An Adaptable Future with Industrial Democratic Design

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The Industrial Democratic Design project is a product of the Copenhagen-based architectural office Vandkunsten's application of research based tools provided by the Adaptable Futures research programme.

Based at Loughborough University the AF research team has developed numerous analytical tools to support the understanding of how adaptability can become an integrated part of building design solutions. The tool kit includes well defined strategies, instruments and measures which can promote adaptable qualities in buildings. As a completion of the three year research the AF team held a design competition which resulted in three winning proposals one of which was produced by Vandkunsten.

Sustainable buildings are adaptable and adaptability releases a powerful democratic potential. This is, in short, the thesis of Vandkunsten's proposal for an adaptable way of building. The basic rationale is that the embodied energy resources of buildings must be protected carefully by ensuring longevity of buildings and building components. The life of a building capable of adapting to new needs – functions, technologies, habits, fashions – should be longer than the life of a building designed for a single purpose only. Today, building codes and certification systems pay little attention to the resource saving impacts of adaptability, but with further increases in energy price methods for conserving material resources it is likely to become more recognized. Vandkunsten's IDD project investigates possible architectural consequences which can be anticipated with a future adaptable building culture. The IDD project aims at contributing with a framework of best-practice rules for the majority of buildings which can be defined as 'ordinary' as they constitute the physical frame for everyday purposes: living, producing, administrating, teaching etc.

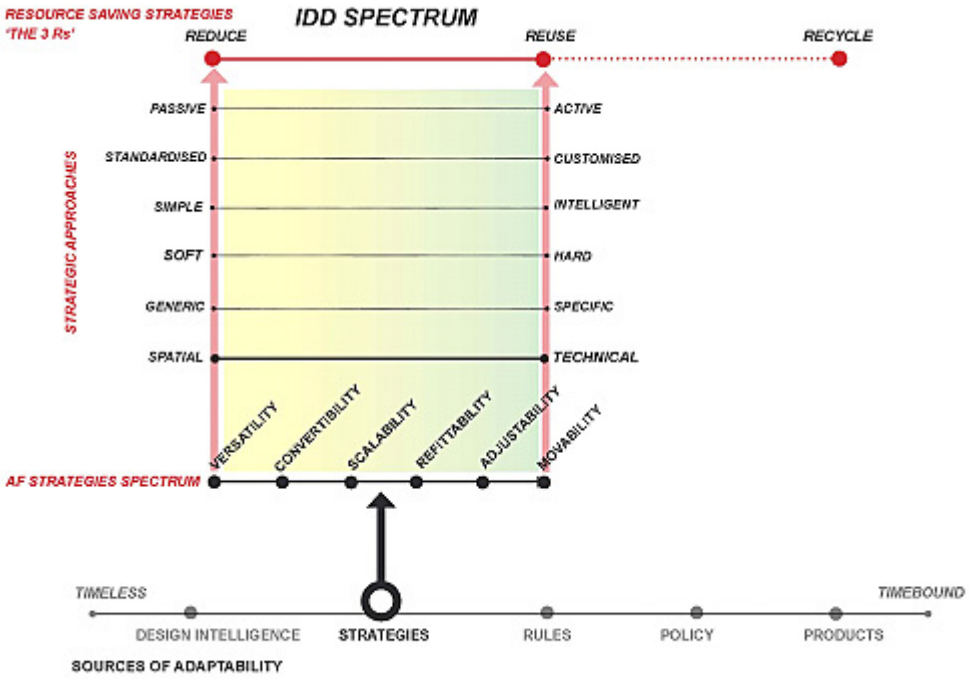

Fig. 1: Relating strategies for adaptability and resource saving.

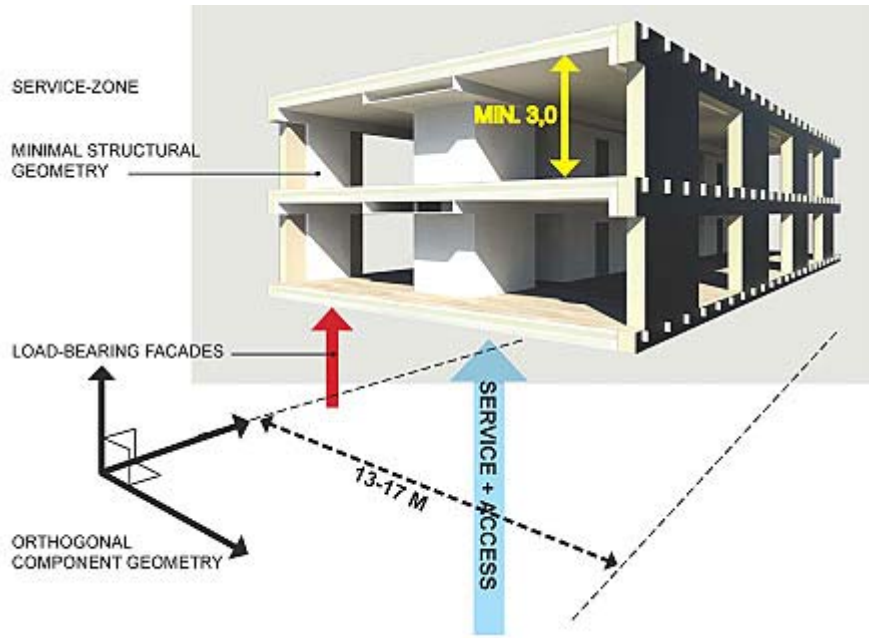

Fig. 2: Multispace diagram

Spatial and technical adaptability
AF literature defines adaptability as the capacity for a building to accommodate effectively the evolving demands of its context, thus maximizing value through life. Under the umbrella of adaptability the AF toolkit defines six strategies (particular types of change) which the IDD design rules are structured according to.
Versatility; change of spatial arrangement (e.g. a new pedagogy or method of operation)
Convertibility; change of functions (e.g. a new owner)
Scalability; change in size (e.g. a change in the market)
Refitability; change of components (e.g. wear and tear, new regulations)
Adjustability; change in position of components (e.g. a new task or user)
Movability; change in location of building (e.g. a shift in demographics, neighbourhood conditions)

Vandkunsten's proposal connects the adaptability strategies to the common known 3 Rs of resource saving: Reduce, Reuse and Recycle (fig. 1). The adaptability strategies can be ranged on a scale of architectural strategies from spatial to technical; Versatility and convertibility rely more on spatial composition, offering generous storey height and building depth, long structural spanning, minimization of structural partitioning walls and central cores for service and access (fig. 2 and 3). Movability, adjustability and refitability are more dependent on technical solutions that can enable change. The overall technical strategy of adaptability is *reversible assembly* of building components - deconstruction is equally important to construction!
The spatial strategies relate to the Reduction-agenda as a versatile, convertible and scalable design reduces the need for a new building or major changes (fig. 2). The more technical strategies relate to the Reuse-agenda as reversible construction is the precondition for the reuse of components. Recyclability is not directly relevant as it only applies when the other strategies fail.

Industrial production
The proliferation of adaptable buildings requires industrial production methods. Improvements in building culture must, within a CO2-agenda, aim at generality and mass volume in order to achieve impact. Industrial production in the building industry is a necessary vehicle. In this respect industrialized production becomes crucial in order to generate volume and affordability to be competitive. The technical precision of industrial production supports refitting operations and low energy construction requiring air-tightness. Besides its advantages, industrial production also has restrictive implications for architectural design, i.e. by imposing modularity and orthogonality of components: Most building materials are Fig. 2: Multispace diagram manufactured in rectangular formats due to manufacturing processes and in order to meet most conventional uses in which they become parts of straight surfaces. This produces the added benefit that materials with generic geometrical properties enable components to be reused in new construction better than customized and individual shapes.

Building layers
The AF terminology incorporates the general idea, adopted from Stewart Brand, that any building can be perceived as a set of layers defined by their function and life-time. The IDD design relates to this by separating building layers technically in such a way that the components can be removed for reuse or recycling without damaging the neighbouring layers. The IDD project presents guidelines for compositional and technical properties of the independent building layers needed to meet unknown future scenarios (fig. 4 and 5). All known legislation and official guidelines are followed for fire-safety, day-light, thermal mass, acoustic transmission, air-flow, thermal insulation, accessibility for disabled, etc.

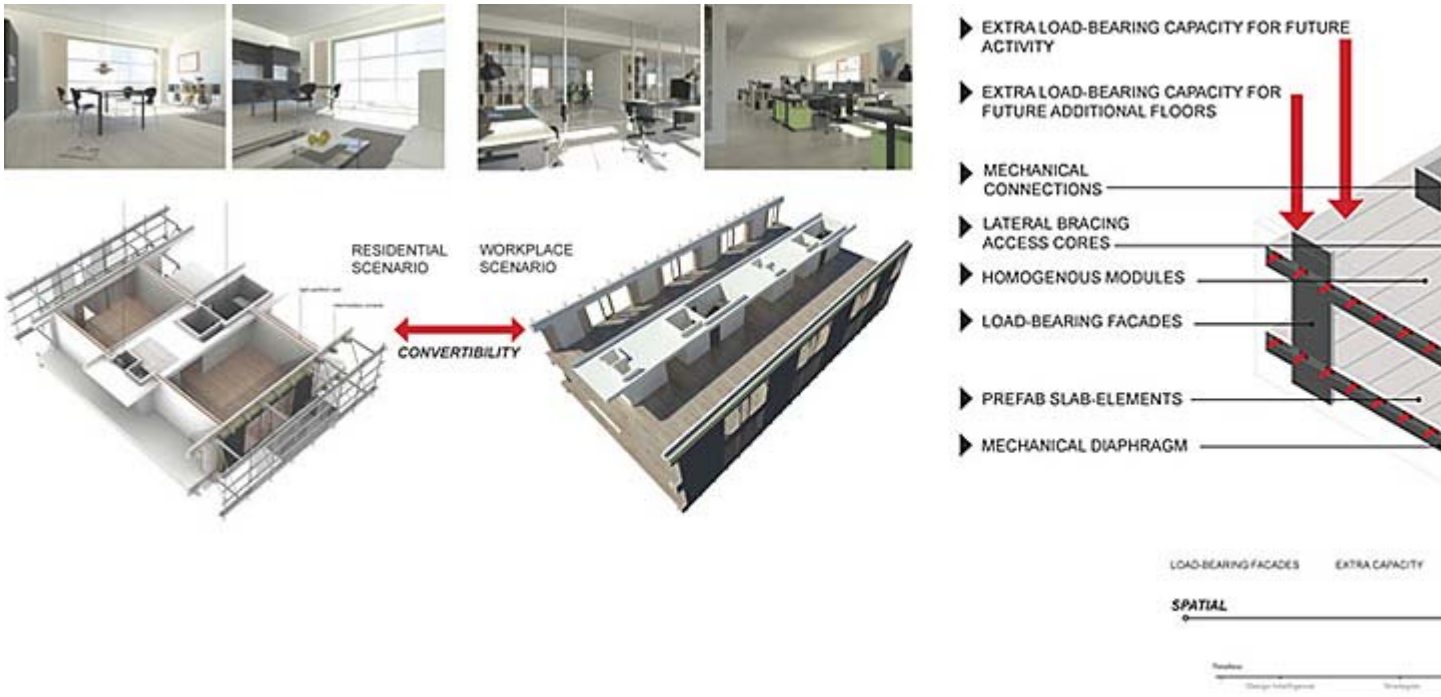

Fig. 3: Convertibility scenario: Office – residence conversion.

Fig. 4: Illustration of design rules for the structural layer

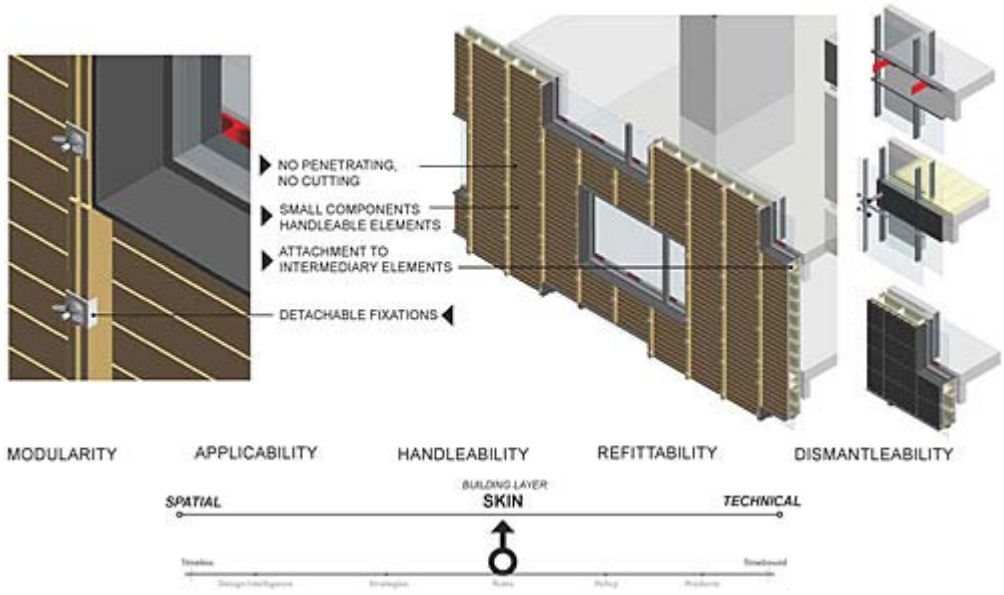

Fig. 5: Illustration of design rules for the skin layer

Assembly

The dominating technical innovation to ensure the independency between building layers is intermediary elements (fig. 6). Intermediary elements are minor components which connect two or more separate layers, i.e. structure and skin, or generate independency between components within a layer, i.e. in a wall.

In order to optimize adaptability within the technical regiment of general reversibility the assembly of an IDD building is structured hierarchically according to building layers defined by their lifetime. This implies that the layer with the highest

permanence should form the root of the hierarchy and more volatile layers should be placed in the outer parts of the hierarchy (fig.7). The hierarchical assembly structure provides a perfect organisational structure for industrial production enabling the building to be produced as a large number of specialized sub-deliveries each optimizing price and technical quality.

Reversibility
The claim for reversibility, implying accessible, dry, mechanical assembly, is the most significant rule of the IDD-design. Reversibility is the main technical condition for the reuse of components and to execute this in practice there is a requirement for accessibility to connections as well as a handleable scale of components. Reversible assembly techniques always imply dry, mechanical connections by means of bolts, brackets, frictional fixations and non-adhesive sealants. On-site cutting and penetration of materials should be minimised as it leads to decomposition and visual degradation of the material in a reuse scenario.

The democratic potential of adaptability
The reversible regime of the IDD system significantly challenges the current culture of producing, using and understanding buildings – as artefacts and as processes. The opportunity of making relatively quick and easy individual changes within the building system sets the stage for new ways of dealing with buildings which can be defined as more open and 'democratic' than with the current building culture. Traditionally the original decision makers - investors, developers, architects - exercise a definitive, life-long and irreversible control over the building design due to permanent and inflexible assembly methods. With reversible assembly buildings change status from static objects to dynamic projects that users can engage with more freely.

The IDD project is ideologically deeply indebted to Umberto Eco's idea of the Open Work - an art concept in which the spectator (in architecture: the user) is a co-producer of the artwork. In architecture for example, this democratic stratification of control has been envisioned through the work of N. John Habraken and his Support (static long-term asset) and Infill (dynamic short-term depreciation opportunities) concept. It’s worth noting that adaptability is not only a necessary tool for resource saving and a vehicle for a more democratic building culture, but also an aesthetic strategy to obtain beauty through complex, ambiguous and surprising compositions evolving slowly over long periods of time - the beauty of time and life as it appears from multiple traces of transformation (fig. 8). Adaptability becomes a spatial and technical driver for the production of visual and spatial qualities which is only partly and indirectly controlled by the original architect.

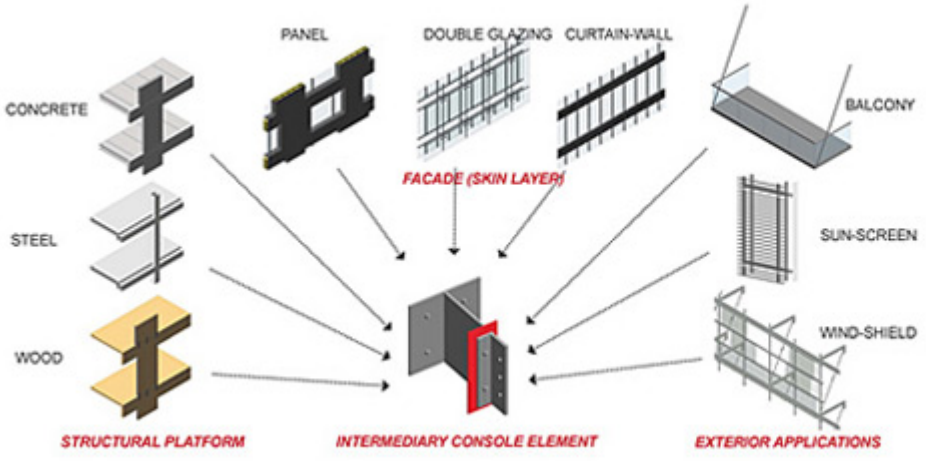

Fig. 6: Illustration of intermediary element.

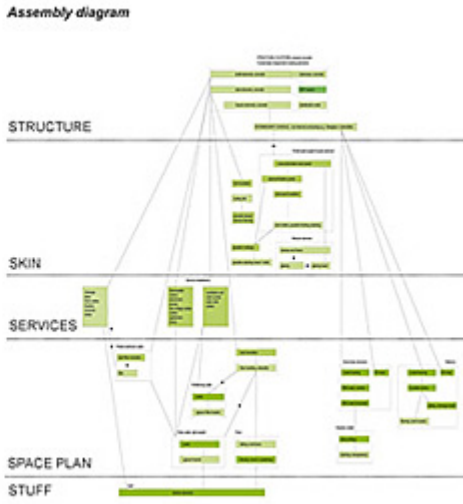

Fig. 7: Assembly hierarchy.
An IDD building is like a chameleon with the capacity to change its skin to fit an evolving context. When a generic structural principle is combined with a highly configurable skin-layer, a completely conventional appearance can be obtained as well as a highly profiled identity. Anarchist individualism as well as corporate identity might take control depending on the type of owner and ownership, the surrounding area and current market conditions. The concept is culturally robust because it is technically adaptable. The IDD concept is exactly as informal, dynamic and democratic as demanded by the context.

As the reuse of materials might take a future central position in the manufacturing industry, *assemblage* might become the equivalent dominating architectural narrative. The aesthetic potential is alluring but also a threat to the traditional

beaux-art position of the architect. The generic spatial structure of the warehouse-like IDD building sets up a limiting framework for architectural design that will shift the focus of architectural motifs from the scale of volumes towards the scale of components and assembly details (i.e. more into the realm of manufacturer, product designer). The outcome of this displaced professional focus might be a richer tectonic culture in which the architectural motif becomes identical with the construction – rather than turning the construction into a vehicle for an abstract non-constructive motif. *Architecture becomes the art of generating motifs from assembly techniques*.

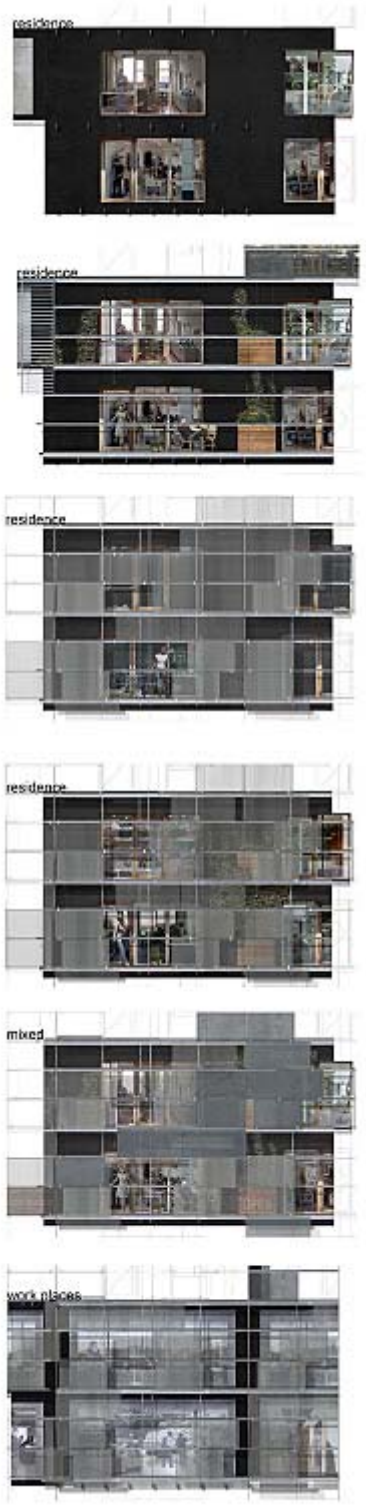

Fig. 8: Facade elevation, change scenarios.

ILLUSTRATION OF FAÇADE ASSEMBLY SYSTEM

The IDD typology

The typology of an IDD building can be defined as a hybrid between a warehouse and a block building – a block with an extraordinary robustness. The IDD concept aspires to become a contemporary, generic, everyday building typology, comparable to the brick-and-timber block typology of first generation industrialism encircling the medieval core of most European cities. The configuration possibilities of such buildings are uncountable and the adaptability has been proven through almost 200 years. Though, the building technology has been obsolete for long, and no new typologies have managed to occupy a similar position. Like the brick and timber typology the IDD building can satisfy most functional purposes at a reasonable price.

An IDD building can be configured for residential purposes as well as office, commercial or workshop purposes. It also permits a liberal mixture of a range of functions. The IDD concept supports a diverse urban life. At the street level the configurative openness can contribute to the site by providing recessed or protruding facades, entrances, gates, public pathways, porches, parking lots etc. The functional convertibility includes the ground floor which is available for any street-oriented use addressing the public such as shops and services.

FAÇADE ELEVATION STREET LEVEL

An IDD building is volumetrically elastic (AF's scalable) due to its technical properties. This implies that the building is both a potential site for a new building through vertical or horizontal additions and a source of building materials (shrinkable) available in a variety of transformation scenarios. In a growth economy the expansion scenario is the most relevant scenario to prepare for but with the emergence of shrinking cities in the western industrialised part of the world a sharpened awareness of reversibility has surfaced at an urban scale.

DIAGRAM, ELASTICITY

Product potential
The IDD typology is a building product designed to be competitive even in an investment environment characterized by rapid resale ratios. By aiming at the highest possible degree of industrialization components can be outsourced to multiple sub-contractors each specialized and competitive in their field. The building budget can easily be trimmed and optimized by the systematic overview of the component deliveries provided by the assembly systematic. Because of the wide spectrum of possible configurations and customizations offered by the IDD concept, it has an equally broad scope of market potential. The building logistics of IDD, implies a high degree of prefabrication and fast mechanical assembly, which shortens the construction period and in turn results in less construction expenses, shorter construction loans and faster returns on investments.

Development platform
IDD is like a paper doll consisting of a structural platform and numerous applications. The platform itself might be an anonymous, low profiled building system or it might be visually significant through its connection details. Any reversible building system might be used and the choice of system for the platform may vary according to market conditions and regional tradition. Steel, concrete and cross-laminated wood or any hybrid will all comply with the static requirements and thus the structural and spatial principles of the IDD concept are not only a constructive platform but also a typological framework within which innovative technical solutions and a specific architectural identity can be developed.

Component development
The intermediary console element connecting the skin layer with the structural layer occupies a special position in relation to product development. As a new component typology introduced to enable change it can be developed into an evolutionary multitude of specific solutions – not unlike classical building typologies such as the chimney, the eave or the plinth. Similarly, it might be expected that the design of application elements will meet the need for easy coupling with the intermediary consoles – directly by integrated coupling devises such as profiling and reinforcements or indirectly by means of secondary intermediary components such as brackets.

ILLUSTRATION, CONSOLE DEVELOPMENT

Drivers
The IDD concept is a silent revolution nurtured by already existing possibilities and terms. The further technical evolution will be driven by market demand. The cultural evolution will be driven by curiosity, experience and feedback and in this way a dynamic building culture will emerge in a shuttle between user habits and technical facilities. A supporting network of not yet existing contracting industries are likely to appear to solve tasks such as material recycling, storage, servicing and managing building upgrades and transformation. Innovative components, products and logistic systems might be expected to emerge as well in the wake of the success of the IDD building typology.

1.Schmidt III et al, 2010
2.Brand, S.: How Buildings Learn, Penguin London 1994

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www.vandkunsten.com
www.adaptablefutures.com