Requirements Engineering

(Summer 2019)

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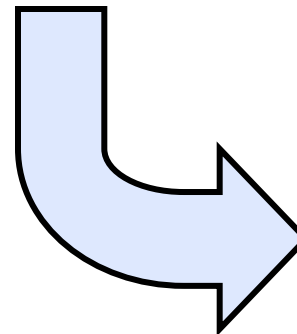
http://homepages.uc.edu/~niunn/courses

Today's Menu

Last Seminar:
Visual Modeling
Notations
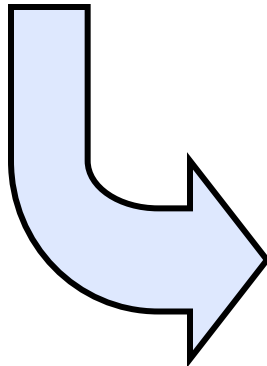
This Seminar:
NFRs
Release ASN2

Next Seminar:
Automated
Traceability

Functional vs. Nonfunctional

→ Functional requirements describe **WHAT** the software does

→ Nonfunctional requirements (NFRs) describe **HOW WELL** the software does it

→ Implications: Elicitation, modeling, analysis, realization, validation, evolution ... of NFRs are different from those of functional requirements

On NFRs

→ **Do we need a (formal) definition (or a complete list) of NFRs?**

- ⇨ **All of the requirements that are related to how a software solution is implemented [Google'17].**
- ⇨ **How the system behaves w.r.t. some observable attributes like performance [Franch'98].**
- ⇨ **System qualities: All the 'ilities' [Easterbrook'05].**
- ⇨ **Quality is a collection of 7 attributes: reliability, efficiency, usability, portability, testability, understandability, and modifiability [Glass'03].**

"If you want to trigger a hot debate among a group of RE people, just let them talk about NFRs. Although this term has been in use for more than two decades, there is still no consensus about the nature of NFRs and how to document them in requirements specifications."

Martin Glinz, RE'07

Example NFRs

→ **Interface requirements**
- ↳ **how will the new system interface with its environment?**
  - ➤User interfaces and "user-friendliness"
  - ➤Interfaces with other systems

→ **Performance requirements**
- ↳ **time/space bounds**
  - ➤workloads, response time, throughput and available storage space
  - ➤e.g., "the system must handle 1,000 transactions per second"
- ↳ **reliability**
  - ➤the availability of components
  - ➤integrity of information maintained and supplied to the system
  - ➤e.g., "system must have less than 1hr downtime per three months"
- ↳ **security**
  - ➤e.g., permissible information flows, or who can do what
- ↳ **survivability**
  - ➤e.g., system will need to survive fire, natural catastrophes, etc

→ **Operating requirements**
- ↳ **physical constraints (size, weight),**
- ↳ **personnel availability & skill level**
- ↳ **accessibility for maintenance**
- ↳ **environmental conditions**
- ↳ **etc**

→ **Lifecycle requirements**
- ↳ **"Future-proofing"**
  - ➤Maintainability
  - ➤Enhanceability
  - ➤Portability
  - ➤expected market or product lifespan
- ↳ **limits on development**
  - ➤E.g development time limitations,
  - ➤resource availability
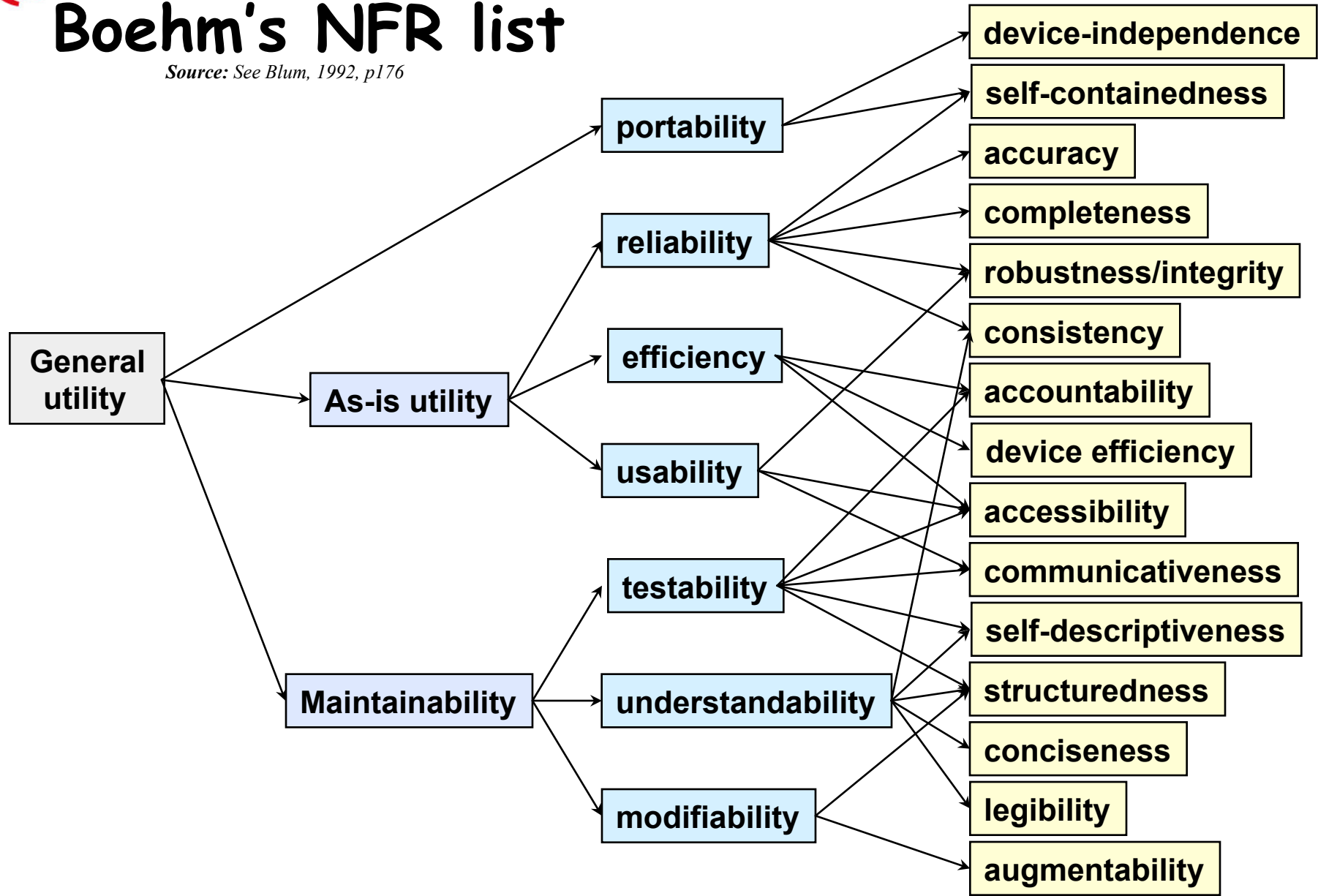 - ➤methodological standards
  - ➤etc.

→ **Economic requirements**
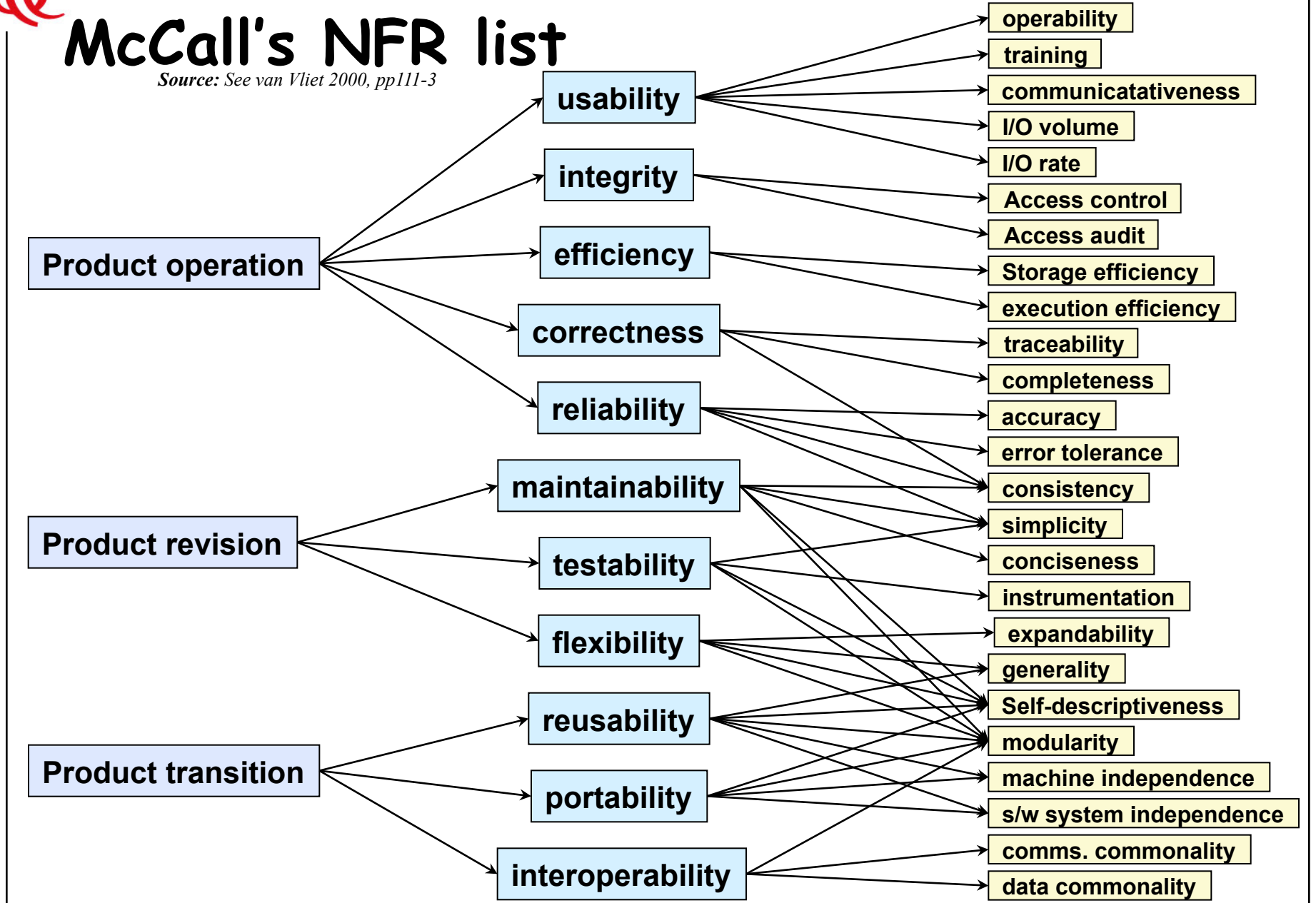- ↳ **e.g. restrictions on immediate and/or long-term costs**

Boehm's NFR list

Source: See Blum, 1992, p176

McCall's NFR list

Source: See van Vliet 2000, pp111-3

Product operation
- **usability**
  - operability
  - training
  - communicatativeness
  - I/O volume
  - I/O rate
- **integrity**
  - Access control
  - Access audit
- **efficiency**
  - Storage efficiency
  - execution efficiency
- **correctness**
  - traceability
  - completeness
  - accuracy
- **reliability**
  - error tolerance
  - consistency
  - simplicity

Product revision
- **maintainability**
  - conciseness
  - instrumentation
- **testability**
  - expandability
- **flexibility**
  - generality
  - Self-descriptiveness
  - modularity

Product transition
- **reusability**
  - machine independence
- **portability**
  - s/w system independence
  - comms. commonality
- **interoperability**
  - data commonality

Challenges of NFRs

→ **Hard to model**

  ↳ **Not directly supported in use cases, class diagrams, ERDs, sequence diagrams, statecharts, and other types of UML models**

  ↳ *Which requirements modeling approach supports NFRs & how?*

→ **Usually stated informally**
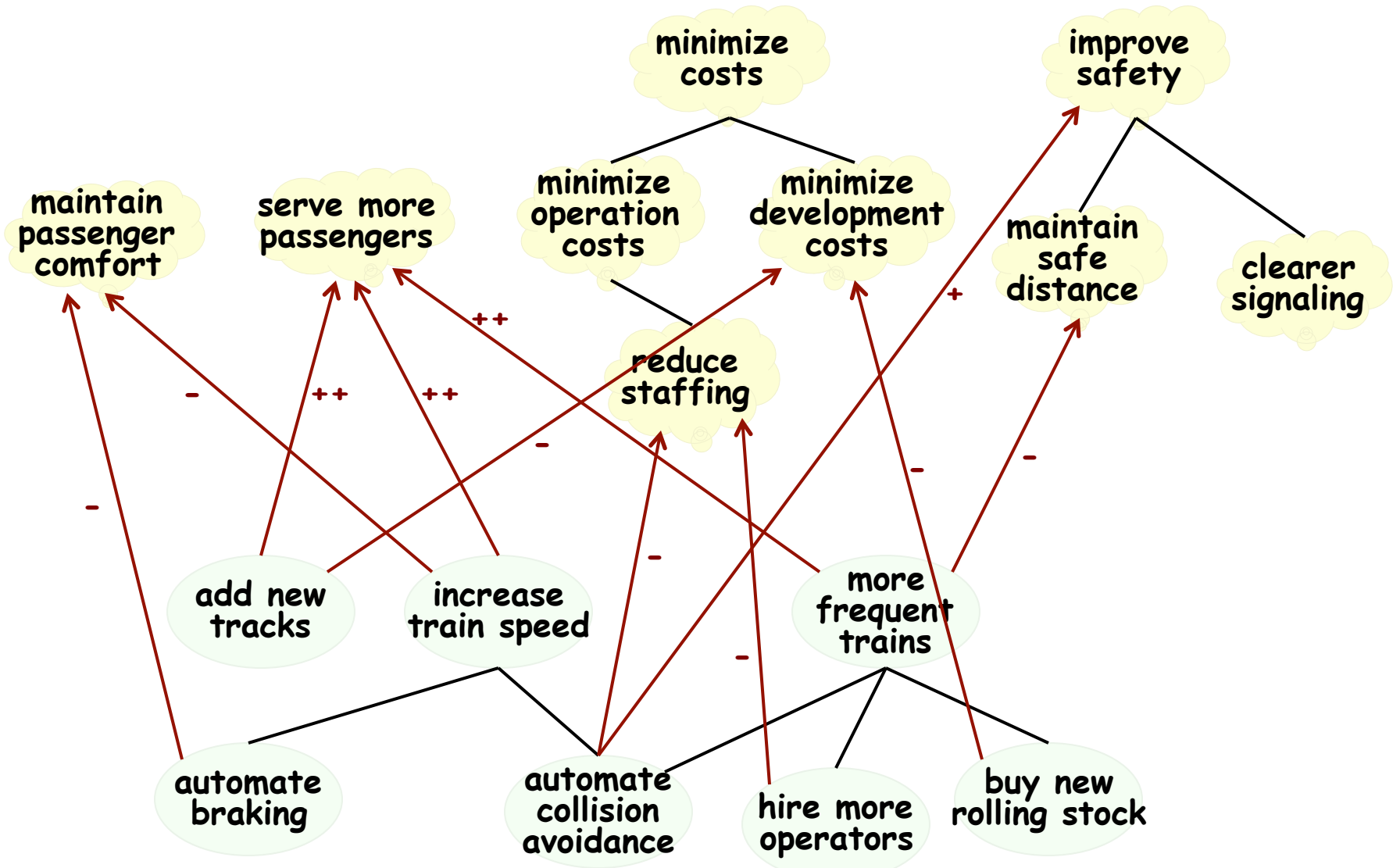
  ↳ **Often contradictory**

  ↳ **Difficult to enforce during development**

  ↳ **Difficult to evaluate for the customer prior to delivery**

→ **Hard to make them measurable**

  ↳ **You can't control what you can't measure**

Softgoal Graph

Terminology: Similarity & Subtlety

➦ performance, responsiveness, interactivity

➦ usability, learnability, mobility

➦ security, safety, privacy, authentication, access control

focus

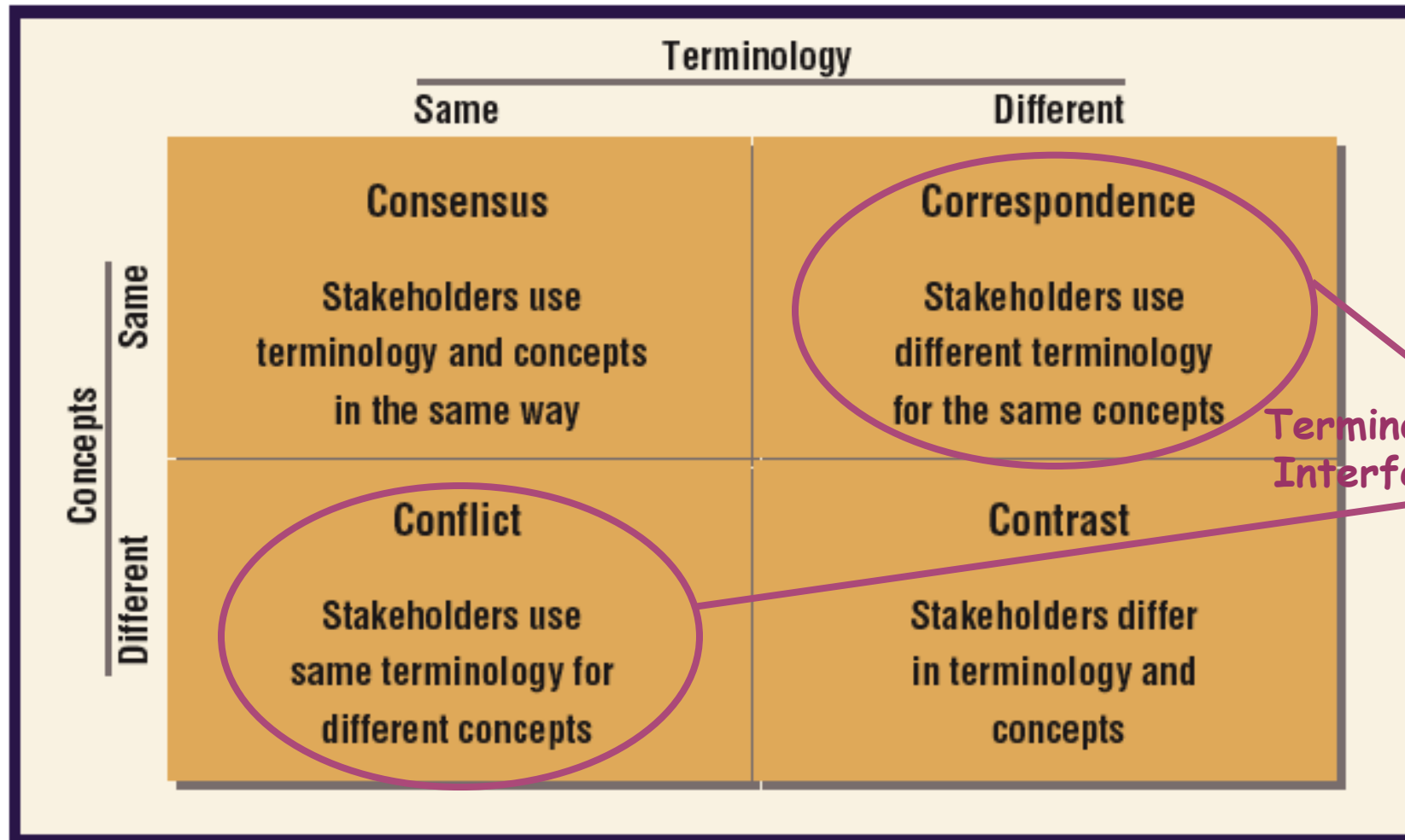**stakeholders in RE..**

So, You Think You Know Others' Goals?

A Repertory Grid Study

Nan Niu and Steve Easterbrook, *University of Toronto*

Concepts and Terminology

Repertory Grid Technique (RGT)

⇨ **George Kelly (1955), psychotherapy**

⇨ **verbalize how people construe certain factors within the area of interest**

    ↳ **verbalizations: constructs (bipolar in nature)**

    ↳ **factors: elements**

RGT Example

⇨ **Information sources**

    ↬ TV, Newspaper, Radio, NewsGroup, Web, etc.

    ↬ <u>elements</u> in RGT

⇨ **Triad: (A) TV (B) Newspaper (C) NewsGroup**

    ↬ <u>construct:</u> many focuses (A,B) vs. single focus (C)

    ↬ as a rating scale (1-5), and each element is assigned a rating on that construct

Sample Repertory Grid

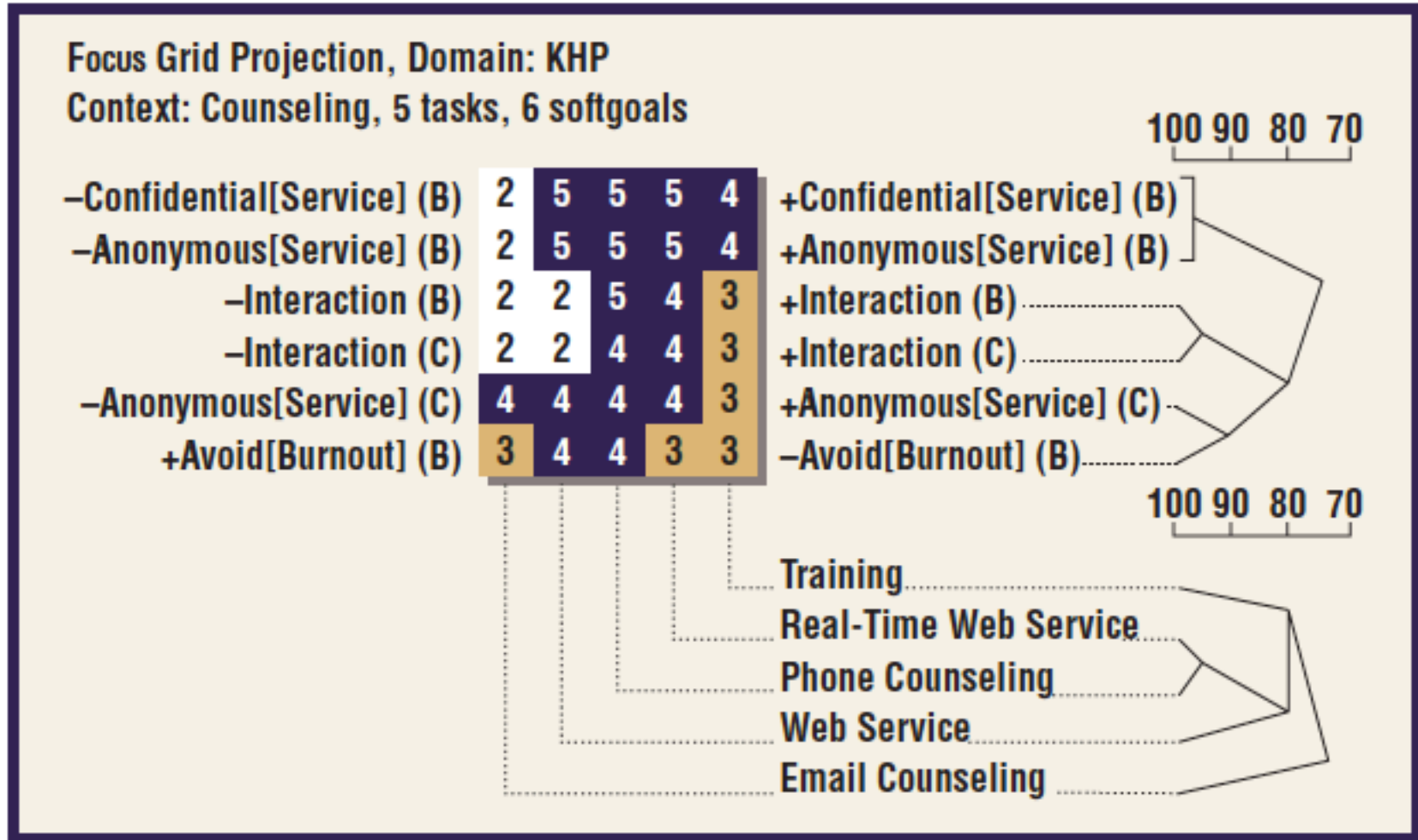|	TV	Newspaper	Radio	Newsgroup	...	
Many focuses	1	2	2	5	...	Single focus
Multimedia	1	4	2	5	...	Text
Entertaining	1	3	1	3	...	Not entertaining
Two-way	5	4	4	2	...	One-way
...	...	...	...	...	...	...

Requirements Goal Models

⇨ **Softgoals – Constructs – Unique to personal views**

⇨ **Tasks – Elements – Shared among stakeholders**

⇨ **Assume: people focusing on similar topics would agree on the definition of a common set of concrete tasks within the area of interest**

⇨ **Idea: compare stakeholder's constructs by how they relate to a shared set of concrete entities, rather than by any terms the stakeholders use to describe them**

Kids Help Phone 😊

Focus Grid Projection, Domain: KHP
Context: Counseling, 5 tasks, 6 softgoals

100 90 80 70

−Confidential[Service] (B)	2	5	5	5	4	+Confidential[Service] (B)
−Anonymous[Service] (B)	2	5	5	5	4	+Anonymous[Service] (B)
−Interaction (B)	2	2	5	4	3	+Interaction (B)
−Interaction (C)	2	2	4	4	3	+Interaction (C)
−Anonymous[Service] (C)	4	4	4	4	3	+Anonymous[Service] (C)
+Avoid[Burnout] (B)	3	4	4	3	3	−Avoid[Burnout] (B)

100 90 80 70

Training
Real-Time Web Service
Phone Counseling
Web Service
Email Counseling

B – Bob C – Cem

Observations

⇨ **Trivial correspondence**

 ↳ High-level softgoals about counseling: Good, Helpful, Proper, High-Quality, etc.

⇨ **Numerical threshold**

 ↳ Anonymous[Service] (Cem) versus (Bob)

⇨ **Conflicts beyond terminological level**

 ↳ (Ana) "Consult New Technique" would "Make-Difficult[Work]", hence hurt "Avoid[Burnout]"

 ↳ (Bob) "Consult New Technique" could help "High[Morale]", thus help "Avoid[Burnout]"

⇨ **Summary**

 ↳ Never assume stakeholders use terminologies consistently

 ↳ RGT/PCT as an interference management method

Summary

→ **NFRs**

  ↳ **Not just 'ilities'**

  ➢ **faceted classification**

  ↳ **Hard to measure (quantifiable; terminology)**

  ➢ **repertory grid**

  ↳ **Hard to trade off (conflicting)**

  ➢ **softgoal graph**

  ↳ **Linking to FRs**

  ➢ **ASN2**

→ **Up next**

  ↳ **ASN2 release**

  ↳ **Automated traceability**