

DesignFactors

Tools for Design Thinking

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Abstract: As more and more people find themselves confronted with design issues - in the roles of planners, developers, and producers - tools which can assist communication across different domains of expertise facilitating participation in design processes and supporting evaluation as well as documentation, are required.

Keywords: Design Methods, Diagrammatic Reasoning

Introduction: Design processes cover a wide range of steps: from the incoherent jotting down of more or less concrete visions to organized ideation processes in teams with members from a diverging set of fields - and ultimately realizations which need to accomplish defined tasks.

These steps can roughly be grouped in following stages:

- *understanding of issues*
- *concept formation*
- *planning*
- *development*
- *implementation*
- *evaluation*

A specific framework for structured support in all of these phases is proposed and various models and methods are evaluated for their relevance and informing potential - albeit from a biased western perspective.

The presented DesignFactors tool should assist:

- *the guidance of brainstorming sessions*
- *the assessment of pre- and post-conditions*
- *the collection of requirements*
- *the examination of interdependencies*

- *the formulation of strategies*
- *the verification of development plans*
- *the evaluation of accomplished tasks*

Definitions:

Model

a formalized construct of conceptions/perceptions

Process

actions/occurrences over time

Method

prescription of processes based on distinct models

Information

meaningful material - implying its physical as well as non-physical connotations

Interface

the means - as signifying material - for accessing Information, affording opportunities for directional and non-directional action

Interaction

the operation(s) of accessing Information

These elements form an integral trichotomy, where each one comes into being through the existence of the others and none exists without any of the others.

Tool

Tool then may be called anything which affords *Interface(s)* for *Interaction(s)* with *Information* to produce anticipated outcome based on a distinct *Method*.

The german word *Werkzeug* illustrates this argument, being composed of *Werk* as in *work/creation/output* and *Zeug* as that which had been generated/devised/produced and hence become *matter/thing*.

Historical Examples:

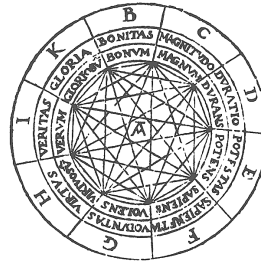
Ramon Llull, 1232 - 1315

Experiencing a world, where different cultures struggled in their claim for primacy, Ramon Llull has been looking for means to develop an unbiased body of knowledge and insight. Inspired by permutational devices of arab astrologers he developed the foundation of a *geometric logic*.

The *Llullian Circles* are haptic multilevel circular diagrams - volvelles - which, through variations in the alignment of their codes, produce a complete set of statements representing what Llull considered the *Ars Generalis Ultima* - a concise general science

More visually accessible are Llull's *tree-diagrams*, where he used the qualities of vertical- and horizontal-symmetry to cluster knowledge domains and the structural detailing of roots, trunk, branches, offshoots, leaves, flowers, fruits to express and follow associations.

Ramon Lull's ground-breaking work has inspired many efforts to externalize and rationalise knowledge purposing support for reasoning and communicating.



Ramon Llull
Ars Magna
1305

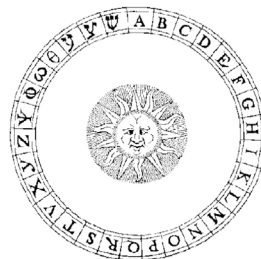


Ramon Llull
Arbor scientiae
Lyon 1515

Giordano Bruno, 1548 - 1600

Aiming to create an universal epistemology outside of the confines of officially sanctioned knowledge, Giordano Bruno described various codification schemes.

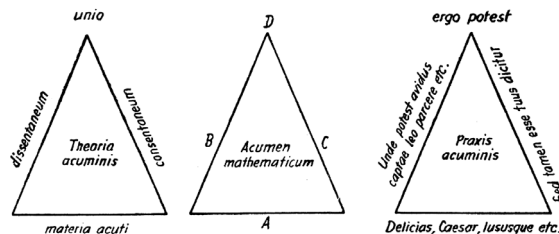
His *Memory Wheels* are extensions of Llull's diagrams, generalizing the rings representation into *Actors, Behaviours, and Attributes*; *Memory* in his understanding is the active projection into both past and future, making the wheels a tool to not only reproduce known associations but also to turn out challenging speculations.



Giordano Bruno
De Umbris Idearum
Paris, 1582

Maciej Kazimierz, 1595 - 1640

Through diagrammatic reasoning, applying the pattern of triangulated argument, Maciej Kazimierz explains wisdom as an ensemble of semantic, syntactic, and pragmatic competencies.

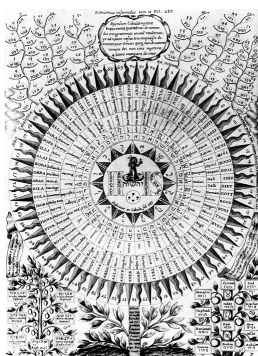


Maciej Kazimierz
De acuto et arguto
1627

Athanasius Kircher, 1602 - 1680

His many imaginations and inventions - at a time when *technology* evolved from being anchored in a complete framework of arts to a domain in its own rights - can be viewed as anticipations of issues informing today's media.

As for Ramon Llull, the attraction of combinatorial processes applied on a finite set of topics/attributes caught his zeal to pursue the uncovering of general principles.



Athanasius Kircher
Oedipus Aegyptiacus
1652 - 1654

Georg Philipp Harsdörffer, 1607 - 1658

His *Fünffacher Denckring der Teutschen Sprache - Five-fold Thought-ring of the German Language* - is a language/poetry engine consisting of five nested wheels, each carrying structural elements of a German word:

- 48 prefixes
- 50 initials
- 12 mid-characters
- 120 trailing characters
- 24 suffixes

This tool allowed not only for the composition of existing and non-existing words but also the generation of phonetic patterns, such as alliterating and end-rhyming pairs.

While other permutation machines to that time had the purpose to uncover or prove certain propositions, the *Denckring* documents an early example of arbitrary formalistic play as a trigger for autotelic inspiration.



Georg Philipp Harsdörffer
Philosophische und Mathematische
Erquickstunden
1651

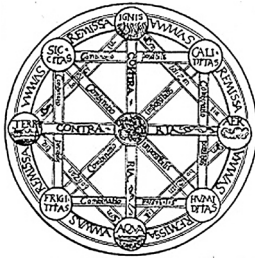
John Wilkins, 1614 - 1672

In *An Essay towards a Real Character and a Philosophical Language* - 1668, John Wilkins proposes a classification scheme that could encode any matter in a cascading sequence of characters, aiming for *the distinct expression of all things and notions that fall under discourse*.

Gottfried Wilhelm von Leibniz, 1646 - 1716

For his atomistic view on knowledge, where propositions can be generated from a distinct set of smallest elements, the *Llullian Circles* have been motivation to expand on a general *ars combinatoria*, as a means not only for communicating known truths but also for the discovery of new knowledge.

His aspiration to capture higher level concepts in a graphically coded *characteristica universalis* - a universal language, has been motivated by the modern experience of diversifying sciences and globalizing economies.

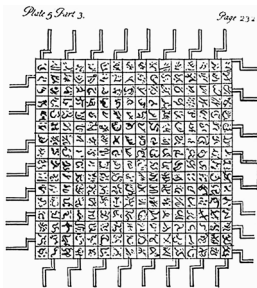


Gottfried Wilhelm von Leibniz
De Arte Combinatoria
Frankfurt 1666

Jonathan Swift, 1667 - 1745

In *Gulliver's Travels* Jonathan Swift describes *The Engine* in the Academy of Lagado on the flying island Laputa: a large scale permutation device as a *Project for improving speculative Knowledge*.

This detailed account touches upon many issues of Information-, Interface- and Interaction-Design as well as scalability and the economics in the media business.



Jonathan Swift
Gulliver's Travels
1726/1735

DesignFactors, a framework for assisting the modelling of design developments and decisions, is based on *triangulation*; any one factor is defined by its relationship/association/proximity to two complementary, interdependent factors.

The primary triad consists of:

- *context specific factors*
- *actors specific factors*
- *outcome specific factors*

This scheme emphasizes that reasoning can not be separated from specific situations which are constituted/recognized/experienced by distinct subjects producing certain output.

In a larger sense, any triadic set is built upon:

- *sense making forces, semantics*
- *structurally binding forces, syntactics*
- *effecting forces, pragmatics*

Inspired by the Unified Modelling Language, UML, **DesignFactors** are grouped into 3+2 *views* which cover a complete modelling cycle where the first three views address issues of conceptualization, design, and planning and then lead to questions of implementation and assessment.

The selection of generic terms to identify each factor advances communication in group sessions with participants from different fields of expertise.

- *scenarios*: describing a pragmatic problem, focusing on the various actors and their active/passive being
- *components*: identifying the elements which play a role in the scenario
- *processes*: capturing flows and dynamic associations between components
- *development*: enforcing an overview, problematizing relations of *scenarios*, *components*, and *processes*
- *application*: observing what has been accomplished; this view is also starting point for a backcasting perspective, reverse-engineering scenarios from assumed solutions.

In the first group, each view is constructed through permutations of the primary triadic associations with the views' main perspective:



The development view permutes all preceding views



The application view asks for assessment of what has been achieved from the scenario blueprint and hence figures as a link between the development and the scenario view of a next iteration.



Each of the primary triads is further detailed by a secondary triadic set, drawing attention to its basic constituting factors; although in practice these factors may not be as clearly separable, recognizing inherent qualities will further overall understanding.

context specific factors

- *needs, comprising also expectations, motivations, purpose; clearly identified needs are often at the origin of effective solutions, guaranteeing a high degree of context identification.*
- *constraints, covering all disrupting, limiting factors; easily perceived as impediments, these are in fact catalysts for adequate, sustainable solutions.*
- *opportunities, pragmatically supportive potentials and capabilities whose thorough understanding inspires speculative propositions, valuing long-term vision over short-term pragmatism.*

outcome specific factors

- *products, tangible, identifiable artifacts whose life-cycles are situated in a complex web of relationships which impact planning, developing, producing, distributing - and disposing/recycling.*
- *services, intangible offerings which can dynamically anticipate and reflect context specific requirements.*
- *environments, spheres for action/interaction; these complex contexts are inseparably tied to any activity and preexist/exist regardless of possible interventions hence they deserve special examination of their potential for design solutions before considering products or services.*

scenarios

- *producers, those who conceive, plan, design, realize and maintain products, services or environments; responsible to warrant sustainability throughout the total life-cycle of their productions*
 - *distributors, mediators between producers and users and accountable to both*
 - *users, validating and consuming products, services and environments they are the driving force for evolution and transformation*
- While users often receive more attention in their clear exposure at the end of market chains, the other two actors require equal recognition.

components

- **information**
- **interfaces**
- **interactions**

focus on any one elicits discussion of the other two

processes

- *evolution, gaining gestalt through propositions, prototypes, evaluations*
- *completion, the state where all original demands have been achieved/fulfilled*
- *transformation, opening up possibilities beyond the initial scope*

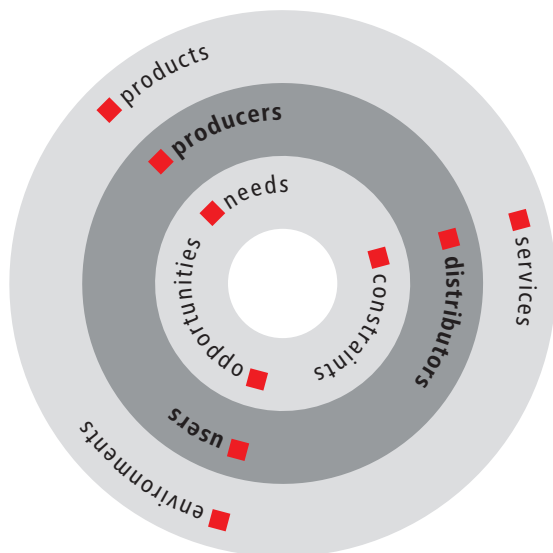
Understanding design solutions as embedded in iterative processes encourages total life-cycle planning.

applications

- **sustainability**, producers are concerned that all factors relevant to production cycles guarantee continuity and options of evolution
- **accountability**, distribution processes need to provide effective transfer/communication between producers and users at minimum loss
- **usability**, on the receiving end, people do - willing and unwillingly, conscious and unconsciously - evaluate what they have to deal with; understanding of these experiences is indispensable to enter a new design-iteration

Mirroring and complementing the scenarios-view, these factors stipulate assessment of anticipations and goals through the evidence of concrete use.

Finally, each of the views is represented in an interactive 3/3 matrix to explore all possible alignments:



How to work with it?

To engage people in one-on-one or group sessions, variations of analog interface have been developed.



a CD-size disk allows for easy manipulation, maintaining an overview at any time.



a pen version focuses on a specific line of associations; parts can be re-combined to experiment with the reversal of the view's vector.



in a more playful approach, dices introduce randomness as force to face unexpected associations; variations on the constellations of the pieces can express aspects of proximity and order



a set of triangular cards to layout and play relationships in group sessions; protocolling the ensuing discussions and diversions to build a rich body of factors relevant to the game's starting issue.

Agenda:

- *build a body of reference from applications in various projects/contexts*
- *develop interfaces for related methods*
- *make it an engine for model-driven development*
- *expand variations of vocabulary*

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