Understanding Client Needs as Input to Conceptual Design

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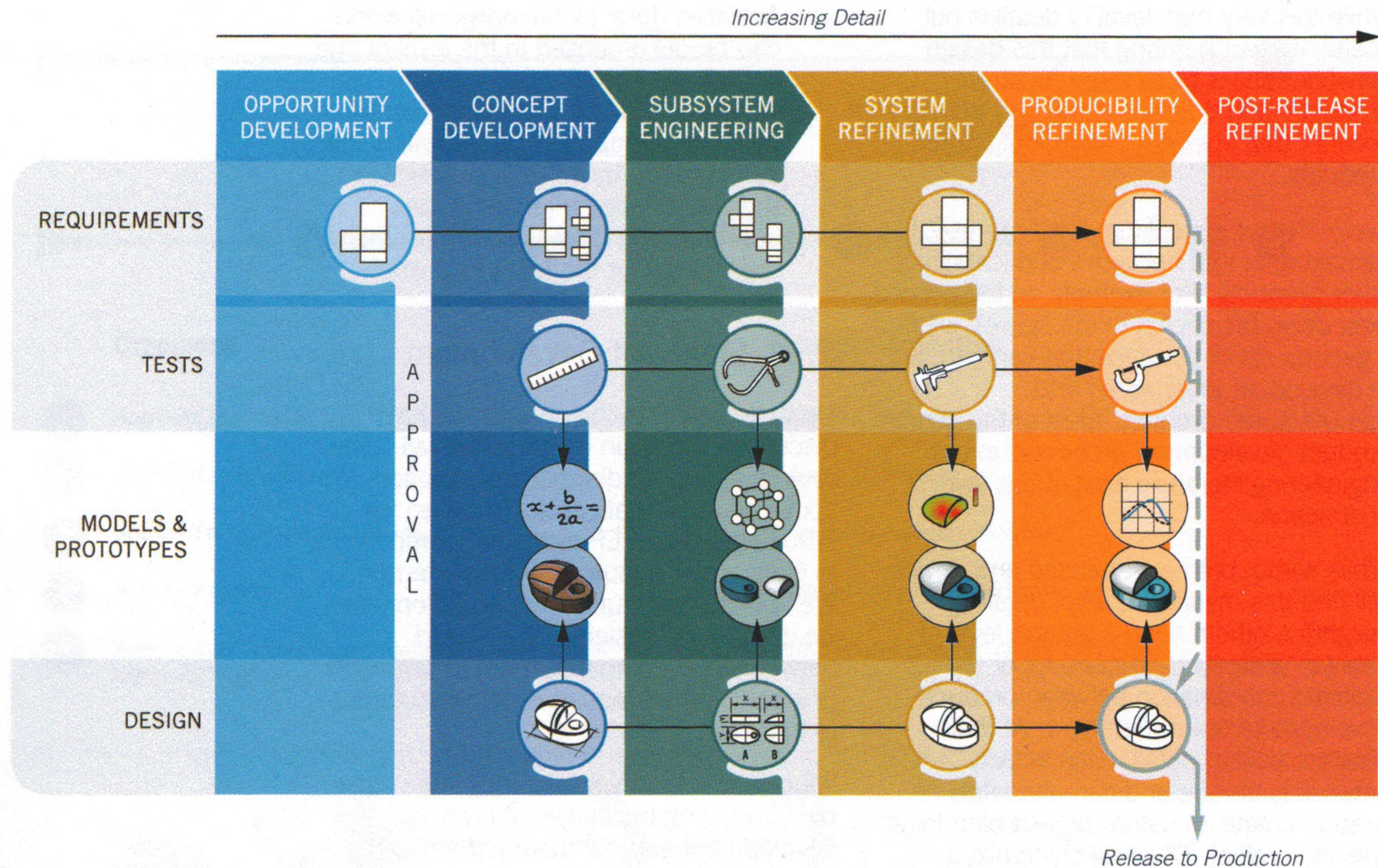
Phase Gate Design Process

Figure 2.10: The requirements, tests, and design all evolve through the stages of product development; the design is eventually released to the production system for manufacturing. Prototypes and models are instantaneous representations of the design that are used in tests to determine predicted and measured performance that can be compared to the requirements.

Goals of these slides

Describe client requirements

- What are they?

- How to obtain them?

- How to organize and assign importance to them?

Next lecture: Describe performance metrics

- How do they relate to client requirements?

- How are performance metrics refined during design?

Note: This reviews ideas from ME 491

Terminology

Equivalent terms:
  Market requirements
  Customer requirements
  Customer needs
  Client needs

Equivalent terms:
  Performance measures
  Performance specifications
  Engineering requirements

Opportunity development phase requires
1. Identifying market requirements
2. Determining appropriate performance measures
3. Mapping market requirements to performance measures

In the textbook, Mattson and Sorensen use the terms "Market requirements" and "Performance measures".

Read

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International Encyclopedia of Marketing

➡ See link on web page for Lecture 1

"The VOC is a product-development technique that produces a detailed set of customer wants and needs, which are organized into a hierarchical structure, and then prioritized in terms of relative importance and satisfaction with current alternatives."

Four aspects of the VOC

1. Customer needs

2. A hierarchical structure

3. Priorities

4. Customer perceptions of performance

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International
Encyclopedia of Marketing

VOC should persist throughout the design process

- Gather VOC input at opportunity development
- Prototype evaluation during conceptual design
- Final product testing

1. A customer need ...

Describes, *in the customers own words*, the "benefit to be fulfilled by the product or service"

A customer need **is not a solution**

Example:

- A better way to maintain my lawn.

Not:

- A new lawn mower.

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International Encyclopedia of Marketing

"If a product-development team focuses too early on solutions, they might miss creative opportunities"

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International Encyclopedia of Marketing

Methods of gathering customer input

Interviews – basic ideas

- Develop questions in advance
  - ‣ Start with broad questions, then get more specific
- Different questions for different types of customers
  - ‣ End users
  - ‣ Managers approving purchases
  - ‣ Executives managing product within business portfolio
- Ask all participants the same questions
- Allow conversation to go beyond script if it is productive to do so

See Ideo Design Kit, http://www.designkit.org/methods, for an overview of Human-centered design. Follow links on interviewing for lots of good advice

Methods of gathering customer input

Interviews – techniques

- Limit number of interviewers to 2 or 3
- Observe body language and other non-verbal cues
  - Words are just one source of data
- Be empathic and non-judgmental
  - View the problem from interviewees perspective
  - Keep eye contact, smile, nod in agreement. Be authentic
- Consider alternative conversation aids
  - Card sort technique: images and ideas related to the problem
  - Prototypes of existing (competing) products
- Don't sell any solutions
  - "What do you like (or dislike) about …?" "What is helpful…?"

See Ideo Design Kit, http://www.designkit.org/methods, for an overview of Human-centered design. Follow links on interviewing for lots of good advice

Methods of gathering customer input

Surveys are simple in concept, complex to execute

- Validity
  - ‣ Do questions accurately expose underlying concepts?
  - ‣ Are conclusions supported by data?
- Reliability
  - ‣ Internal consistency: Use multiple questions to examine one concept
  - ‣ What causes variability in responses?
- Sample size is important: Is large N practical?
- Statistical tools for survey analysis is very different that statistical analysis of physical measurements

Free advice: Surveys may be a good starting point, but may not be practical as a source of conclusive data given short time available to teams

Methods of gathering customer input

Focus Groups

- More complex than interviews
    - ‣ Best done by people with training
    - ‣ One moderator, multiple observers
- Can be used to evaluate ideas
    - ‣ Learn what people like/dislike about current situation
    - ‣ Get responses to your design concepts
- Can be costly in time, prep and execution

Free advice: May not be useful for most Capstone teams

2. Hierarchical structure

- Gaskin et al.:

  - ▸ "Discussions with customers usual identify 75–150 phrases that might be considered an articulation of customer needs"

- Large lists of customer needs come from market research: interviews, surveys and focus groups.

- Capstone teams are unlikely to have such long lists of customer needs, however….

- Organizing needs in a hierarchy is still important.

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International Encyclopedia of Marketing

Organize customer needs as primary or secondary

Primary needs

- Strategic
- 2 to 10 overarching concerns that drive product decisions

Secondary needs

- 3 to 10 secondary needs are grouped under a primary need
- Tactical, as opposed to strategic
- Specific expressions of primary needs

See example of features for a movie theater in the paper by Gaskin et al.

NOTE: Secondary does not necessarily mean "less important"

Example: A weather station for remote monitoring

Primary need	Secondary needs
Economical	I can afford it I can fix it myself I can choose the features
Reliable	It doesn't rust It runs in a Minnesota winter Birds won't hurt it Lightning won't hurt it

Sorting/Organizing Primary and Secondary needs

1. Collect statements of needs directly from the customer

2. Simplify language, but keep in VOC

3. Use positive statements

   ➡ "doesn't rust" becomes "resists corrosion"

4. Avoid absolutes like "must" and "should"

   ➡ "provides choice of sensors" instead of "must have …"

5. Group related statements of need

See "Product-focused requirement statements" and "Requirements Hierarchy" in part 2 of Mattson and Sorenson Textbook

Example: A weather station for remote monitoring

Primary need	Secondary needs
Economical	I can afford it I can fix it myself I can choose the features
Reliable	Resists corrosion Works in extreme temperatures Protected from animals Protected from Lightning

3. Prioritize

Assign an importance level to each primary need

Mattson and Sorenson recommend using geometric progression like 1, 3, 9 as values

Best: Let the customer assign importance

Lacking access to a marketing department and large numbers of customers, the team will have to assign importance based on interactions with the customer

Voice of the Customer, S. P. Gaskin et al., 2010, Wiley International Encyclopedia of Marketing

Example: A weather station for remote monitoring

For a hobby farm:

Impor-tance	Primary need	Secondary needs
9	**Economical**	I can afford it I can fix it myself I can choose the features
3	**Reliable**	Resists corrosion Works in extreme temperatures Protected from animals Protected from lightning

For a rural airport:

Impor-tance	Primary need	Secondary needs
3	**Economical**	I can afford it I can fix it myself I can choose the features
9	**Reliable**	Resists corrosion Works in extreme temperatures Protected from animals Protected from lightning

Tangent: Kano's Model

Dr. Noriaki Kano developed a model of Customer Satisfaction

Three types of features

- Basic features

- Performance features

- Excitement features

For our purposes: we want to understand the customer view of design outcomes.

See e.g., https://en.wikipedia.org/wiki/Kano_model
Ullman, The Mechanical Design Process, 5th ed., McGraw-Hill 2016
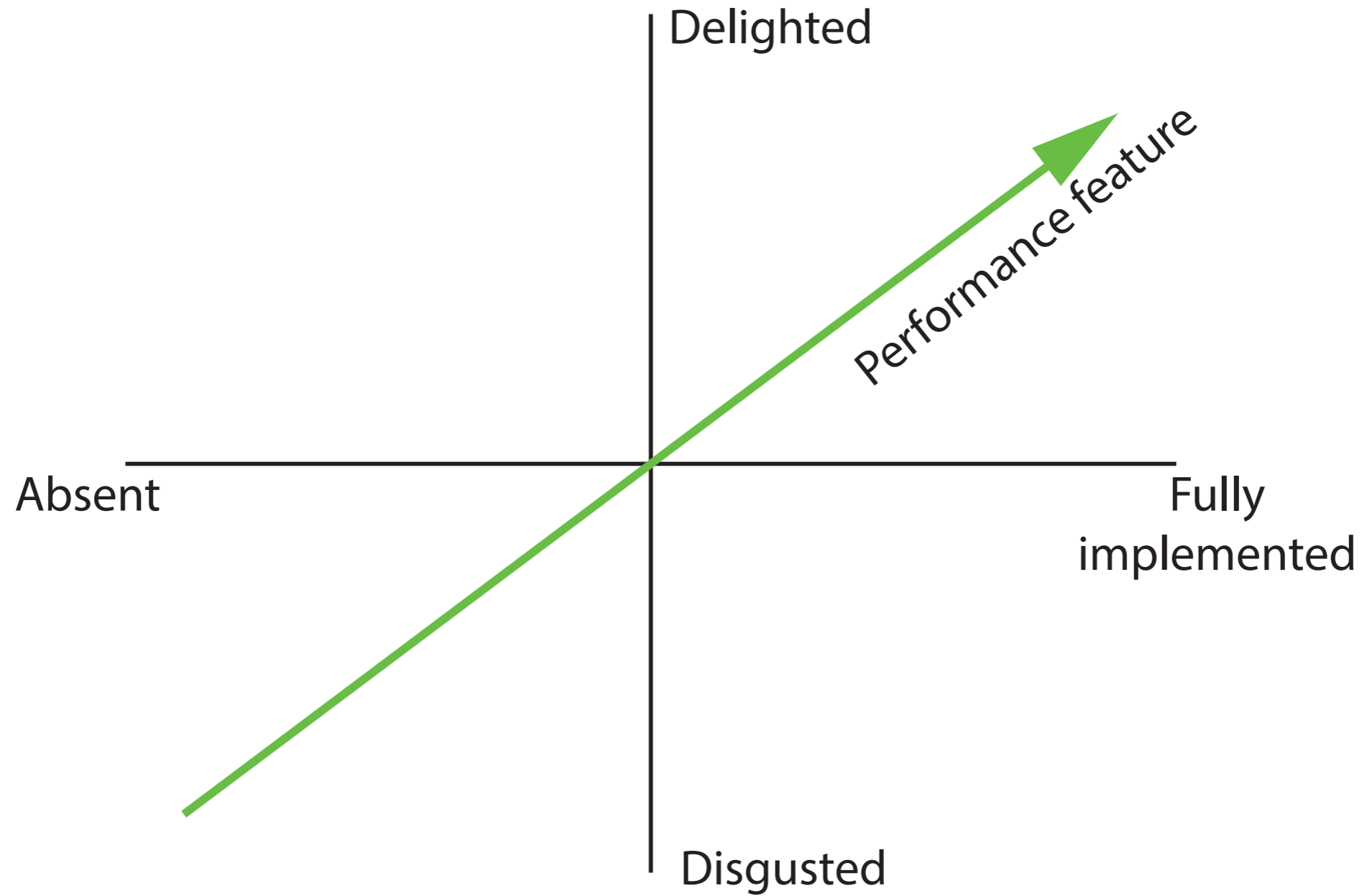
Kano model
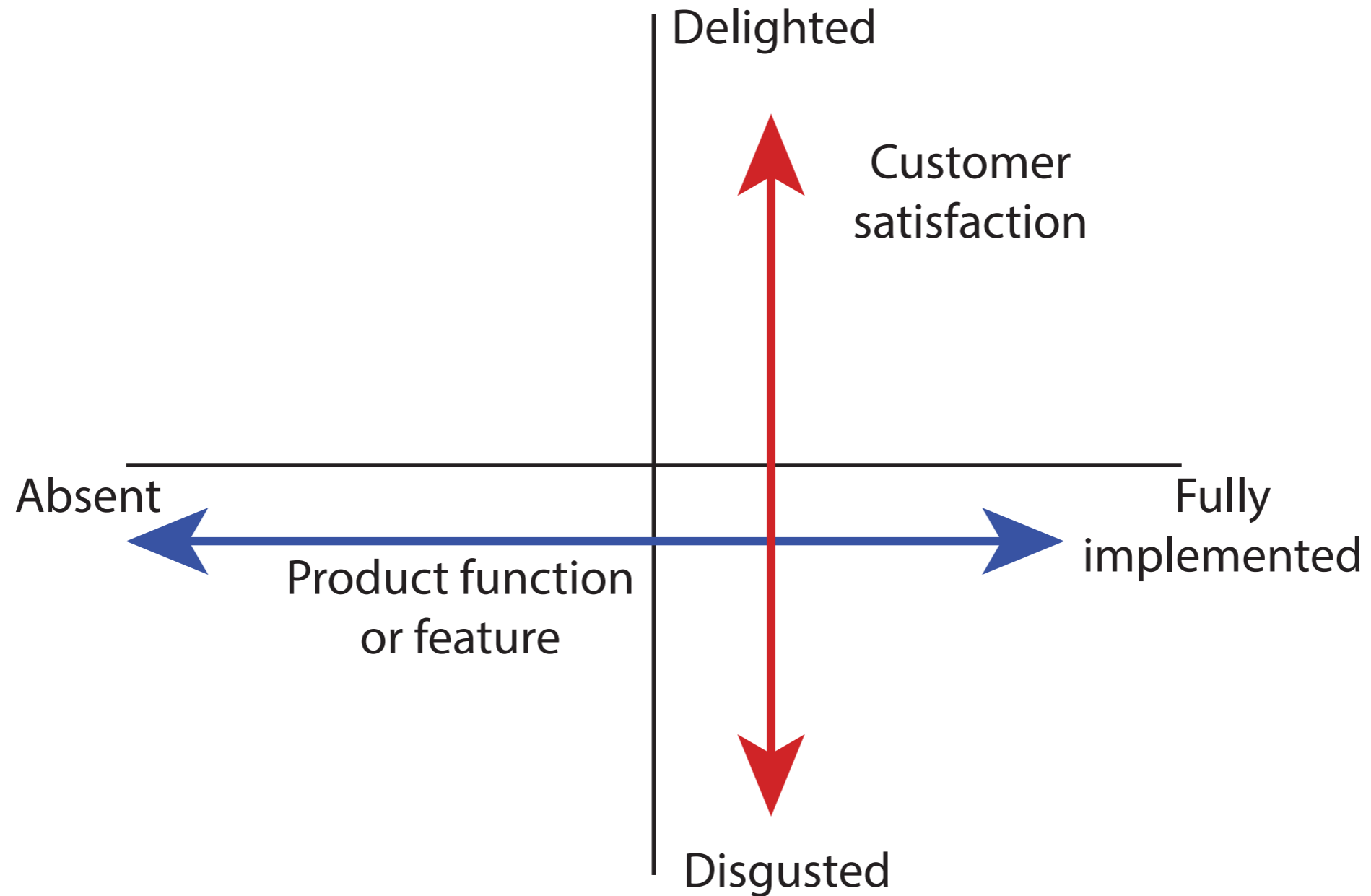
Performance Features (Kano Model)

Performance features

- Can increase customer satisfaction when those features are increased

- May involve tradeoff, e.g. increasing performance at increasing cost

Example:

- ABS - brakes that respond to tire slippage

  ‣ Performance is stopping distance

  ‣ Performance is resistance to violent shaking

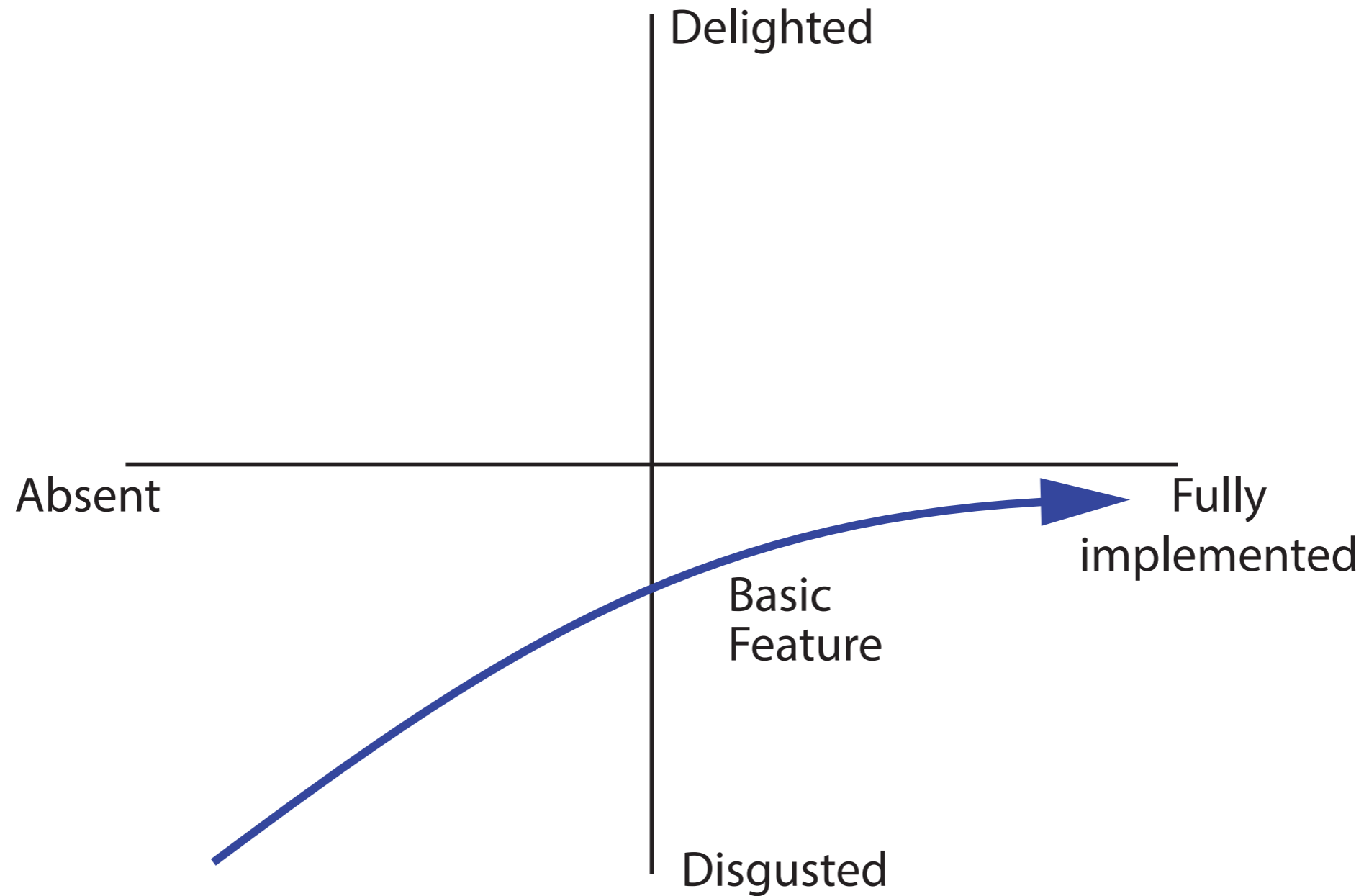# Kano model

Basic Features
(Kano Model)

Basic features are

- Obviously necessary

- Would disgust customers if absent

- When fully implemented have a neutral effect on customer satisfaction

Example:

- Brakes on a car

Kano model

# Excitement or Surprise Features (Kano Model)

Excitement features

- Customer may not be aware of feature, or its absence, and is not disappointed by its absence

- Customer is surprised and delighted by the feature

- Customer satisfaction can increase drastically with addition of the feature

Example:

- Collision-detection system that applies brakes even before you are aware braking is necessary

Kano model
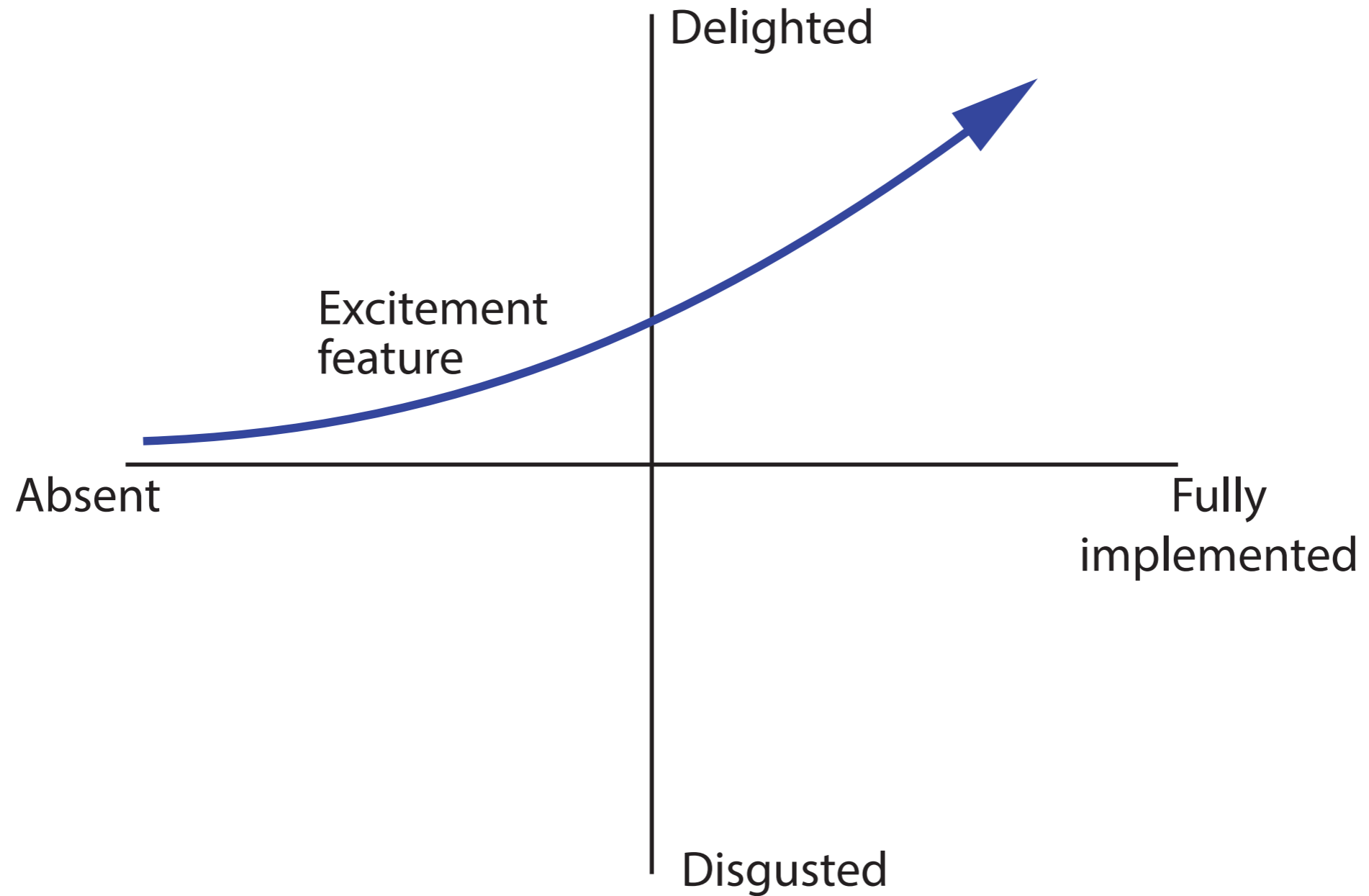
# Changing customer perception over time (Kano Model)

After many product cycles

- Excitement features become performance features
  - ‣ Not optional unless it makes a reasonable compromises, e.g. saves money
- Performance features become basic features
  - ‣ What used to be an option, now is a necessity

Example:

- Would you buy a mobile phone that didn't have a camera?
- What will we think of ABS when we have self-driving cars?

Kano model
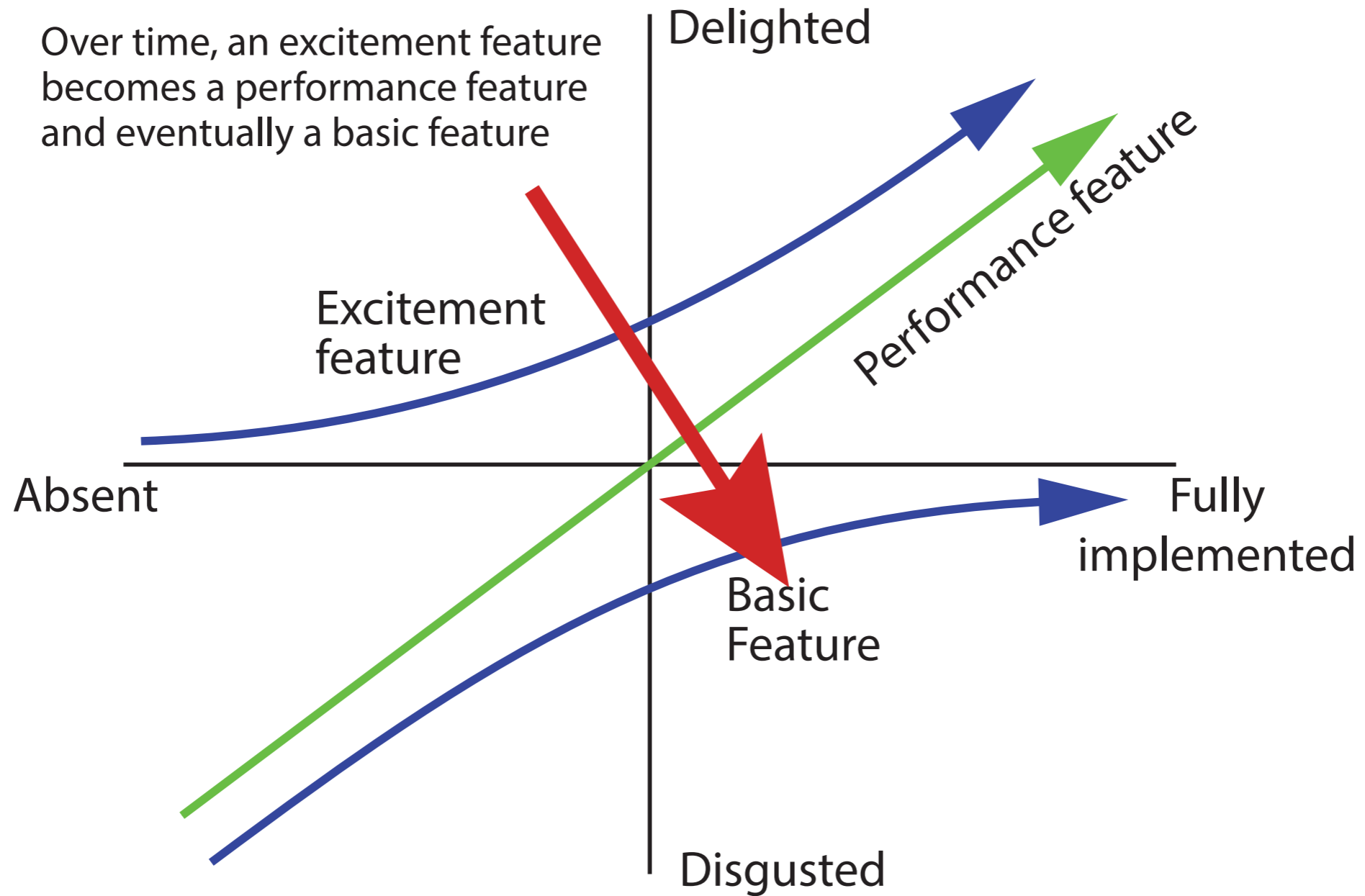
How to use Kano's model

Keep it simple

- First, be aware of the three types of features
- Let customers determine the type of feature
- But … don't put words in their mouth
  ‣ Don't explain the model and ask them to use terms like "basic feature" and "performance feature"
- Recognize that the customer perception is likely to be different than your perception
  ‣ Is a feature basic or performance?
  ‣ Is a feature really exciting, or is it just cool tech?

References

1. Steven P. Gaskin, Abbie Griffin, John R Hauser, Gerald M. Kats and Robert L. Klein, *Voice of the Customer,* 2010, Wiley International Encyclopedia of Marketing

2. Christopher A. Mattson and Carl D. Sorensen, 2016, *Fundamentals of Product Development*, 4th ed., Brigham Young University, Chapter 4 and Part 2

3. David G. Ullman, *The Mechanical Design Process*, 5th ed., McGraw-Hill, chapter 6.

4. Karl. T. Ulrich and Steven D. Eppinger, *Product Design and Development*, 5th ed., 2012, McGraw-Hill, chapter 6.