could advance to absorb the responsibilities and demands we associate with architectural discipline. These accidental hiccups on the grassy patches outside buildings are only a glimmer of the diverse constructs and worlds to be devised.

These pools are chemical particles and waves of frequencies that produce a viscous volume of disparate materialities, designed to work in parallel with each other. They are designed pockets of coursing energy fields that structure and organize space as well as create and hold their own aesthetic proclivities. The characteristics of pools differ from our association of interiority and rooms in which geometric form and surface are used to demarcate on which side of that condition the body resides. The creation of an architectural pool is formed from gradient intensities that do not produce the same dichotomy. The physical properties of the material energies that construct these spaces consist of their own strengths and limitations, which inform their abilities, size, shapes, and aesthetics of the spaces they produce. The extent of a room's size is no longer defined by the extent of spans, shaped enclosures, or apertures in surfaces that provide access and light. Lines and surfaces therefore do not act as the primary means for defining spatial edges; instead, currents and points of intensity overlap to demarcate edges and thresholds that redefine architecture's existence.

The attempt here is to do more than simply "condition" exterior spaces, or produce recognizable climates. Engaging these "active contexts" as pools is not a reconstruction of an understood climatic ideal. These pools of design seek not simply to move activities and events associated to the interior and displace them to the "outside," but also to acknowledge that such a discussion will have fundamental repercussions on the social experiences as well as the definitions of these programs. The intention is to seek new territories of design, texture, and social interaction—to tease out the spatial and social implications that arise when "walls" and "geometry" are no longer our primary means of spatial organization. The context that our bodies move through daily is material ready for our design engagement, a site of action, of nuanced materialities that are now only lumped into a single category of energy, not recognized for the opportunities they present.

As we approach architecture as an active context, we enable projections and speculations of how these typologies of space will become the catalysts for seeking new spatial boundaries that inform organizational activity and social engagement. Our architectural spaces will consist of these active contexts that our bodies will experience, encased within gradient energy boundaries that course around us directing and informing our spatial surroundings. They need only to be embedded with the responsibilities we now associate with geometries. To do this, the active context needs to amplify the existing energy systems we are already commonly aware of, heightening them to become architectural materials and buildings blocks. As material energies, they will construct an active context into architecture, define the boundaries of movement, and absorb the spatial loads that currently rely solely on geometries and surfaces.

ACKNOWLEDGMENTS

This paper is an excerpt from a chapter of the same title in a forthcoming book called The Air on Other Planets.

REFERENCES

Berkes, H. (2008). China's Olympic Swimming Pool: Redefining Fast. NPR, August 10. http://www.npr.org/templates/story/story.php?storyId=93478073.

FINA, Federation Internationale de Natation. (2010). FINA Requirements for Swimwear Approval. http://www.fina.org/H2O/docs/rules/SWIMWEAR_APPROVAL_from_01012010.pdf.

Holmyard, E. J. (1931). Makers of Chemistry, 121. Oxford: Oxford University Press.

Kuhn, T. S. The Structure of Scientific Revolutions, 52–55.

NOVA. Discovering Air. http://www.pbs.org/wgbh/nova/everest/earth/air.html.

Sloterdijk, P. (2009). Terror From the Air. Semiotext(e).

SMART DISASSEMBLIES:
OR, HOW I LEARNED TO TAKE THINGS APART

Thomas Kelley
University of Illinois at Chicago

Sarah Blankenbaker
University of Illinois at Chicago

ABSTRACT

Taking things apart is easy. How something works, or even what it is, is irrelevant to its dismantling. If assembly can be perceived as a rational act, then disassembly is certainly its counterpart: an intuitive, foolproof, and mindless errand of the seemingly curious subject. It is in this unflattering description, however, that disassembly warrants an analysis of its smart potential

Smart Disassemblies locates the exploded view drawing, a representation that conveys the instructions for assembly, within its architectural legacy, from its origins in the Renaissance to its more contemporary appropriation by Thom Mayne and Daniel Libeskind. The categorical rules, and the part-to-whole relationships they imply, gleaned from these precedents are then subverted toward the end of disassembling an object. The proposed rule sets (Point of Explosion, Point of View, and Explosion Sequence) and their variants are tested through their application to a complex assembly of objects, a jazz quintet.

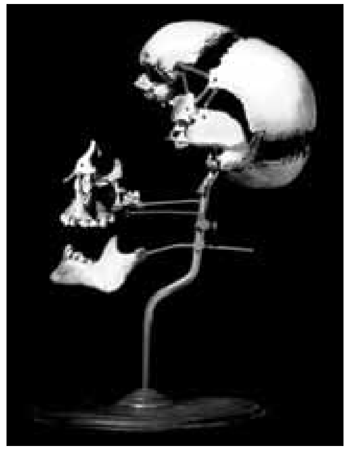


figure 1

figure 2

1 PREFACE

1.1 The Act of Disassembly

Taking things apart is easy. Unless you are handling explosives, you do not need to know how something works to take it apart. In fact, you do not even need to know what something is to take it apart. If assembly can be perceived as a rational act, then disassembly is certainly its counterpart: an intuitive, foolproof, and mindless errand of the seemingly curious subject. It is in this unflattering description, however, that disassembly warrants an analysis of its smart potential.

Disassembly aims to understand the singular and composite forms of the parts when displaced from the whole. Prior to disassembly, the whole is perceived as perfect and carries with it a set of intentional part-to-part relationships that comprise the physical makeup of the object in question. However, as the first part is separated from its whole, both part and whole become incomplete, dysfunctional, and fragmented. The whole is broken like a shattered skull, and the farther parts get from their original position, the more autonomy is gained from the whole.

At this point, neither the part nor the whole perform normally. Once their union explodes, the larger whole function is subsumed by local-formal relationships. The whole's functional past is of no concern to the broken mess of parts. As the distance grows and the orientation changes from the point of explosion, both false and strange appearances begin to emerge. "The only thing broken is a certain type of expectation that we have," writes geometer and historian Robin Evans on the topic of breakage and fragmentation that can incite new histories (Evans 1995). He cites Braque's paintings, in which enormous physical forces have been unleashed upon large subjects, resulting in the collapse of fractional and total organizations, as a testament to a revised legibility in modern art.

A smart disassembly inverts expectations, in so much as parts are no longer tied to their whole once functional alignments have been reoriented in space. Although the parts themselves do not alter their geometry, the translation that occurs in disassembly repositions both legibility and intention. The original object submits coherence in favor of a Cubist's sense of simultaneity. Disarticulation, or the separation of parts at their joints, introduces the notion of a calibrated technique that coats precision with an affect of intuition. While Cubism's affection for the fragmentation of modern culture offers one interpretation of disassembly, it is the inventions of the Renaissance that make comprehensible both the representation and reading of part-to-whole relationships.

1.2 The Exploded View Drawing

During the Renaissance, many graphic inventions were designed to emphasize part-to-whole relationships, especially when conveying the intricacies of mechanical devices and human anatomy.

Although orthographic projection was commonplace in organizing these complex sets of relationships, the ability to convey multiple layers of assembly required more nuanced techniques for drawing.

The exploded view is a "three-dimensional illustration that shows the mating relationships of parts, sub-assemblies, and higher assemblies" (Walton 1965). Today, we are familiar with this technique through BIM modeling software and patent drawings, where style gives way to legibility. This type of comprehensive graphic description argues for visual coherence while prompting the viewer to engage a set of mechanical, structural, or formal part-to-part relationships. In the case of Morphosis' 2-4-6-8 House Parts Drawing from 1978, arguably one of the most canonical exploded view drawings in recent times, the goal was to detail "each aspect of its construction in a form any layperson could comprehend"(Morphosis 2012). The drawing achieves its goal through a multi-axial explosion of wall, roof, and floor types emanating from the center of a cube. The immediacy with which the drawing is understood illuminates a desire to maximize accessibility.

In stark contrast to the Morphosis drawing is Daniel Libeskind's Micromegas series. While not explicitly described as an exploded view, the drawings suggest an opposite intent. Through the use of multiple projection types, a compilation of descriptive geometry, and superimposed axonometric projection, the parts coalesce to produce an erratic formalization. The drawing provides no fixed viewpoint and loosely distributes hierarchy across the frame. There is no trace of a previous whole, nor is it clear if the drawing is complete.

Although the two examples are antagonistic to one another, each drawing presents a set of rules from which to unpack the exploded view and unravel its potential as a tool from which to incite new part-to-part relationships and a revised definition of visual coherence, formal legibility, and simultaneity.

In the subsequent diagrams and text, we aim to outline the three most salient variables of the exploded view drawing. The rules are as follows:

Rule 1: Point of Explosion
Rule 2: Point of View
Rule 3: Explosion Sequence

By no means should the rules be read as truths; rather, they should be read as a set of new circumstances, which err on the side of visual clumsiness, and from which to question the exploded view's ability to provide designers with a renewed appreciation for the smart disassembly of parts.

2 RULES

2.1 Point of Explosion (Generic) : *Exponential Autonomy*

The exploded view technique begins with an explosion that emanates from the center of an object. The point of explosion, however, is variable and may emanate from one of the three following points: center, part, external. From each distinct point of explosion comes a new set of expectations. The cube is no longer defined by symmetry, nor by its balance of 6 faces, 12 edges, and 8 vertices. As parts move farther away from an explosion point, the autonomy of the part from the whole increases exponentially (Figures 1–4).

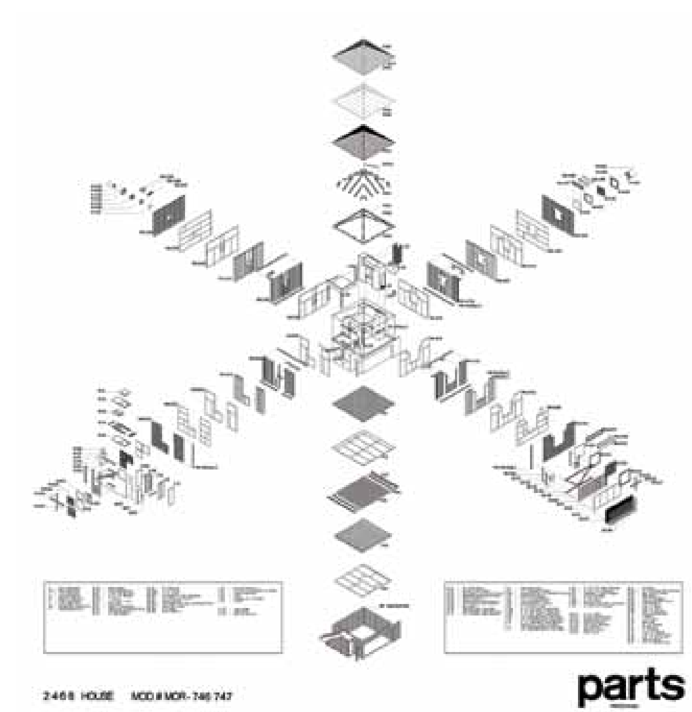


figure 4

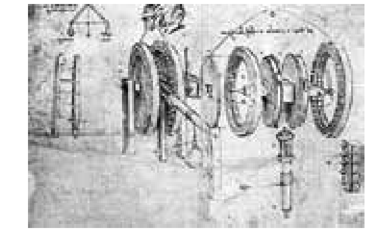


figure 3

figure 1

Richard Barnes Skulls depicting Humans and Animals-2006. 24x20 each image C-type digital photographs.

http://www.clarkgallery.com/artists/richard-barnes

figure 2

George Braque. Violin and Candlestick. 1910. Oil on canvas, 24 in. x 19-3/4 in. SF MoMA, San Francisco.

http://www.sfmoma.org/explore/collection/artwork/89#ixzz266hTKucp

San francisco Museum of Modern Art

figure 3

Leonardo da Vinci, [Reproduction of page from notebook of Leonardo da Vince showing a geared device assembled and disassembled].

Published in: Bruno, Leonard C. The Tradition of Technology: Landmarks of Western Technology in the Collections of the Library of Congress (Distributed for the Library of Congress). (Washington DC, Library of Congress, 1995).

figure 4

Morphosis 2-4-6-8 House Parts Drawing, 1978. Image courtesy of Morphosis Architects.

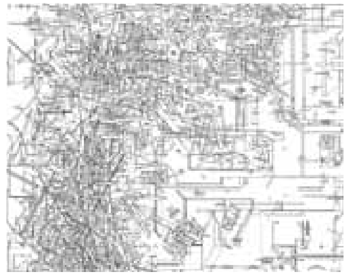


figure 5

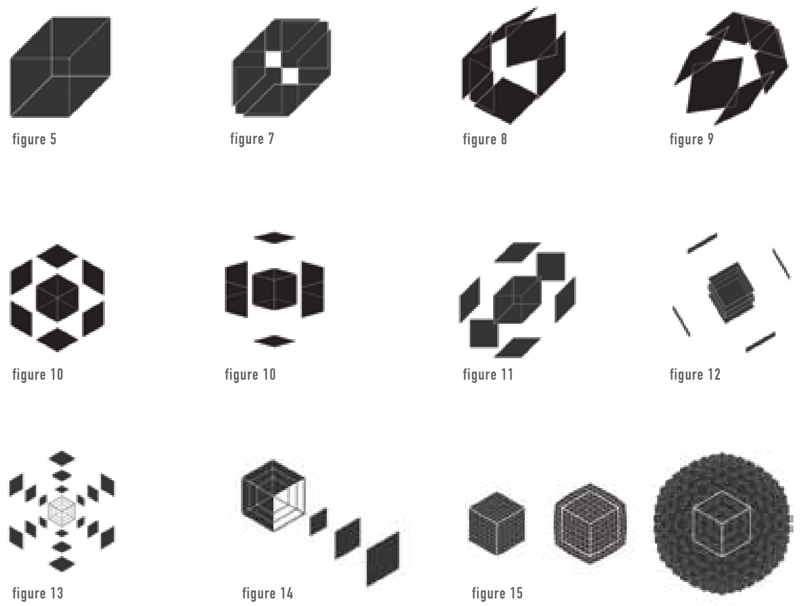


figure 5
Daniel Libeskind, Micromegas. Image courtesy of Studio Libeskind.

figure 6
Dimetric (15-degree).

figure 7
Elevation oblique (35-degree).

figure 8
Trimetric.

figure 9
X, Y, Z (equidistant).

figure 10
One-sided.

figure 12
Typical.

figure 13
Center.

figure 14
Part.

figure 15
External.

2.2 Point of View (Generic) : *Privileged Symmetry*

Typically the projection of parts in an exploded view is illustrated from above and diagonally from the left or right side of the drawing, thus allowing for all parts to be visible and equidistant from their point of explosion. The view is not limited to a parallel projection, and often can include a perspectival view. For the purposes of this analysis, the exploded view technique has been focused on four axonometric projections, each one maintaining the measurability of the initial object's dimensions. Even though the object retains accurate dimensionality post-explosion, the overlapping of parts in some cases, and the retention of symmetry in others, suggests that certain objects privilege distinct parallel projections. The four axonometric projections include isometric, dimetric, oblique, and trimetric (Figures 5–8).

2.3 Explosion Sequence (Generic): *Descriptive Manual*

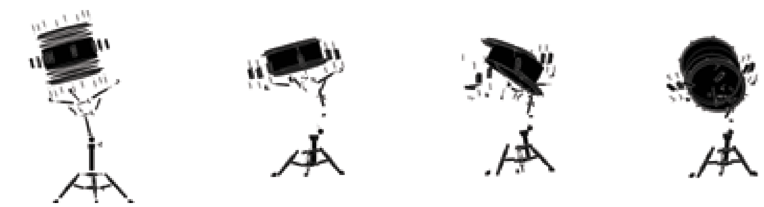
The sequence by which parts are exploded is integral to a revised legibility of the whole. In mechanical systems the components on the outside normally get removed first. The logic of sequence, however, is subsequent to rules 1 and 2. The first two figures respect the logic of assembly in that no parts overlap, parts are removed at equidistant intervals from the point of explosion, and most importantly, each part is translated (not rotated or scaled) away from the whole (Figures 9 and 10).

The last figure illustrates a concern for disarticulation: the surfaces of the cube have been subdivided into a finer collection of smaller planes (Figure 11).

As the parts move away from the whole's centroid, the whole begins to exert unfamiliar shape characteristics to the X, Y, Z (equidistant) original cube. This technique is akin to Jesse Reiser's notion of the generic collage, where an unchanging unit gets deployed along a variable trajectory. He writes that space here is one of ubiquitous difference rather than of a fixed and unchanging background (Reiser 2000). The sequence proves false in terms of understanding the whole, but true in the sense that the subdivision of faces can produce new readings based on higher levels of disassembly.

3 CASE STUDY

3.1 Point of Explosion (Figures 12–15).



3.2 Point of View (Figures 16–19)

3.3 Explosion Sequence (Figures 20 and 21)

3.4 Two Explosions: *Kapow! Series*

The Kapow! series is a meditation on arrhythmic composition. Illustrated in 45-degree oblique projection, each drawing is comprised of five instruments (grand piano, drum kit, ¾ bass, tenor saxophone, and trumpet) that have been exploded according to a set of variables typical to the exploded view drawing: 1) point of explosion, 2) point of view, and 3) explosion sequence (or distance from an explosion point). Rather than serve as an assembly guide, a diagram of part-to-whole relationships, or a fetishization of the tectonic objects represented, the series loosens its parameters in favor of apparent imprecision and clumsiness, and consequently, new spatial arrangements (Figures 22–26).

REFERENCES

Evans, R. (1995). The Projective Cast: Architecture and Its Three Geometries. Cambridge, MA: MIT Press.

Morphosis. (2012). 2-4-6-8 House. Accessed February 7. http://morphopedia.com/projects/2-4-6-8-house.

Reiser, J., and N. Umemoto. (2000). Atlas of Novel Tectonics. New York: Princeton Architectural Press.

Walton, T. (1965). Technical Data Requirements for Systems Engineering and Support. New Jersey: Prentice-Hall.

figure 16
Isometric (30-degree dimetric).

figure 17
Dimetric (15-degree).

figure 18
Elevation oblique (45-degree).

figure 19
Trimetric.

figure 20
External, equidistant.

figure 21
External, non-equidistant.

figure 22
Jazz quintet, starting position, plan.

figure 23
Explosion 1, plan.

figure 24
Explosion 2, plan.

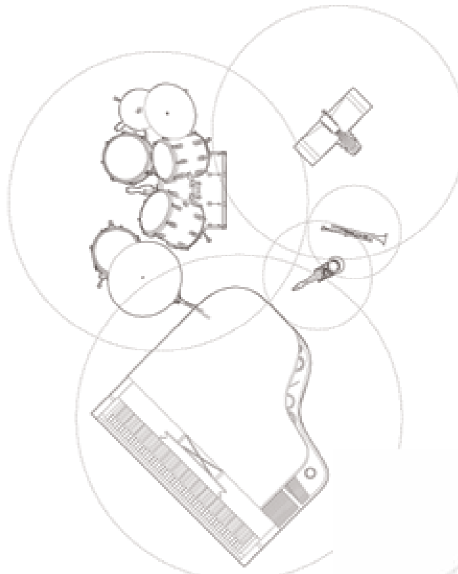


figure 22

figure 23

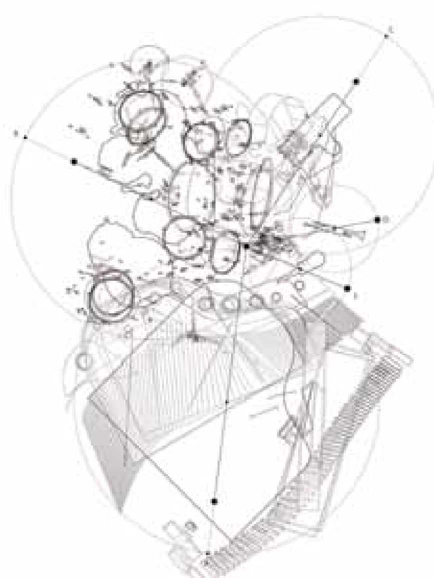


figure 24

figure 25
Explosion 1.

figure 26
Explosion 2.

figure 25

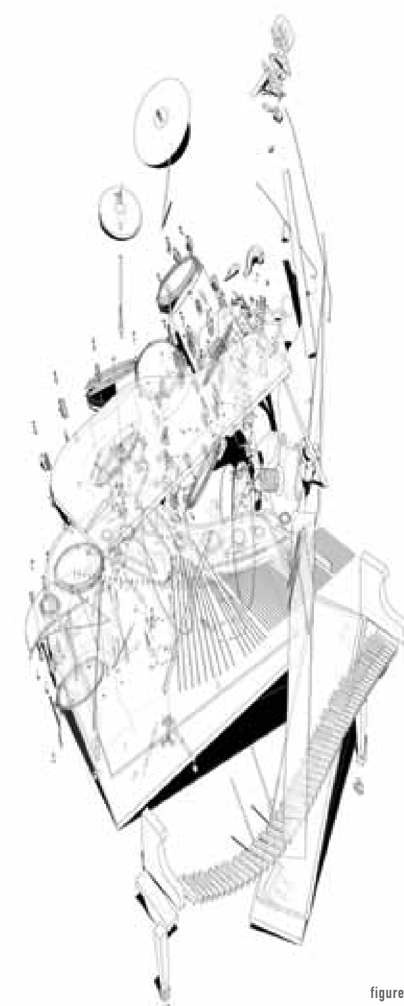


figure 26