

Requirements (R)

- includes all expressions of (existing or fictitious) customer or market needs, demands, wishes and constraints that are explicitly provided to the designers at the outset of a design task.

e.g.: requirement issues include 'technical performance requirements [...] articulated by the customer', 'stakeholder requests, and 'customer needs and wants'

Kannengiesser & Gero (2017) Can Pahl and Beitz' Systematic Approach be a predictive model of designing?

Function (F)

- purposes of the artefact being designed
 - any expression related to potential purposes of the artefact'
- »what the artifact is for«

Unlike requirement issues, function issues are not directly provided to the designer; they are generated by the designer based on interpretations of requirement issues or design task.

Function issues in Systematic Approach include 'the intended input/output relationship of a system', examples of needs related to safety, aesthetics or economic properties. Function issues include the notion of a use case.

Gero & Kannengiesser (2013) Commonalities across Designing

Expected Behaviour (Be)

- attributes that are expected from the artefact's structure (S);
 - includes attributes that describe the artefact's expected interaction with the environment;
- »what the object does / (is expected to do)«

Expected Behaviour (Be) attributes can be used as guidance or assessment criteria for potential design solutions; attributes of an entity that allow comparison on a performance level.

Be issues in Systematic Approach e.g. "physical effects"; "technical, economic and safety criteria" for design evaluation

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Structure Behaviour (Bs)

- includes those attributes of the artefact that are measured, calculated or derived from observation of a specific design solution and its interaction with the environment.
- »what the object does«

Instances of Structure Behaviour (Bs) must be of the same type as instances of Expected Behavior (Be), so as to allow comparing and evaluating design solutions.

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Structure (S)

- includes the components/elements of an artefact/design and their relationships.
- »what the object consists of«

can appear either as a 'concept structure' or a 'solution structure', which are the outputs of phases 2 and 3 (im Vorgehensmodell VDI 2221);

includes 'layout' and 'form' (Pahl & Beitz, 2007, p. 227),

'code' (Kruchten, 2004, p. 256), and

'detail designs' (El-Haik and Roy, 2005, p. 7)

Gero & Kannengiesser (2013) Commonalities across Designing

Description (D)

- includes any form of design-related representations produced by a designer, at any stage of the design process.

mechanical engineers may produce

- sketches, CAD models, requirements lists, physical prototypes, calculations, and other documentations

software designers produce Descriptions including

- storyboards, UML models, code files, test plans and other representations

Gero & Kannengiesser (2013) Commonalities across Designing