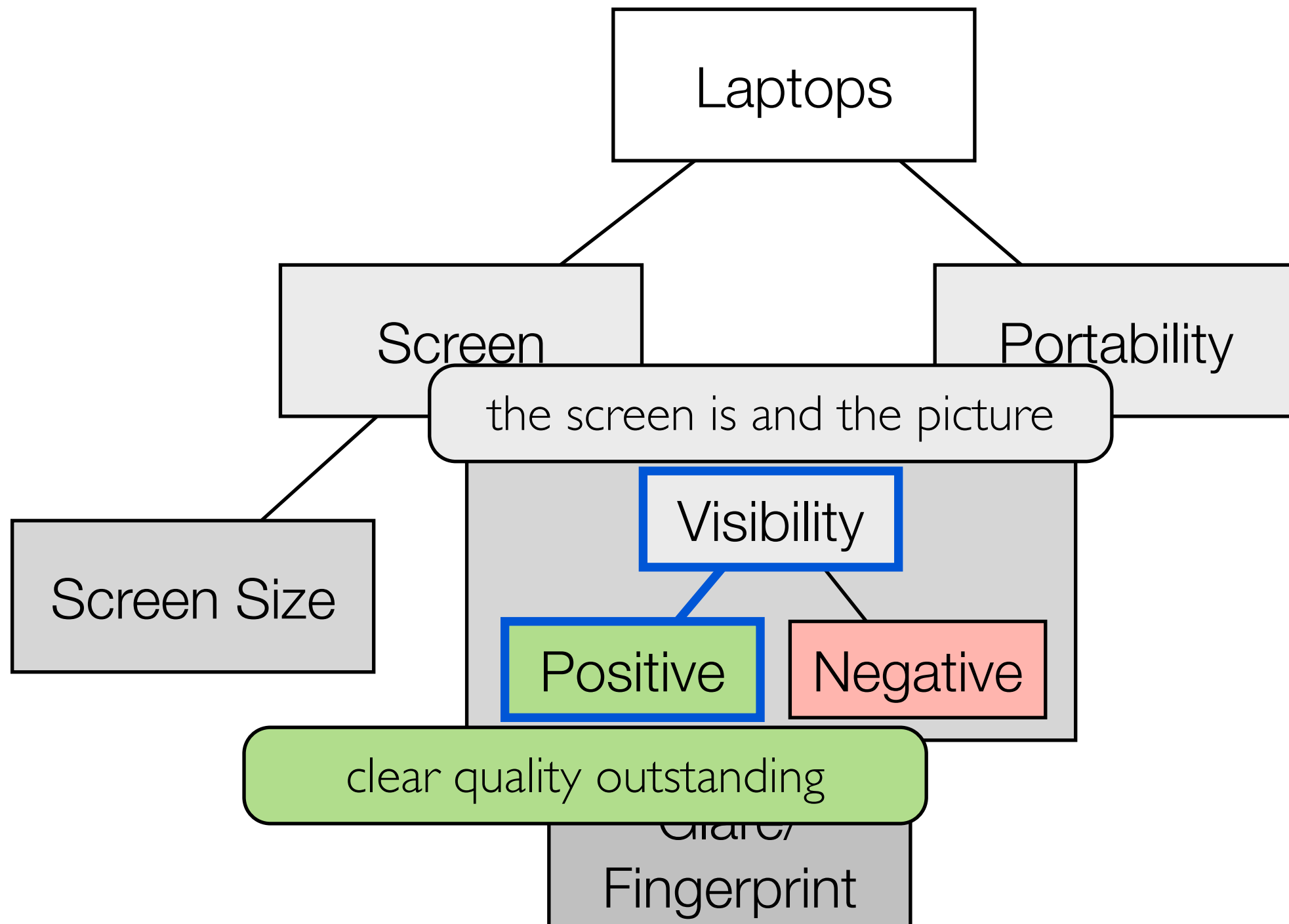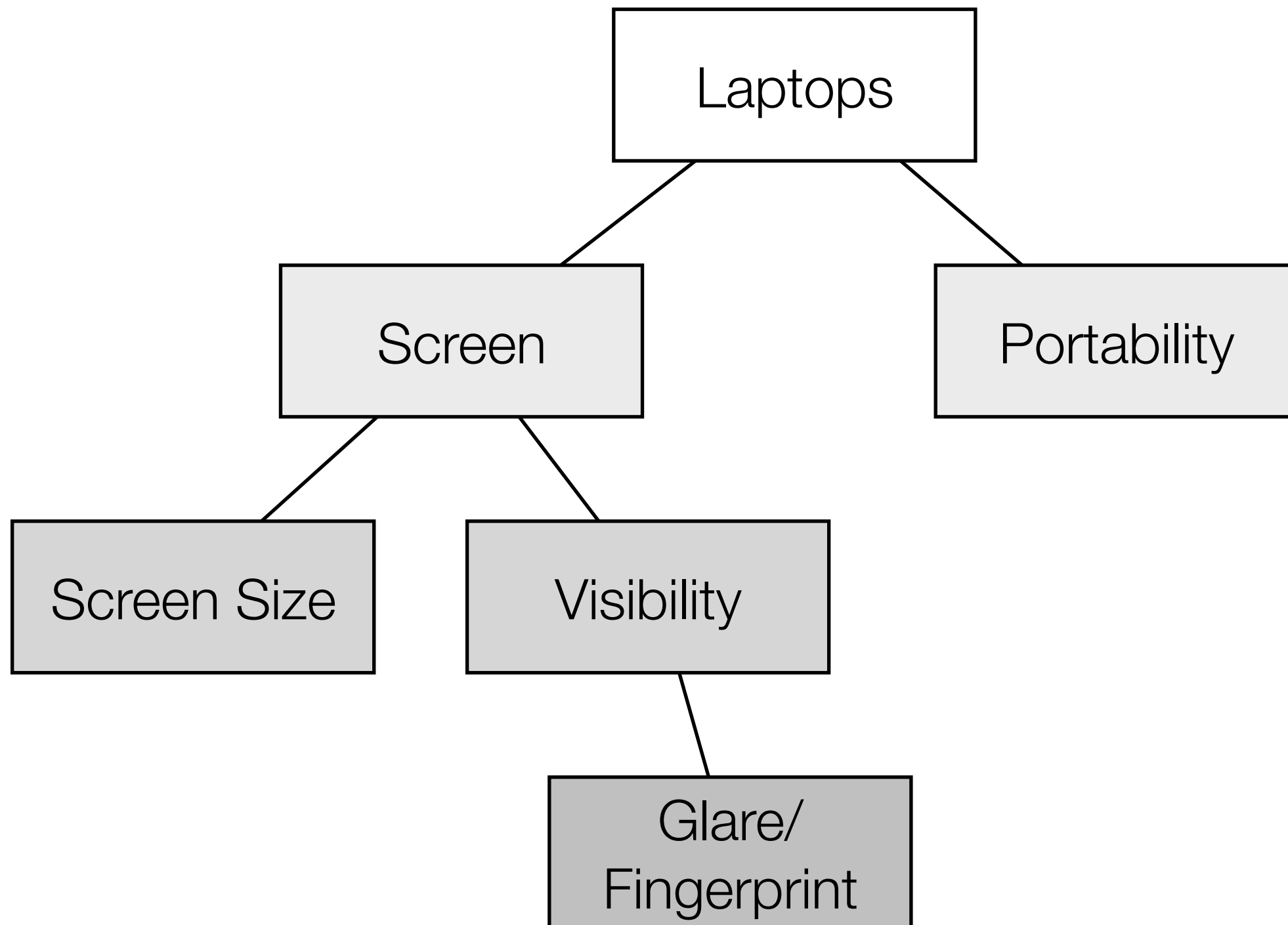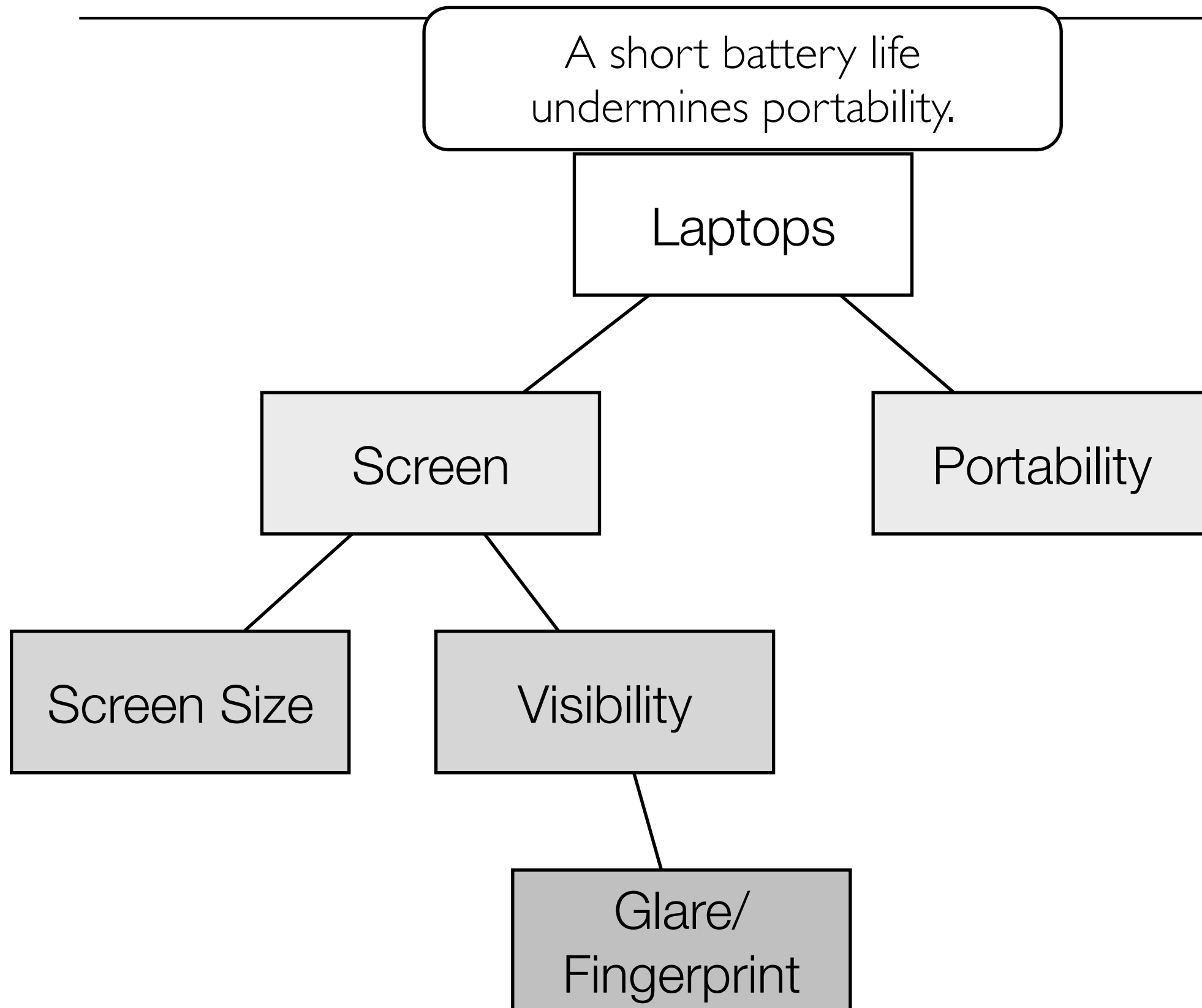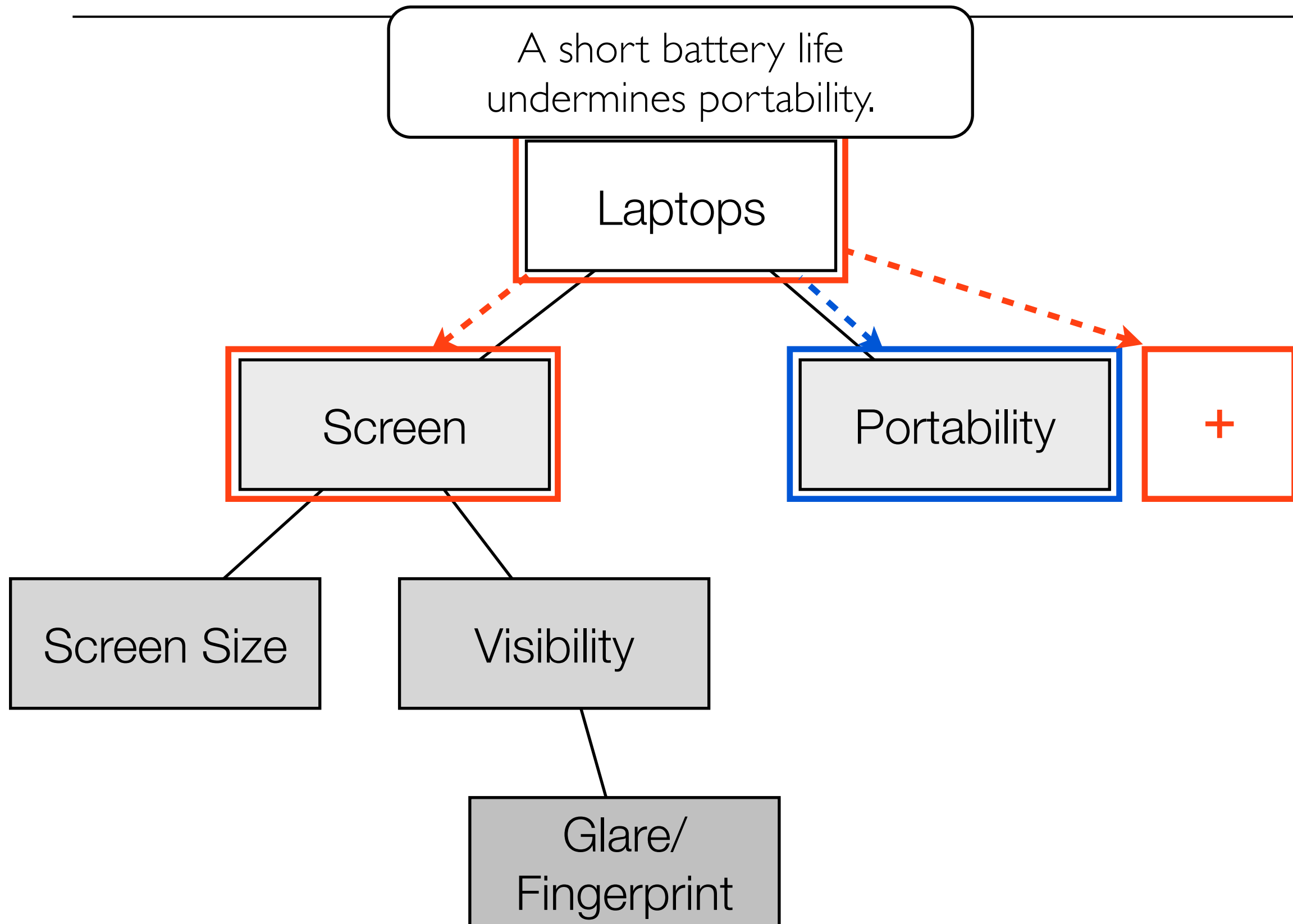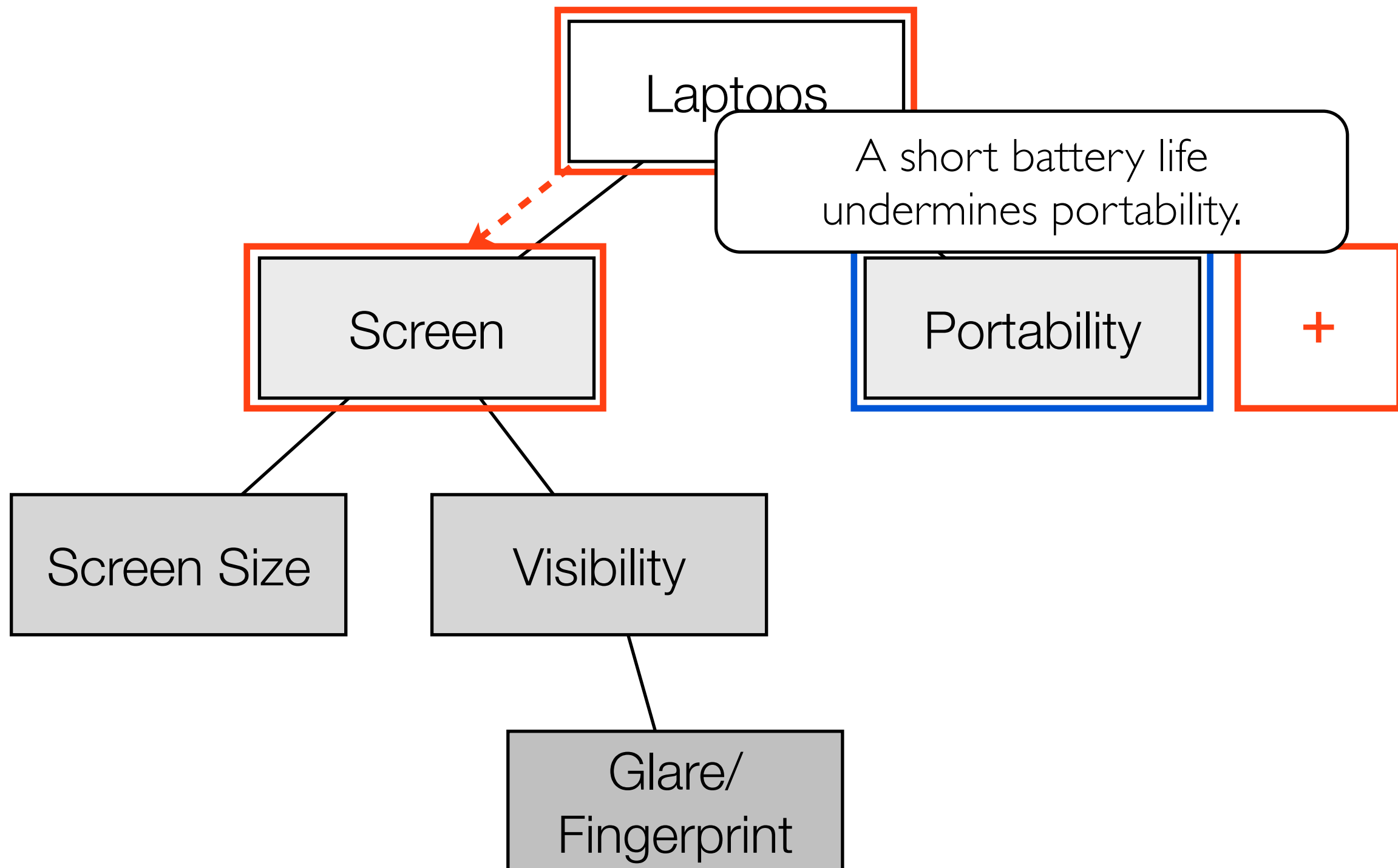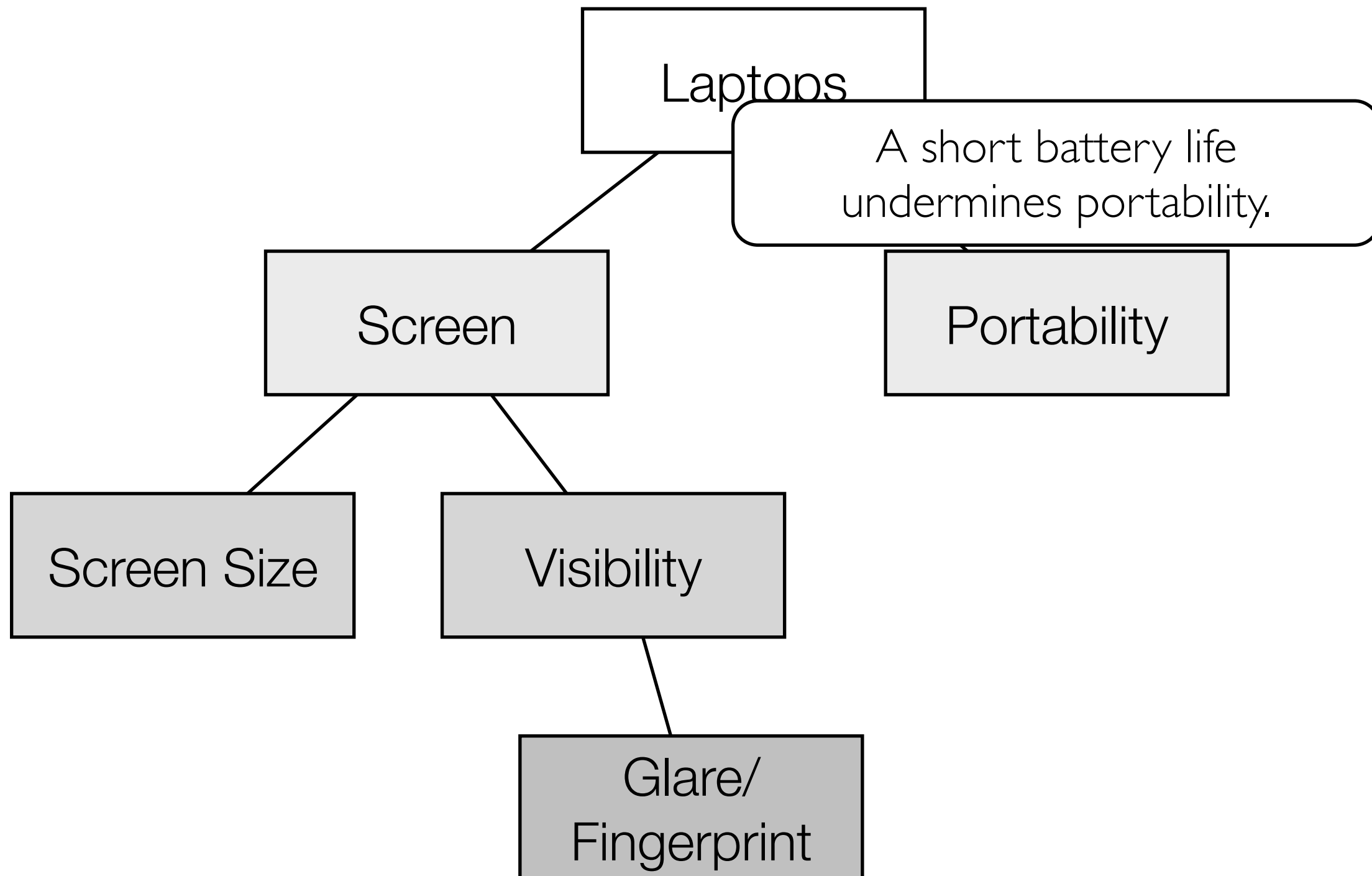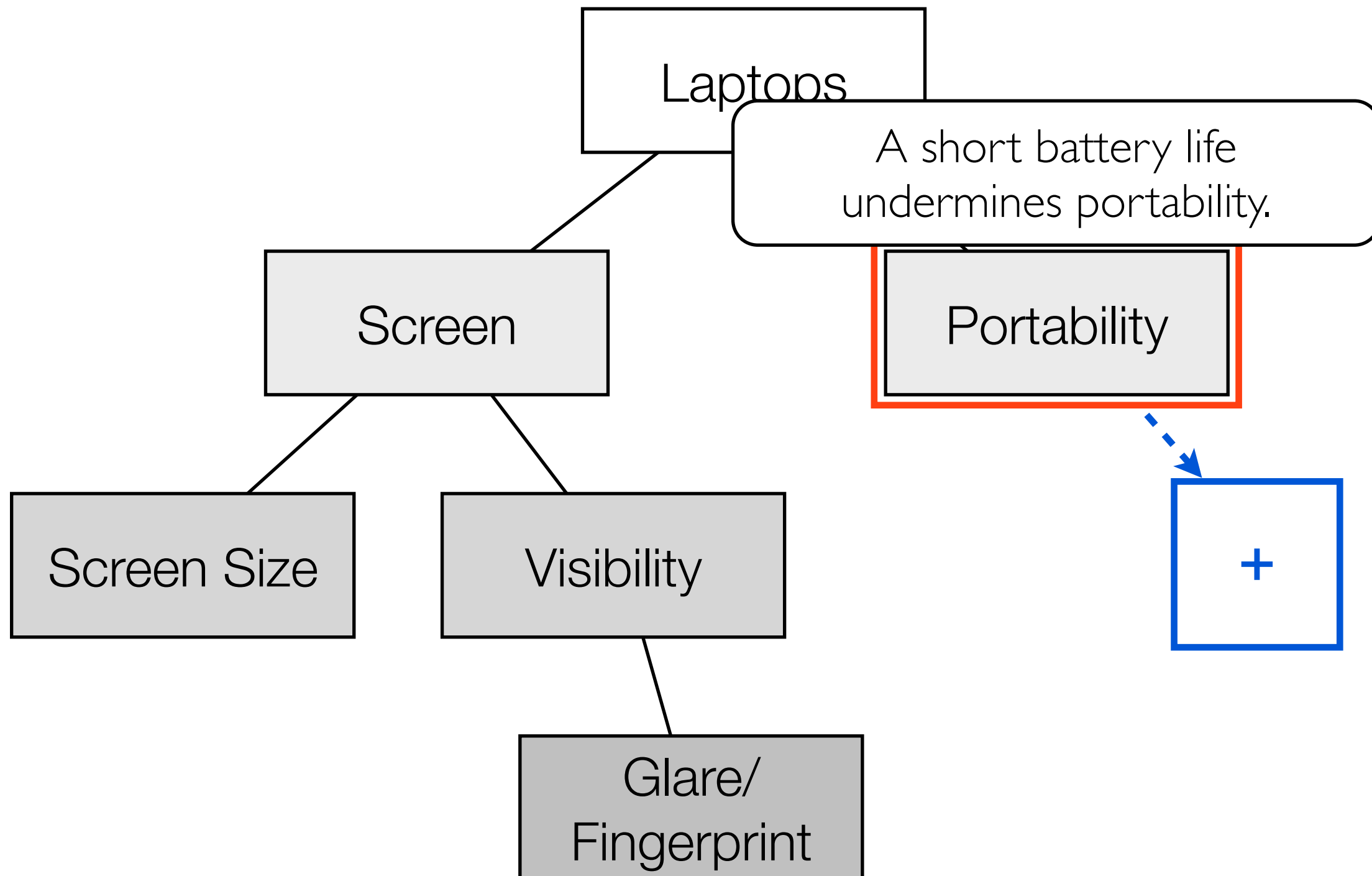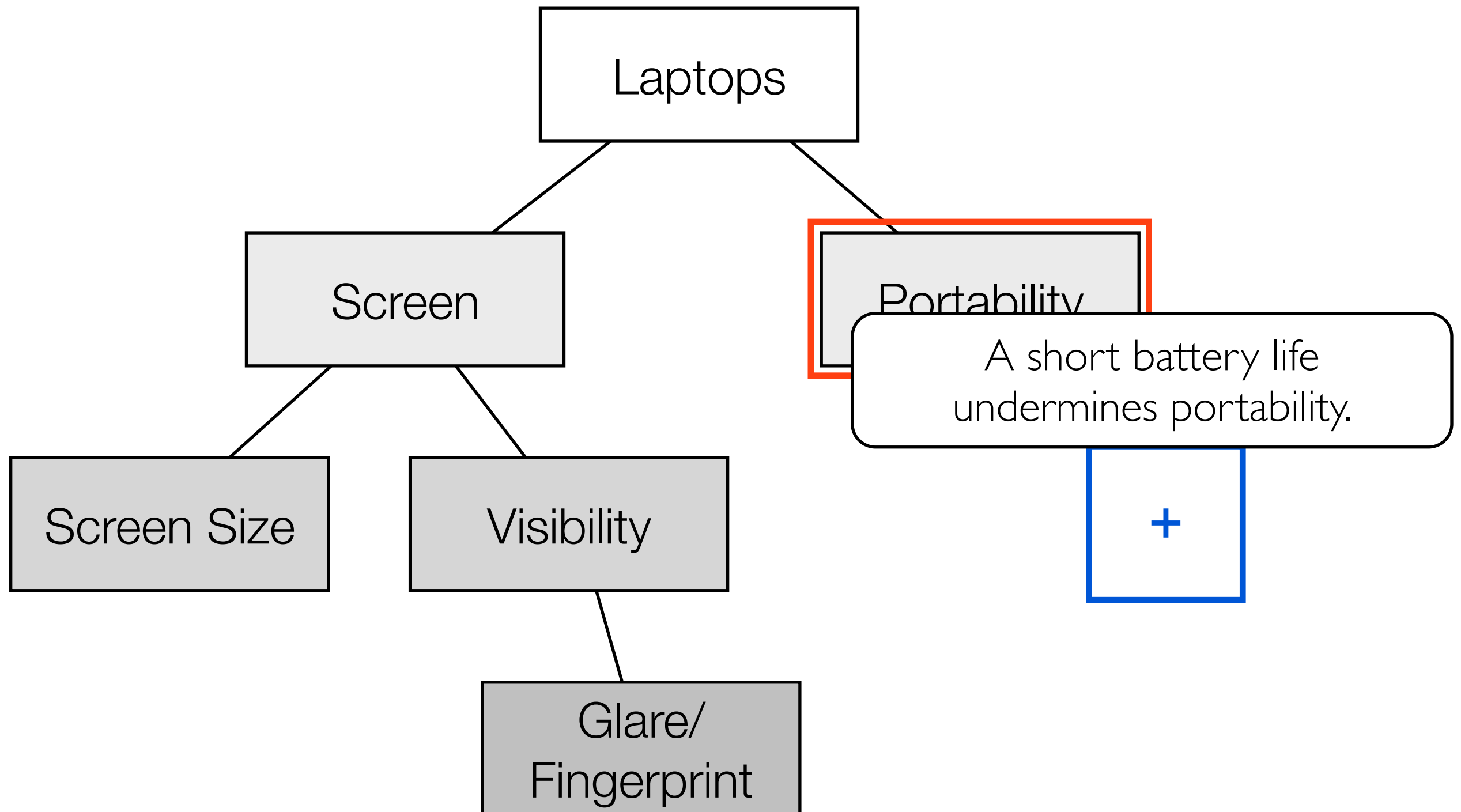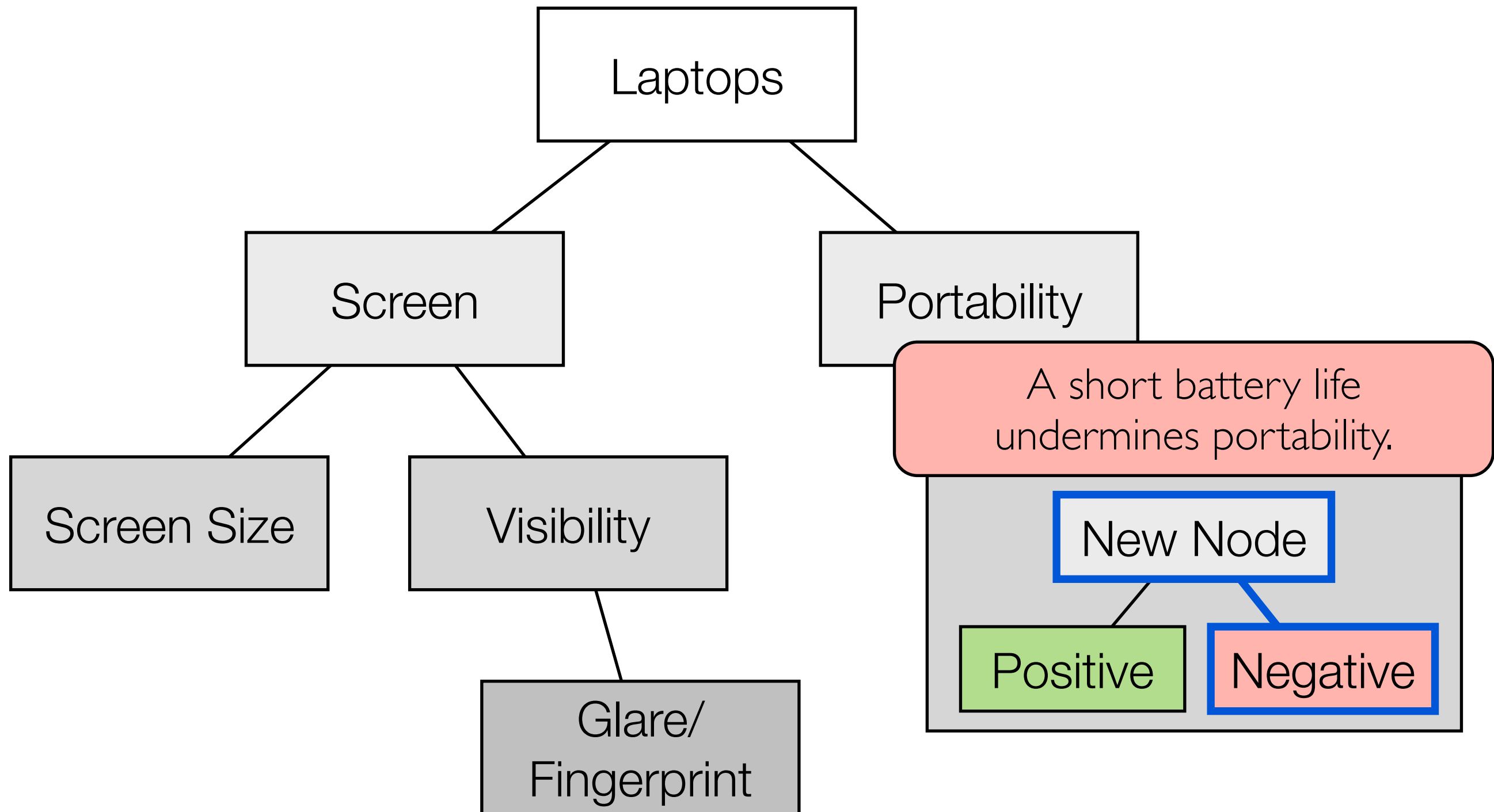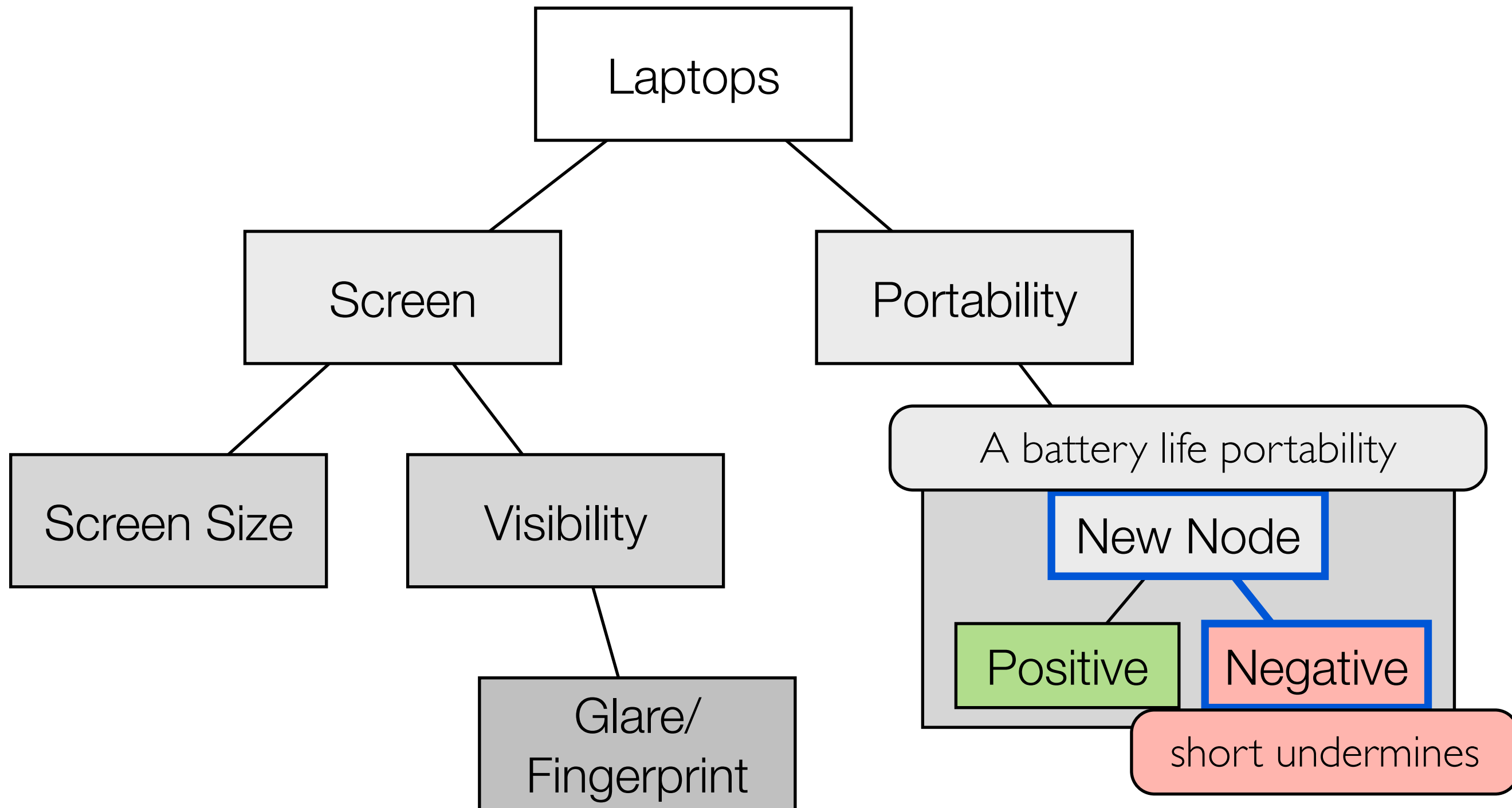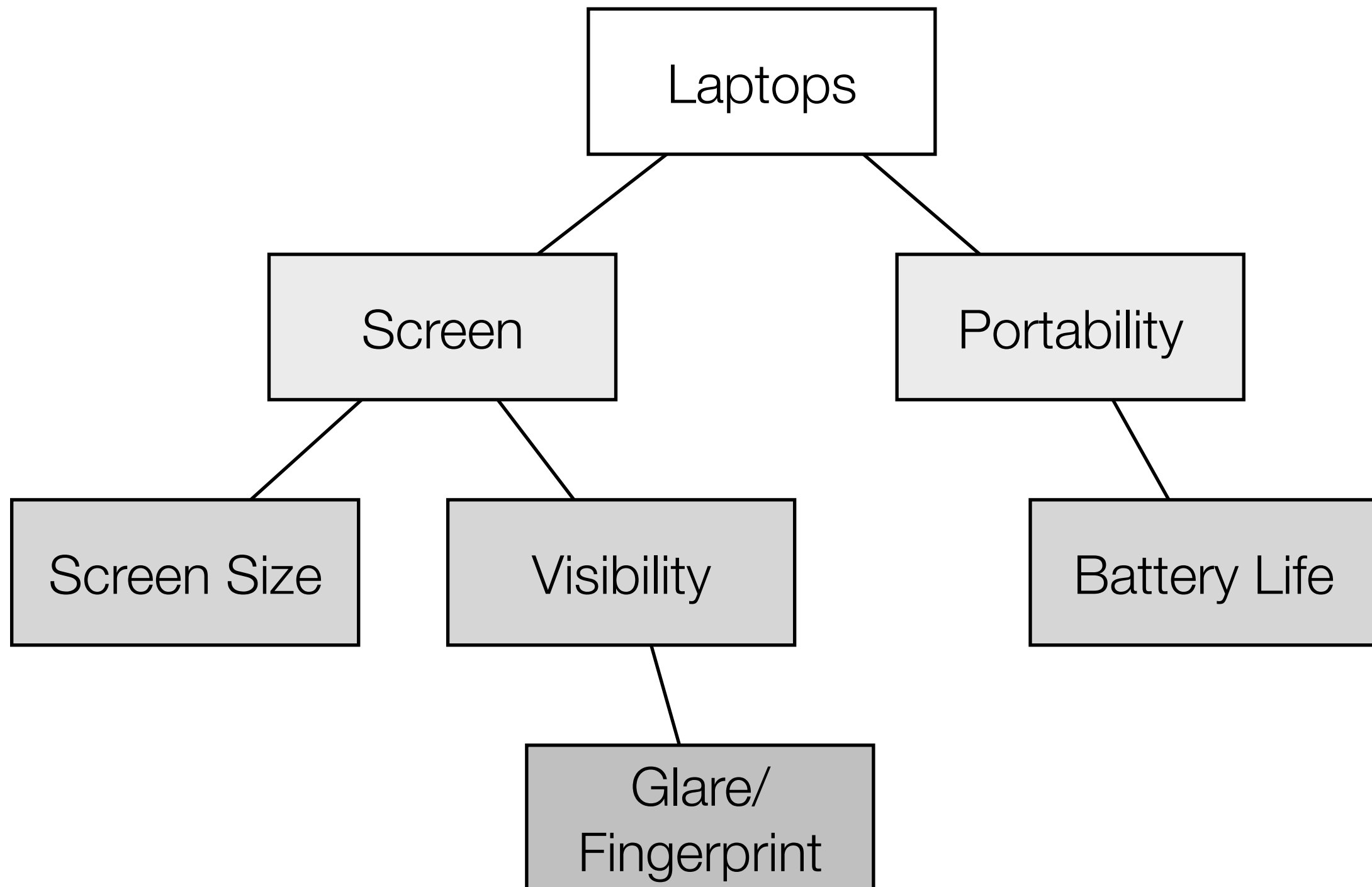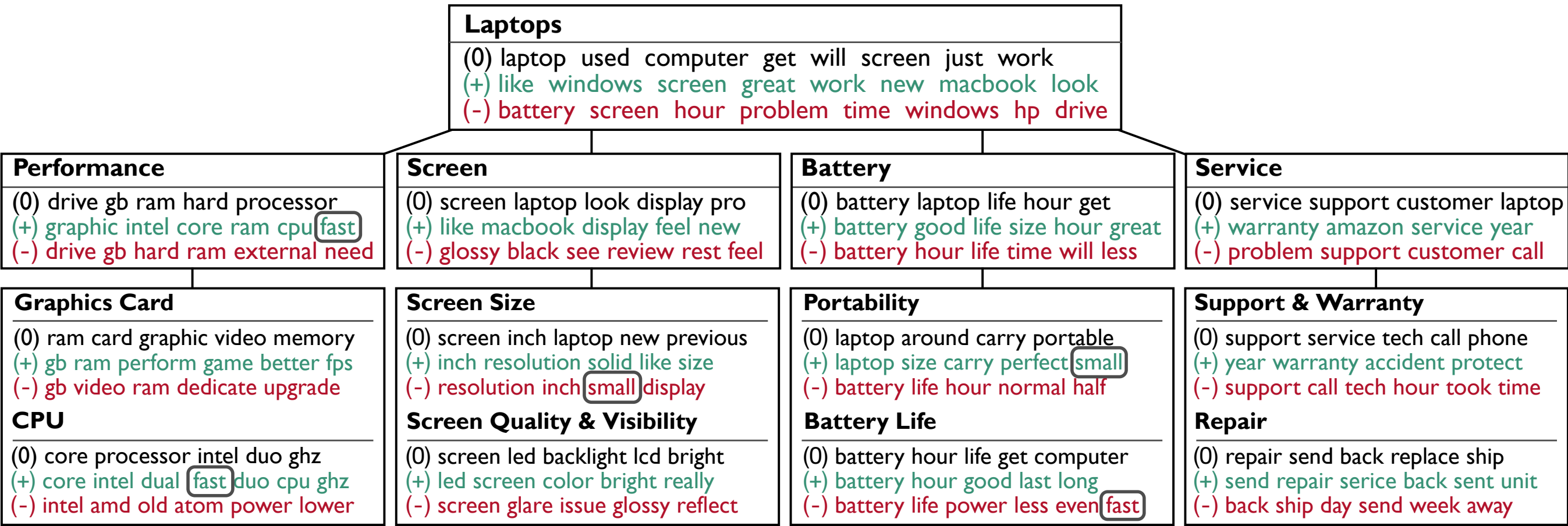(+) battery good life size hour great
(-) battery hour life time will less

Service

(0) service support customer laptop
(+) warranty amazon service year
(-) problem support customer call

Graphics Card

(0) ram card graphic video memory
(+) gb ram perform game better fps
(-) gb video ram dedicate upgrade

CPU

(0) core processor intel duo ghz
(+) core intel dual fast duo cpu ghz
(-) intel amd old atom power lower

Screen Size

(0) screen inch laptop new previous
(+) inch resolution solid like size
(-) resolution inch small display

Screen Quality & Visibility

(0) screen led backlight lcd bright
(+) led screen color bright really
(-) screen glare issue glossy reflect

Portability

(0) laptop around carry portable
(+) laptop size carry perfect small
(-) battery life hour normal half

Battery Life

(0) battery hour life get computer
(+) battery hour good last long
(-) battery life power less even fast

Support & Warranty

(0) support service tech call phone
(+) year warranty accident protect
(-) support call tech hour took time

Repair

(0) repair send back replace ship
(+) send repair serice back sent unit
(-) back ship day send week away

(a) LAPTOPS dataset

Digital SLRs

(0) camera used lens can canon picture get take digital
(+) lens picture great like can canon take good nikon
(-) lens can canon picture digit mm shoot just set

Image Quality

(0) camera image quality iso sensor
(+) quality like high better sensor
(-) picture quality size sensor raw

Lens

(0) lens mm camera kit zoom get
(+) lens mm kit good af zoom great
(-) mm camera kit buy ef purchase

Operation

(0) camera set mode can focus auto
(+) set camera mode lcd view
(-) camera set focus button mode

External Accessories

(0) camera card battery flash get
(+) battery card raw software grip
(-) card flash memory get battery

Image Sensor

(0) sensor camera shake dust feature
(+) dust sensor camera shake clean
(-) work camera stabilize notshake

Low-Light Ambience

(0) iso noise camera image low light
(+) quality image iso noise good high
(-) iso noise low light high image set

Lens Performance

(0) lens mm vr camera kit lens used
(+) lens kit mm good wide angle great
(-) lens mm af dx nikon nikkor ed

Lens Features

(0) lens camera can use old system
(+) lens stabilize body image range
(-) lens af focus old camera older

Menu Operation

(0) set mode camera can auto manual
(+) mode set manual auto control
(-) set mode manual menu change

Live View Finder

(0) lcd button screen camera view set
(+) lcd screen view live viewfind set
(-) button shutter can press change

Battery Grip

(0) battery camera grip hand around
(+) battery grip life hand comfort time
(-) hand carry grip battery small bag

Flash Memory

(0) card raw camera gb memory sd
(+) raw card image file software photo
(-) card memory gb sd cf flash speed

(b) DIGITAL SLRs dataset

17

Laptops

(0) laptop used computer get will screen just work
(+) like windows screen great work new macbook look
(-) battery screen hour problem time windows hp drive

...nce

...o ram hard processor
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Screen

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- Aspects become specific as depth increases
- Children of an aspect are close to their parent
- Word *fast*, *small*, *high* occur in both positive and negative topics

18

...uality   Lens   Operation

User Scenario

Part of Aspect-Sentiment Hierarchy for a SLR camera

Overall Evaluation

(+) highly recommend if you have a crop sensor camera
(+) This camera is best for stills if hand held
(−) It doesn't compare to a dedicated video camera

Picture Quality

(+) full-framed sensor camera continues to impress me
(+) as with 21 megapixels I can crop with no problem
(−) the photos always have lots of grainy red dots

Low light condition

(+) The image quality - even for high iso - is amazing
(+) helped me the most during the low light condition
(+) focus is better in low light for sure

LCD Screen

(+) the true VGA screen is a very welcome change
(+) good exposure on the rear LCD screen
(+) no need to adjust lcd brightness from time to time

Lens Related

(+) For high quality you need only new mark II lenses
(−) Canon please make us a wide angle lens with this
(−) disappointing for a lens that costs over $1K

I'm looking for a camera with…
- Good picture quality
  (esp. under low lights)
- Good LCD screen
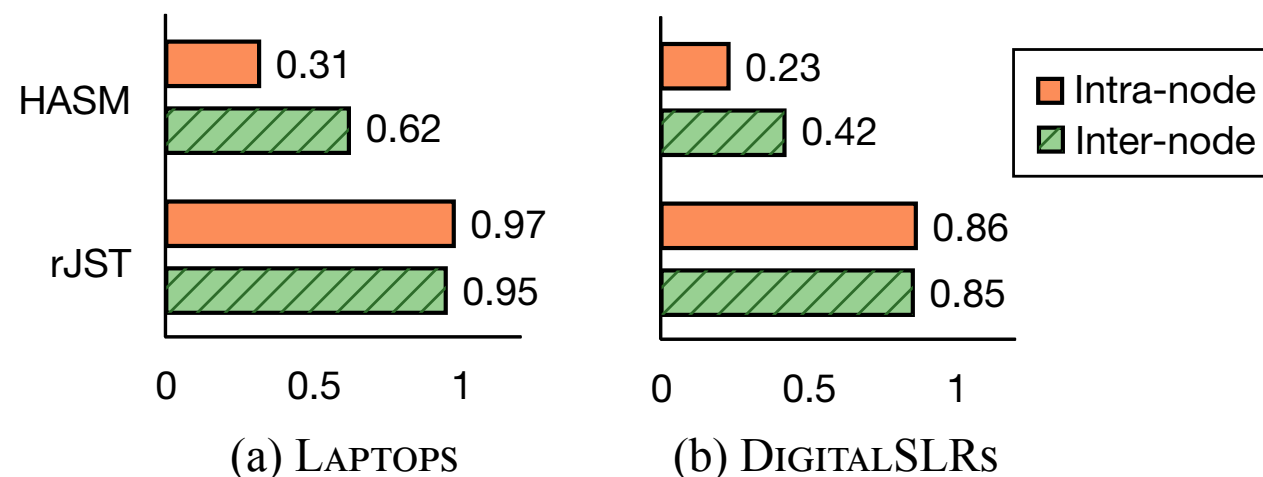- High-end lenses available

19

Evaluation

- No prior work that discovers a hierarchy of aspect-sentiment nodes

  - A comprehensive comparison is difficult

- Divide the evaluation into two parts:

  - Hierarchy analysis

  - Sentiment analysis

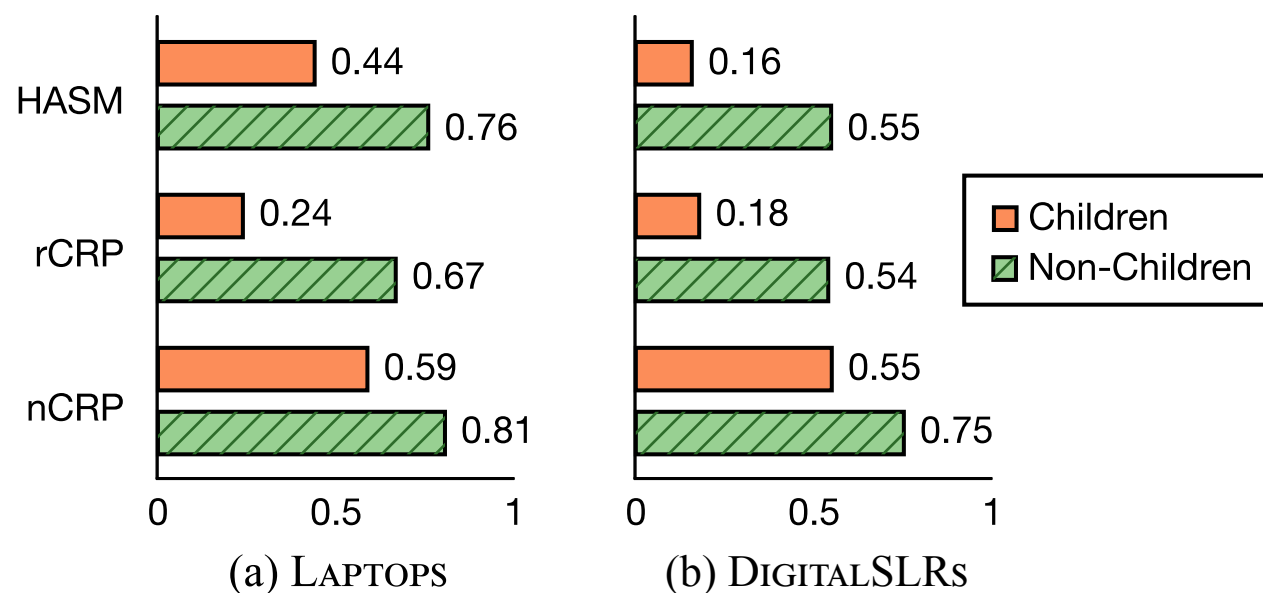# Evaluation: Hierarchy Analysis
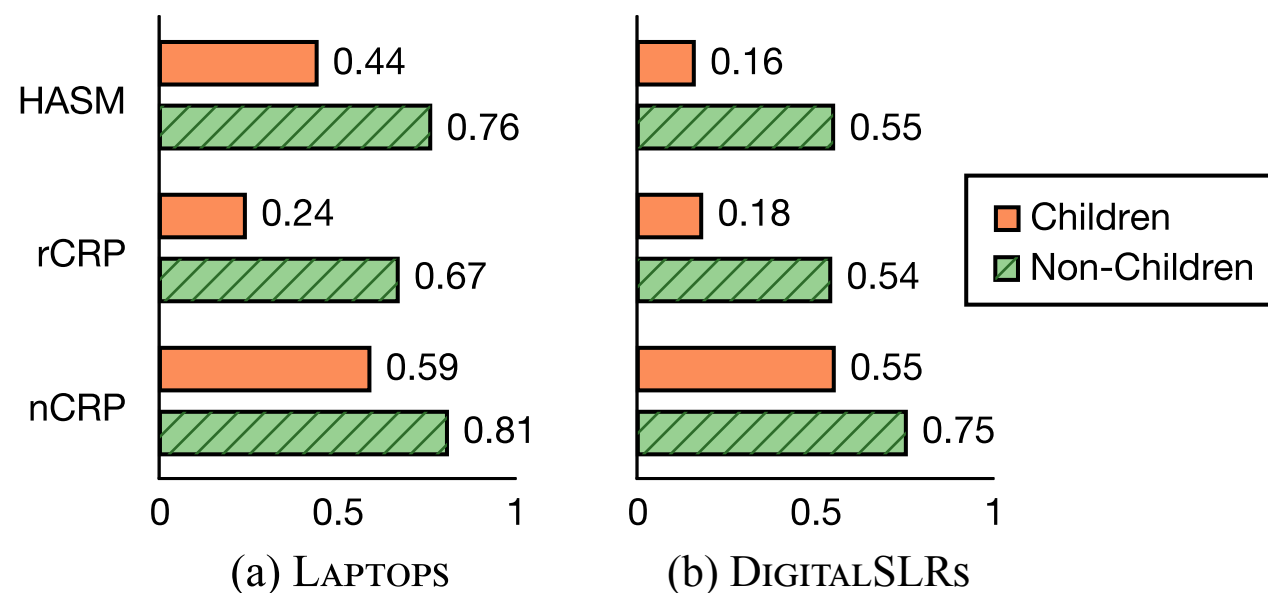
Hierarchical Affinity

(a) LAPTOPS

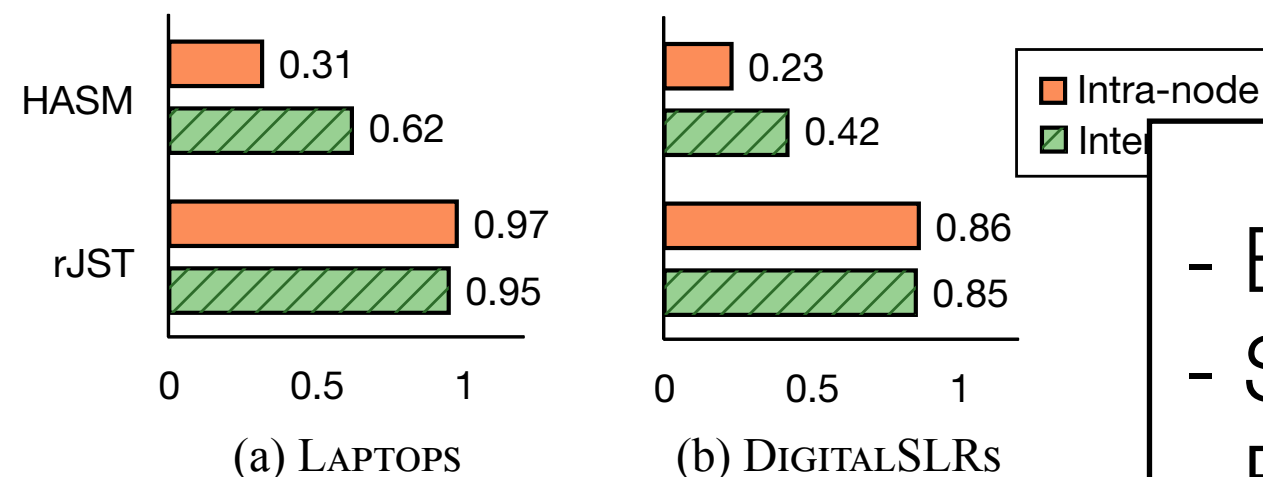(b) DIGITALSLRs

Aspect-Sentiment Consistency

(a) LAPTOPS

(b) DIGITALSLRs

- Measures the quality of hierarchy

- Hierarchical Affinity "My parent should be more similar to me than my parent and nephew"

- Aspect-Sentiment Consistency "Sentiments in an aspect-sentiment node should be themselves more similar than other topics"

21

Evaluation: Hierarchy Analysis

Hierarchical Affinity

(a) LAPTOPS

(b) DIGITALSLRs

Legend: Children, Non-Children

Aspect-Sentiment Consistency

(a) LAPTOPS

(b) DIGITALSLRs

Legend: Intra-node, Inter-node

- Measures the quality of hierarchy

- Hierarchical Affinity "My parent should be more similar to me than my parent and nephew"

- Aspect-Sentiment Consistency

- Better HA than nCRP (Blei 2003)
- Similar HA to rCRP (Kim 2012)
- Better ASC than rJST (Lin 2012)

Evaluation: Classification Accuracy
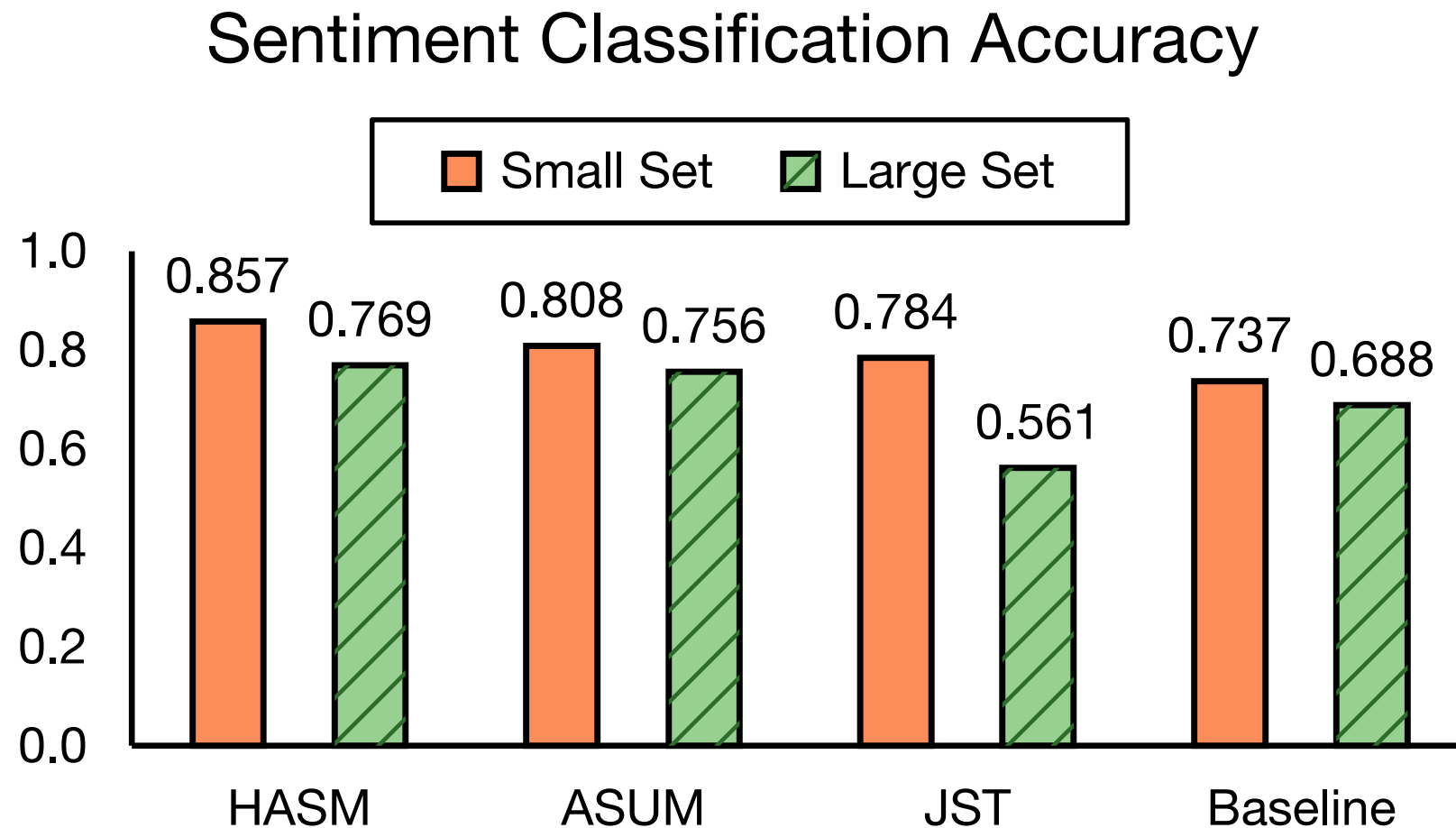
Sentiment Classification Accuracy

- Sentiment classification using short (<100) reviews

- Small set contains positive reviews of 5 stars, negative reviews of 1 star

- Large set contains positive reviews of 4~5 stars, negative reviews of 1~2 stars

22

Evaluation: Classification Accuracy

Sentiment Classification Accuracy

- Sentiment classification using short (<100) reviews

- Small set co~~ntains positive reviews of 5-star reviews~~
  reviews of 1
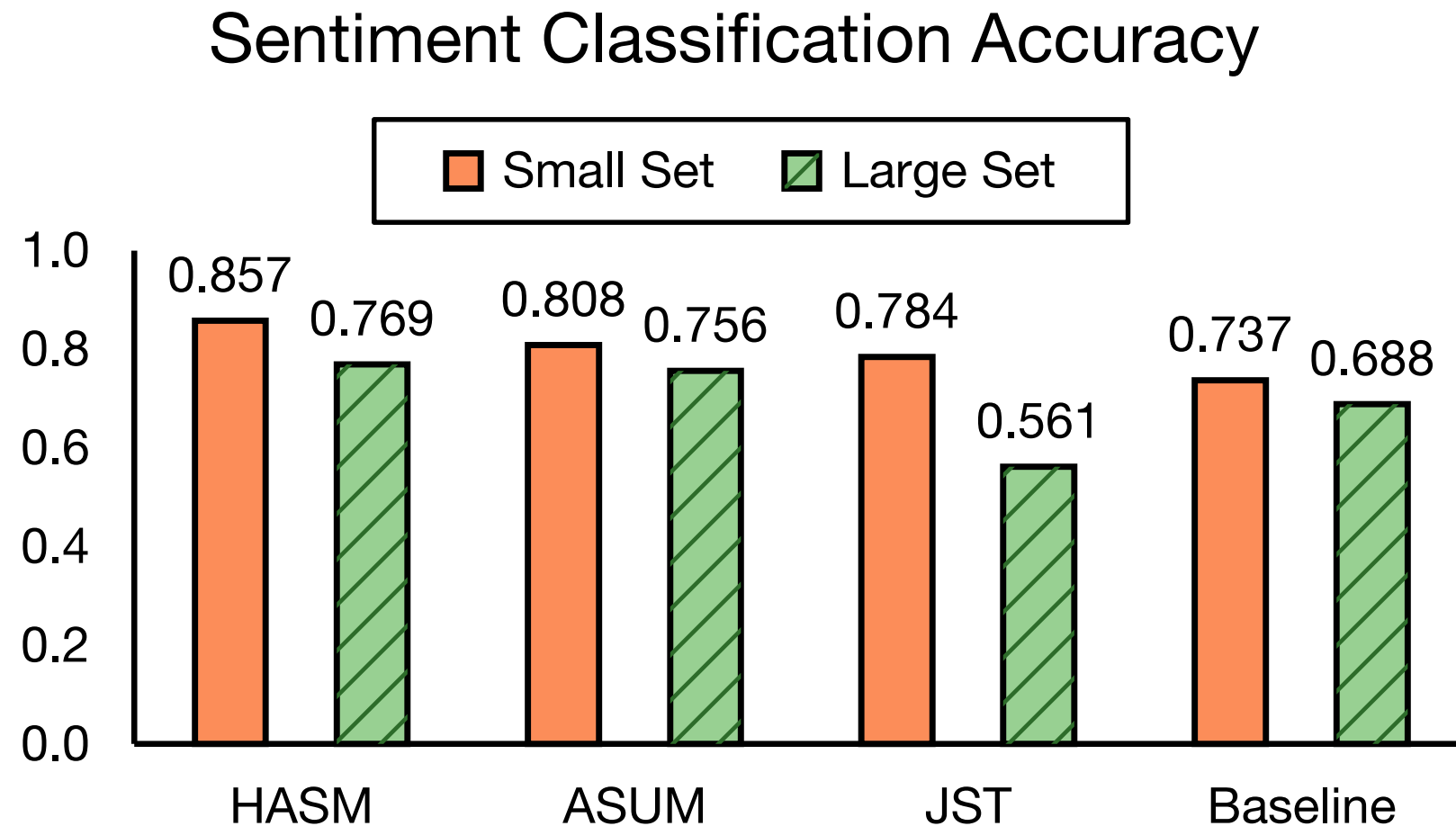
- Large set co~~ntains~~
  reviews of 1

Classification Accuracy is comparable to other three models for both datasets

Conclusion

- The first model to discover hierarchical structure of aspect and aspect-dependent sentiments

- Bayesian nonparametric prior allows high flexibility

- Both hierarchical quality and sentiment classification accuracy are comparable to other models

- Framework can be further extended

Email me:
suin.kim@kaist.ac.kr

See you at the poster session!
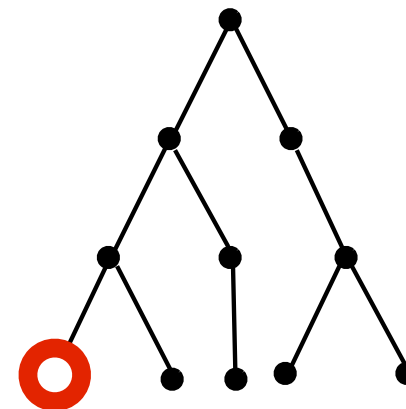
Questions?

HASM: Model

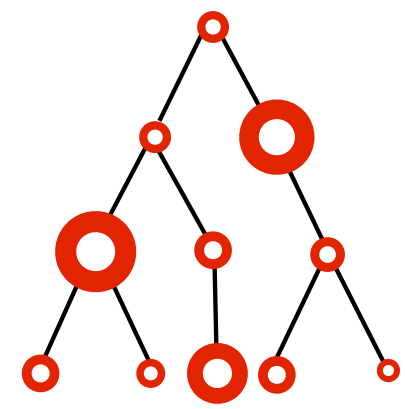- A Bayesian probabilistic model

- Recursive CRP (rCRP) prior
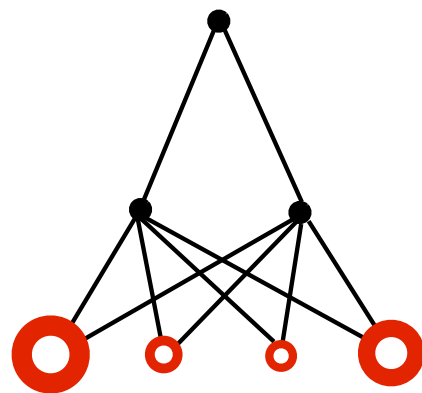
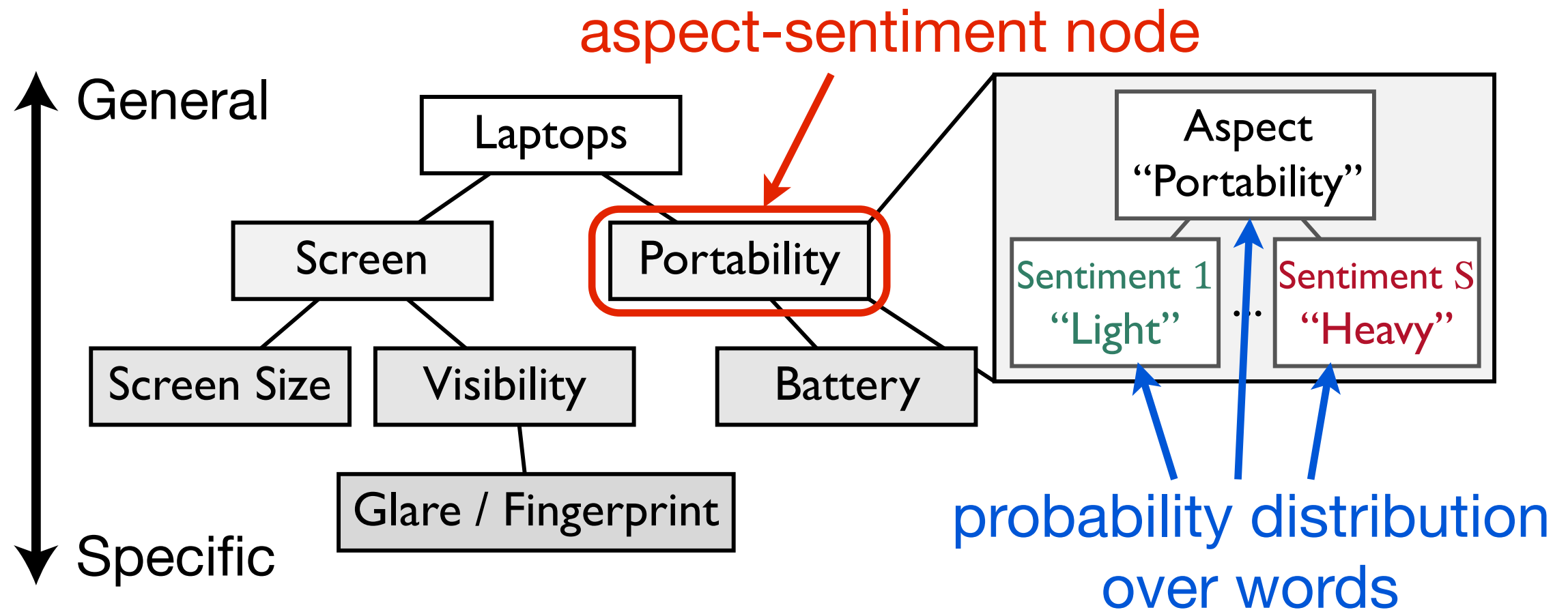Pachinko Allocation   nCRP   TS-SB   rCRP
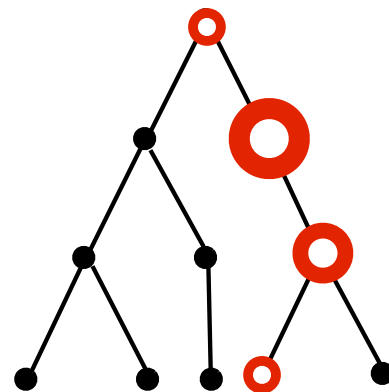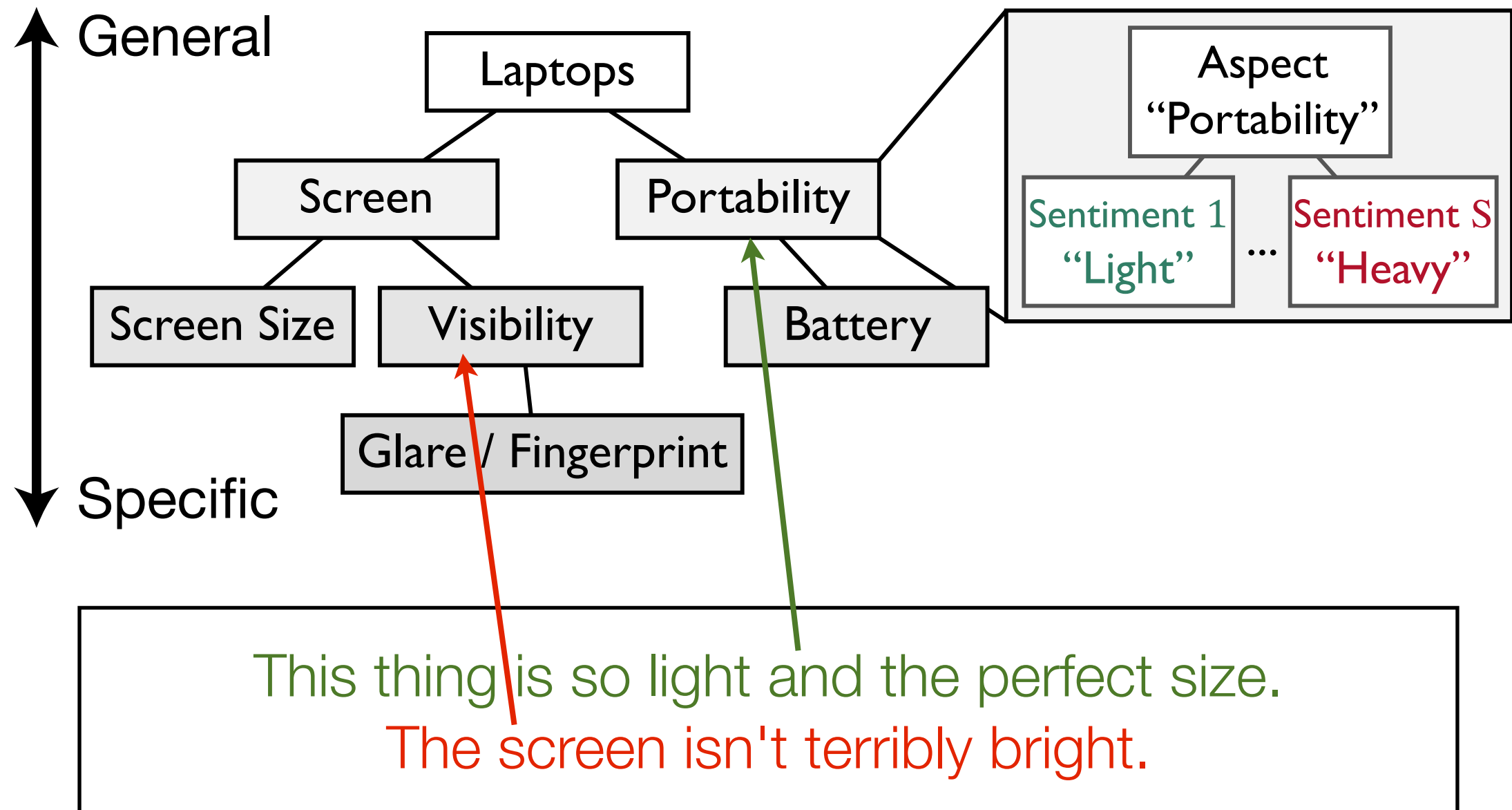
A review can have multiple aspects and sentiments

Nonparametric prior allows flexible tree
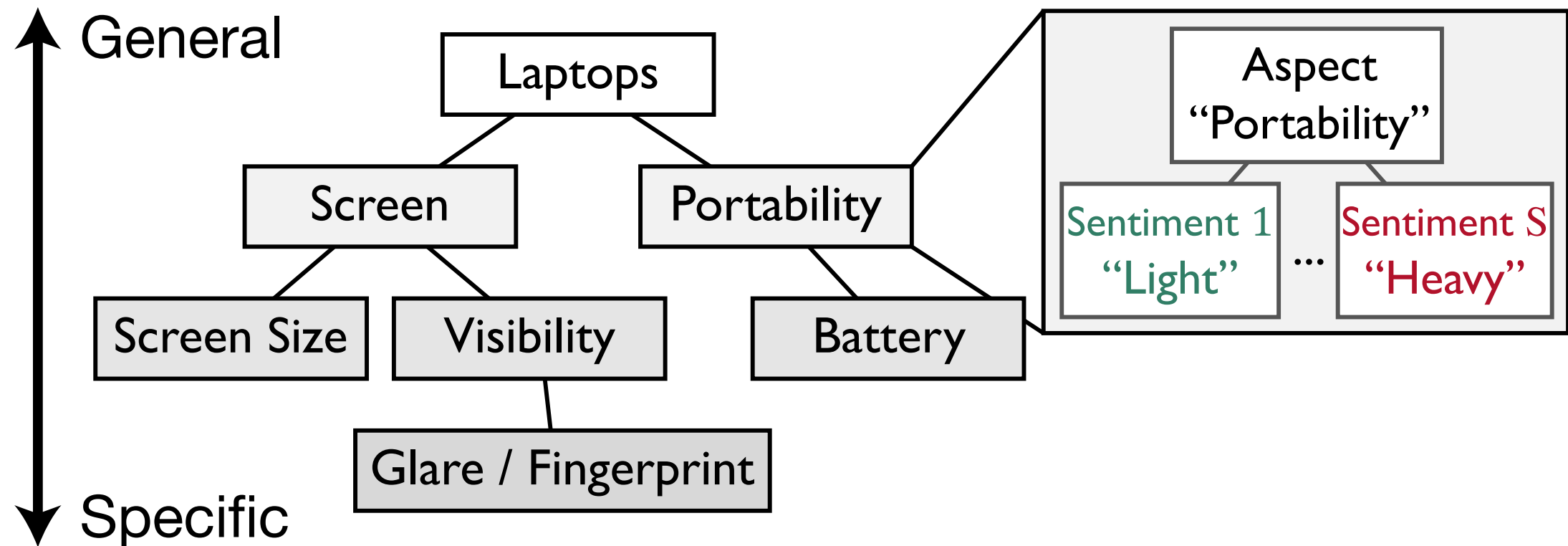 - unbounded width, unbounded depth

25

Model Assumption

- Each aspect-sentiment node consists of sentiment-polar topics

- Each aspect and sentiment is a probability distribution over words

26

Model Assumption

- Each sentence in a review is generated from a single aspect and sentiment

Model Assumption

- Each word in a sentence is either neutral or subjective

A short battery life undermines portability.
The screen is crisp and outstanding.