

AMU



House / Casa / 住宅

Series:

The Home of the Future

Kent Larson

Part A: Scenario, Creating a Home in the Future

The home industry may look something like this in a few years: By 2015, savvy well-capitalized companies from outside of the housing industry have taken over the market, and speculative developers have all but vanished. A young couple looking to build a new home begins the process at one of a number of internet home sites, where they play design games and select from options presented to them. As the system begins to understand their needs and values, proposals are produced for their evaluation - which then, in turn, leads to additional designs.

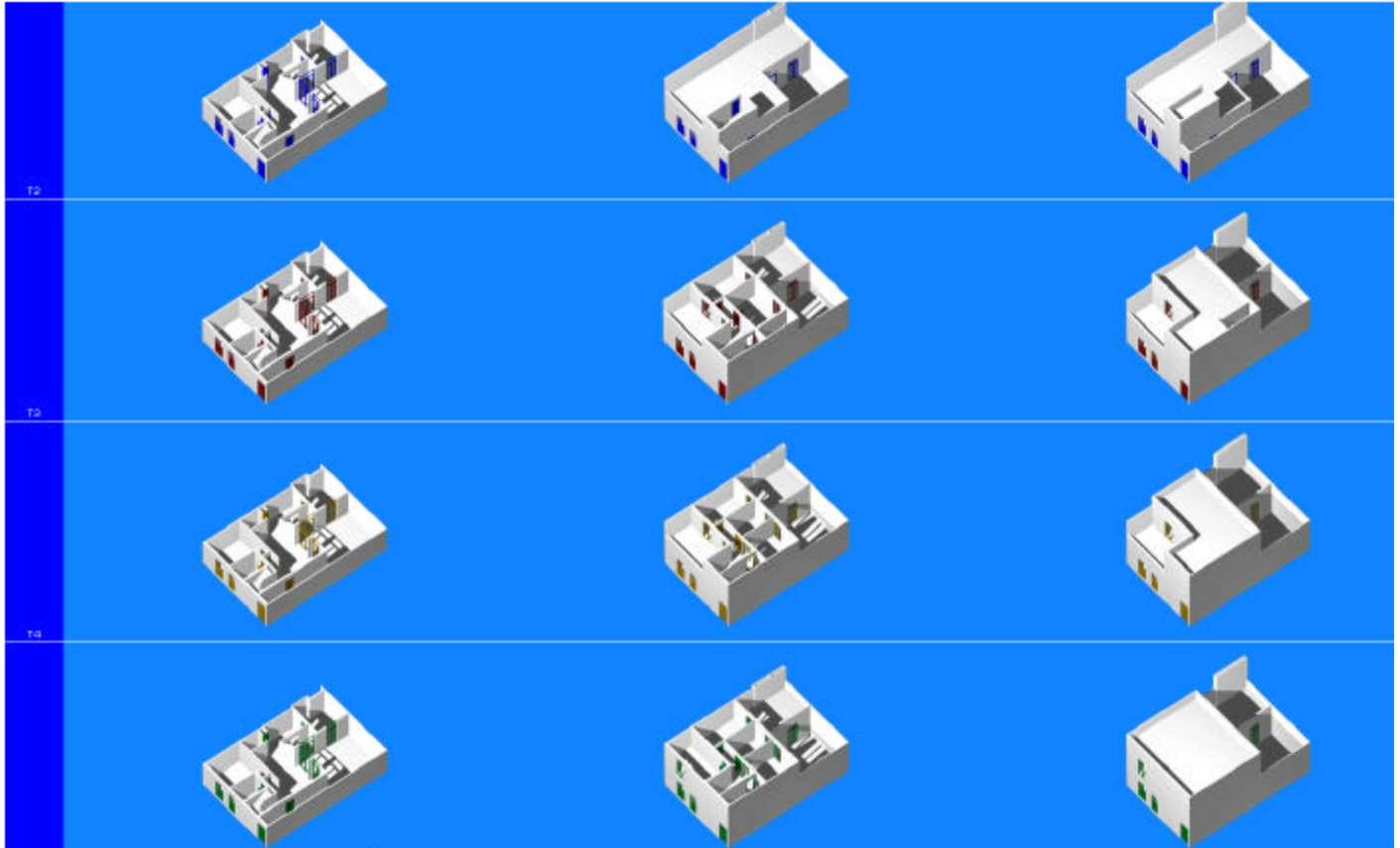
In the process, they find that there has been an explosion of creative activity as dozens of young architects and industrial designers develop and license systems to integrators - based on new industry-wide standards for both physical building components and digital technologies. Systems from one manufacturer are now interchangeable with another, similar to what evolved in the PC industry twenty-five years earlier. They learn that Ikea Systems has expanded their kitchen and home furnishing product line to include low-cost kit home components with Scandinavian detailing and energy saving technologies; BMW has developed sleek, modernist, high-tech house components made from no-maintenance, high-performance composites and metals; and Home Depot and Martha Stewart have partnered to offer fully furnished reproduction historic homes.

At each step of the process, our couple investigates spatial configurations and options for lighting, finishes, appliances, energy producing components, and a whole host of new technologies - making choices that take them closer and closer to their ideal. For several weeks, the couple spends hours each evening in their living room discussing alternatives and exploring the wealth of information available to them.

With a limited budget but unwilling to compromise on quality, they finally settle on a small, compact design strategy developed by an Australian architectural firm with cleverly conceived transformable and multi-use spaces using BMW parametric components. For example, they select options for the conversion of the husband's office to a formal dining area for the parties they will host every few months, and also to a guest suite with fold-down bed for the occasional overnight visitor. They preplan a series of additions they intend to make over time as the size of their family and income increases. They also attach an efficiency apartment for the wife's frail mother, signing up for a \$49.95 per month, 24-hour health monitoring service by HomeBiometrics.com™ that includes a host of robotic assistive devices that will help her live independently.

Ordering their home is no more difficult than buying an automobile on-line. Behind the scene, software agents have already negotiated with lenders, installers, and energy and service providers, allowing the couple to precisely determine their total

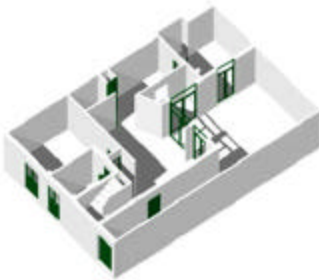
- Corpus
- Introduction
- Designs
- Layouts
- Subtypes
- Ab
- Ac
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- Variations
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Subtype Bb T5 - Derivation

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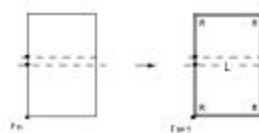


Functional Organization



Grammar Rules

Stage: Defining 1st floor
 Step: Creating openings
 Rule: Introducing openings



DEFINE 1st FLOOR

LOCATE FUNCTIONAL ZONES
 Locate outside / inside zones

Locate passage

Locate living / sleeping zones

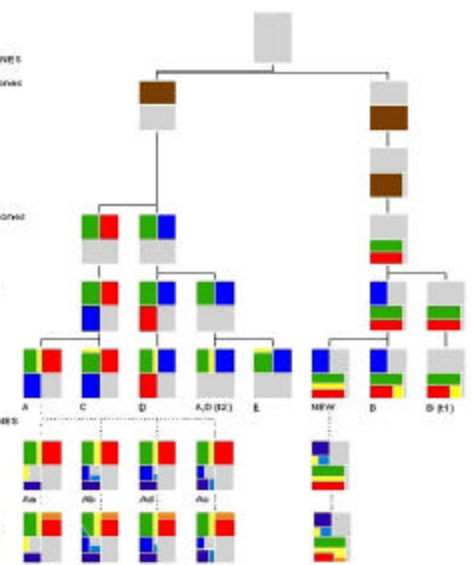
Locate remaining zones
 Basic Pattern defined

LOCATE STAIRCASE
 Type defined

DIVIDE FUNCTIONAL ZONES

Divide service zone
 Subtype defined

Divide remaining zones
 Basic layout defined
 (functional organization)



monthly cost. Rejecting lease options, they choose a twenty-year mortgage with a twenty-year warranty and upgrade package with regularly scheduled maintenance. The shrink-wrapped, digitally tagged house components arrive on their site four weeks after ordering, and three installers connect the pieces together using conductive, industrial Velcro fasteners. They move in two weeks later.

Living in their new home takes some getting use to. With sensor arrays and digital displays embedded into most surfaces, the home begins to discover their patterns of activity and tries to anticipate what they might need or want. At first, it gets it only about half right, but within several weeks it begins to fit like a glove. It adjusts the ambient light for reading a book in the afternoon, keeps tuna fish on hand in the pantry, monitors their nutrition, and suggests new films that they may enjoy. It becomes a companion of sorts.

Part B: Assessing the Vision

How realistic is this scenario? If it seems farfetched, this is only because the housing industry is years behind others in transitioning to the information economy. Compare the housing industry to others:

Most major companies outside of housing compete internationally, with innovation on one side of the globe instantly rippling across to the other. New materials, technologies, and processes are adopted in just months. Industrial behemoths have become lean, agile, integrated, and digital - they tap information in real time In housing, competition is primarily local, processes are labor intensive, and innovations take an average seventeen years to find their way into homes. More sophisticated technology is found a \$39.00 Furby doll than in many new houses.

We assume that this year's cell phone or disk player is dramatically more useful, higher quality, and less expensive than last year's. Customers are demanding more for less from their products - and getting it Except for the vanishing small percentage of homes designed by architects for individual adventurous clients, the U.S. housing industry produces variations of the same low-grade, standard product that it has been making for the past 50 years. There is a perception that housing gives you less for more with each passing year.

Companies making products from cars to clothes have become customer-centric, selling lifestyle and fantasy. Whimsy and pleasure are often as important as function and features. Many have "disintermediated," cultivating a relationship directly with consumers. The Ford Motor Company has decided that Fordism is outdated, with "mass-build-to-suit" to replace mass-production for the customization of cars in the future. Sophisticated companies are selling services, systems, and experiences - not commodities Speculative homebuilders still market a handful of "one-size-fits-all" commodities on a take-it-or-leave-it basis. Rather than helping to create experiences and pleasure - a stage set to play out one's life - developers are creating mostly banal boxes.

New Rules of the Game

But the rules have recently changed in the housing industry, creating risks for companies stuck in the old ways and extraordinary opportunities for those who know the new game: 1) the internet, information technologies, and powerful computation have created a new alternative to factory or site-built mass-production models: mass-customization, 2) labor-intensive, site oriented processes are increasingly unworkable in a hot economy where skilled labor is expensive and scarce, 3) sophisticated technology/service companies have identified the home as a huge potential market, and are looking for avenues for entry - often requiring new ways of designing and building, 4) demographic changes have made the "Ozzie and Harriet" suburban family stereotype apply to only about 7% of U.S. households, making the old single-template model of housing unworkable for a large segment of the population, and 5) the baby boomers are beginning to demand more choice and a greater level of sophistication in housing than did the generation before.

Boomer Market Forces

The baby boomers, born between 1945 and 1965, control much of the wealth in the U.S. and are the largest purchasers of new homes. Their values are very different from those of their depression-era parents who accepted mass-produced homes. Market studies by AARP Research, Roper Starch, and others reveal that boomers are sophisticated consumers who want choice and tailored solutions that closely reflect their values. They are a diverse group who reject the "one size fits all" model. They want homes that can accommodate increasingly complex family activities and work patterns. They want environments that can easily adapt over time as family/financial/health situations change. They want their homes to help them remain productive, connected, healthy and autonomous as they move into retirement. They have ever increasing expectations of the products they buy and want to be assured that they are getting value for their money. They expect full disclosure and immediate information. They want low maintenance materials, systems that can be upgraded without disruption, and houses that can readily accept new technologies and services. It is difficult to find even one of these attributes in the generic, mass-market, low-tech offerings of speculative housing.

Post-Industrial Design and Construction

Many of the design and construction tools that make up the scenario presented above are actively under development. For example:

Automated Design Tools. The economics of professional practice have prevented architects from having any meaningful role in the design of most houses and housing. That could change if architects begin to focus on the far more challenging task of creating agile and customizable architectural systems and strategies - where success is measured according to how effectively different but fully coherent solutions can be created. Work is now beginning at MIT to develop automated design tools that 1) encode into rules high standards of practice (from universal design principles to energy conservation design), 2) define as rules multiple architectural design strategies or visions through the use of shape grammars and parametric design, 3) remotely decipher and evaluate personal values and programmatic requirements 4) generate multiple, coherent, tailored design solutions for evaluation by an individual homeowner, and 5)

provide people with the information and visualization studies they need to make informed decisions regarding budget, spatial configurations, finishes, direct and ambient light, comfort, energy consumption, technology options, and life-cycle costing. Ironically, the automation of design could finally bring the art of architecture into the places where most people.

Component-Based Mass Customization of Housing. Automated design tools will be particularly useful when linked to automated manufacturing. This will require the home to be made up of manufactured components integrating structure, finishes, communication, power, embedded sensors, etc. Components should be rapidly locked together on the site with little skilled labor. CNC (computerized numerically controlled) machines have become common in many large millwork and metal plants, allowing unique components to be manufactured as efficiently as identical units. The manufacturing infrastructure is largely in place - even if it has not been widely tapped for residential construction. Controlled and precise fabrication of integrated components will more easily allow new materials such as advanced polymers, composites, and special-purpose metals to find their way into the home. It will also permit the low-cost embedding of delicate electronics and devices into the fabric of the environment.

Open Architectural Standards. Just as competitors in the computer industry have adopted universally accepted standards that yield great diversity, a component-based approach to architecture will require standards for protocols, infrastructure and connections. Whereas many in the past have developed proprietary single-factory approaches, Universally accepted, coherent, open architectural standards would allow for diverse companies to compete head-to-head for the loyalty of customers. This will foster desperately needed innovation in the housing industry. Discussions are now beginning to take place to define these standards.

Integrated Technologies

Many of the technologies that are hinted at in the above scenario are also under development. For example:

Integrated Information and Communication Technologies. Many major building material manufacturers have prototypes that integrate low-cost sensors and energy producing elements into materials, and are only waiting for applications and market demand. The Internet is leading to an explosion of new services for the home, but the potential of this technology is limited if not fully integrated into the environment. With economies of scale, the cost of embedding sensors ranging from heat and humidity detectors to miniature cameras into architectural components will likely approach the negligible - as is evident in the toy industry. This will make practical a home where structure, enclosure, and finishes contain devices that continuously measure the state of the physical world - finely tuning it to maximize energy conservation, energy production, etc. Low cost output devices such as large displays and projectors will provide feedback to users wherever and whenever they need it in the home, simplifying connection to the digital world.



Environments Responsive to Its Occupants. Future-thinking physicians are beginning to realize that twenty-four hour, non-invasive biometric tracking of the well being of people in their own homes may revolutionize the practice of medicine. Health-related infrastructure in the home may make possible for the first time effective preventative medicine, helping doctors to monitor health, exercise and nutrition, and to identify potential problems before they become critical. Ultimately, monitoring algorithms in conjunction with medical knowledge-base information systems may make preventative medical care low-cost and ubiquitous. Arrays of sensors embedded in the environment and miniature wearable computers will simplify the task of obtaining data about the activities of people. Using computational reasoning and pattern recognition techniques, this sensor data can then be used to compute what the people in the space are currently doing. By monitoring what people typically do, it then becomes possible to predict what they might do next, enabling imaginative new products with comfortable, natural, and easy-to-use interfaces that bridge the digital and physical domains. This will give biometric data the necessary context for accurate interpretation, and allow the home to begin to anticipate needs and desires. Eventually, sophisticated systems will be self-programming, with the environment melding ever more intimately with the individual over time.



Environments Aware of Objects. Many large producers of consumer goods are actively working on a transition from the bar code (UPC) to low cost radio frequency identification tags placed on every product we buy. Standards for the electronic product code are now being developed at MIT. In just a few years, most objects entering and leaving the home will be recognizable by

low-cost sensors embedded in architectural components. At least one manufacturer has developed a prototype for low cost tags readers embedded into counter top laminates, with the idea that all horizontal surfaces in the home may eventually incorporate object sensors. Such infrastructure will make possible continuous and unattended inventory of objects in the home, automated reordering of commodities, appliances that interact with objects and connect to the manufacturer's website for optimized control, low cost robotics systems designed to interact with tagged objects, digitally mediated medicine dispensing, and automated routing of goods from factory to warehouse to kitchen cabinet. This new infrastructure could spawn dozens of new enterprises providing new products and services to the home.