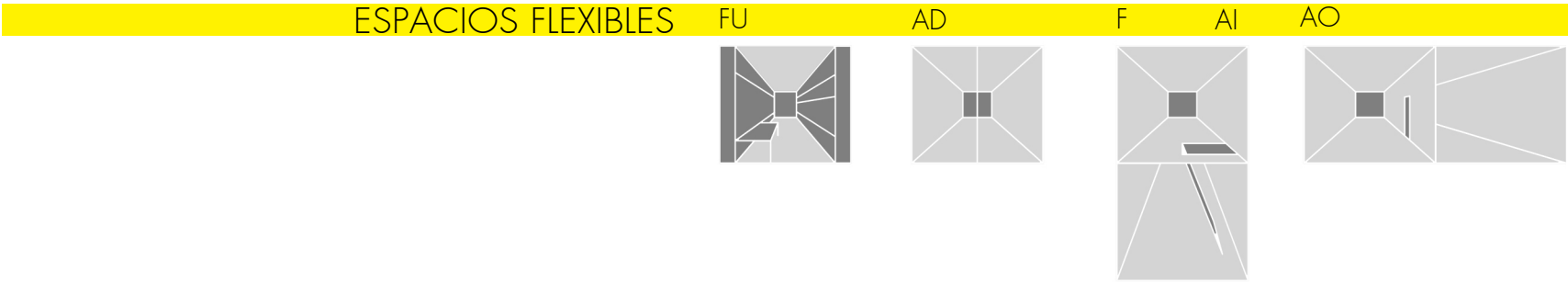


Estrategias para el diseño de



ESCUELA TÉCNICA
SUPERIOR DE
ARQUITECTURA

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PALABRAS CLAVE:

Flexibilidad, espacio, movilidad.

RESUMEN:

La flexibilidad en arquitectura reflexiona sobre la vida útil de una edificación y sobre la variedad de funciones que las personas pueden cambiar a lo largo de este tiempo. El concepto del espacio flexible puede resolver todos los aspectos que conlleva un proyecto arquitectónico. Los arquitectos deberían de tomar la flexibilidad como una opción para diseñar espacios más adaptables y concienciados con el paso del tiempo. Este trabajo busca las posibles técnicas de diseño que permitan el espacio flexible. Son cinco: Flexible, Add on, Add in, Adaptable y Furniture. En cada estrategia, se describen proyectos para estudiar la aplicación de cada uno en una situación práctica. Como resultado, se clasifican dos tipos de maniobras: En primer lugar, Flexible, Add on y Adaptable que son las más adecuadas para resolver un proyecto de gran escala debido a la complejidad de la solución, por ejemplo una estructura reticular o un sistema de paneles móviles para la distribución interior; En segundo lugar, Add in y Furniture son complementarias a las anteriores. En conclusión, se demuestra que la flexibilidad es una herramienta real para realizar cualquier proyecto y por este motivo se facilita una guía para aplicarla.

KEYWORDS:

Flexibility, space, mobility.

SUMMARY:

Flexibility in architecture reflects on the time of a building and the variety of functions that people can change it during all this time. Also is the idea of a concept that solves all the problems that an architecture project can get it. Architects should take flexibility as an option to layout spaces more adaptable and conscious about the time. This research searches possible architecture techniques that carry out the flexible space. There are five strategies: *Flexible*, *Add on*, *Add in*, *Adaptable* and *Furniture*. In each strategy, it is investigated cases to study the application of each one in a practical situation. As a result, it is classified two types of strategies: Firstly *Flexible*, *Add on* and *Adaptable* are the best ones to solve a large-scale project because of the complexity of the solution like a reticular structure or a system of mobile panels to layout an interior distribution; Secondly, *Add in* and *Furniture* are complementary solutions of the others. In conclusion, it is demonstrated that Flexibility is a real tool to make any project and it is provided a guidance to apply it.

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1. INTRODUCCIÓN

1.1 Objetivos y método del trabajo

El propósito del trabajo es manifestar que la flexibilidad es un instrumento de proyecto capaz de resolver el planteamiento de un proyecto arquitectónico. Se comienza realizando un análisis en el tiempo de distintas técnicas de proyecto en las que la principal directriz es la flexibilidad espacial. Normalmente la concepción de la flexibilidad ha estado asociada en mayor medida a la tipología residencial. En 1973, Andrew Rabeneck, David Sheppard y Peter Town ya recopilaron una serie de proyectos residenciales donde el motivo principal era la flexibilidad que aportaban sus espacios.¹ La información fue recogida en dos artículos publicados en la revista *Architectural Design*. Los casos de estudio se clasificaron por países ya que se aprovechaba para hacer en cada uno de ellos un breve análisis de cómo el concepto había sido aplicado y transmitido en cada lugar.

A partir de este arranque, resulta imprescindible recabar información de otras tipologías edificatorias. Por consiguiente, un proyecto flexible requiere de una serie de procedimientos para el diseño de los espacios que se desarrollarán a lo largo del trabajo. Se decide diferenciar cinco tácticas: Flexible, Add on, Add in, Adaptable y Furniture. Además se ahonda en mostrar qué fórmulas se han podido efectuar

para distintos modelos edificatorios. De esta manera, se consigue tener una visión más global del fenómeno. En última instancia, se quiere hallar la validez de los métodos para poder aplicarlos en según qué función. Dentro de cada maniobra se muestran una serie de casos de estudios ya que resulta necesario ver cómo las técnicas de diseño se aplican a la práctica. Se catalogan en dos periodos, antes de la década de 1970 y posterior hasta la actualidad. Asimismo se clasifican en casos de vivienda y en otras tipologías.

El método de proyecto se basa en un plan que se ha seguido para la elaboración del trabajo. Consta de las siguientes partes:

- Análisis del concepto de flexibilidad a través de un análisis inicial.
- Lectura de los artículos *Housing/flexibility?* publicados en la revista *Architectural Design* en 1973-74.
- Elaboración de las cinco estrategias de proyecto.
- Dentro de cada procedimiento se recopilan ejemplos prácticos clasificados en:
 - Vivienda del S.XXI.
 - Vivienda hasta 1970.
 - Otras tipologías.
- Por último, se demuestra qué tácticas se han podido llevar a otras

¹ Rabeneck, A., Sheppard, D. y Town, P. (1973). "Housing/flexibility?" en *Architectural design*, 43, p. 698-711, 717-727.

funciones y razonar el porqué.

En resumen, el trabajo busca ver la flexibilidad de la manera más práctica posible. Por este motivo, se exploran distintos patrones de trabajo y se analizan para averiguar si es posible aplicarlos en más ámbitos de la arquitectura. De esta manera, se consigue una guía de cómo podemos aplicar la flexibilidad en según qué proyecto y mediante qué estrategia se debe hacer.

1. INTRODUCCIÓN

1.2 Concepto de flexibilidad

‘Flexible: susceptible de cambios o variaciones según las circunstancias o necesidades’. (RAE)

La flexibilidad en arquitectura es la capacidad que tiene un edificio de adaptarse a distintas situaciones a lo largo del tiempo. Se pueden dar cambios de usos, cambios del número de ocupantes/usuarios o cambios de su configuración espacial. Es posible que totalmente o parcialmente un proyecto sea flexible, pero para ello tienen que cumplirse una serie de condiciones que hagan viable dicha capacidad.

Por otra parte, la reflexión sobre la flexibilidad es un tema que ha despertado mucho interés en el panorama teórico-práctico de la arquitectura desde mediados del siglo XX hasta la actualidad. Durante el siglo XX a causa del desarrollo industrial, surgieron los medios de transporte tanto de largas distancias como de cortas, como por ejemplo el automóvil. Por ello hoy en día los individuos podemos trasladarnos, cambiar de trabajo, de ciudad y de agrupaciones sociales. Asimismo, las características de la vida contemporánea como el transporte personal, la informática, los teléfonos móviles y el acceso a viajes accesibles en avión manifiestan una sociedad que se encuentra en constante cambio. Ya durante el Movimiento Moderno, la flexibilidad en arquitectura fue uno de los temas más recurrentes. En 1954, Walter

Gropius recalcó que la arquitectura necesita ser lo suficientemente flexible para contener “la dinámica de la vida moderna”.² Conjuntamente a finales del S.XX, Richard Rogers comentó cómo los edificios actuales ya no simbolizan un orden jerárquico y estático, en cambio, se han convertido en contenedores flexibles para ser usados por una sociedad dinámica.³

Con respecto a las ventajas que tienen los edificios así trazados, se muestran las más destacables: En primer lugar, se pueden usar durante más tiempo; se adecúan mejor a su finalidad, ya que albergan la experiencia y la intervención de los usuarios; también sacan partido de las innovaciones técnicas con mayor facilidad y por último, son económica y ecológicamente más viables.

2 Gropius, Walter. (Feb, 1954). “Eight steps toward a solid architecture” en *Architectural Forum*, p. 157.

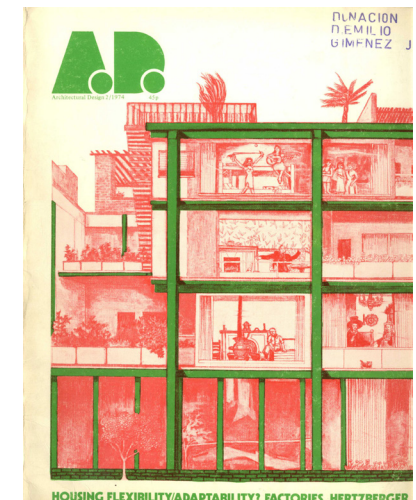
3 Rogers, Richard. (2015). *Ciudades para un pequeño planeta*. Barcelona: Gustavo Gili.

1. INTRODUCCIÓN

1.3 Evolución del concepto

Antes de desarrollar las técnicas de proyecto principales para poder efectuar flexibilidad arquitectónica, es importante analizar el desarrollo que ha tenido la flexibilidad a lo largo de la historia.

Se remarcan una serie de épocas y culturas que han tenido más presente el concepto. En primera instancia, se explora el génesis del diseño flexible en modelos de construcción tradicionales e históricos de la cultura nómada. Posteriormente se reflexiona sobre el concepto de 'lugar' que muestra Martin Heidegger y la aplicación del concepto de flexibilidad en la cultura japonesa. Por otro lado, se investiga los primeros indicios del concepto en el periodo industrial del S.XX y su influencia con el concepto de planta libre. Además se estudia cómo los años 70 del siglo pasado fueron una época que actuó como punto de inflexión en el tema ya que se recopilaron teorías de diferentes culturas y épocas. Por este motivo, es necesaria la distinción entre la época anterior a este punto y la época posterior. Para terminar, se indaga en el *open building*, movimiento actual surgido en respuesta a la arquitectura masiva de los años 60. Este grupo es el perfecto ejemplo teórico-práctico de arquitectura flexible que arriesga en estrategias innovadoras. Su propósito es conseguir esta capacidad utilizando recursos tecnológicos e industriales.



1. Portadas de los ejemplares nº43 y nº 44 de la revista *Architectural Design* (1973) donde se reflexiona sobre la flexibilidad durante la década de 1970.

1. INTRODUCCIÓN

1.3 Evolución del concepto

1.3.1 Comunidades nómadas

A lo largo de los siglos, ha habido muchas culturas que se han acostumbrado a una existencia nómada. Desplazándose con las estaciones y transportando con ellos herramientas ligeras, móviles y case- ras de múltiples usos. Por ende, surgen construcciones como respuesta a la necesidad de conseguir rápidamente un refugio que se adapte a distintos usos y climas.

Un ejemplo de vivienda móvil utilizada por las tribus indias americanas serían los *tipis*, que eran construcciones efímeras con forma cónica.⁴ Se construían básicamente con postes de madera inclinados que actuaban como estructura y además formaban un volumen cónico para protegerse de los fuerte vientos. Sobre la estructura se coloca una membrana que en muchos casos era piel de animal para utilizarla de cerramiento contra el frío y el agua. Este ejemplo de construcciones permitía a las tribus poder instalarse y conseguir un habitáculo rápidamente. Por consiguiente, este tipo de arquitecturas eran flexibles ya que basaban su diseño en la capacidad de poder adaptarse a cualquier lugar y uso.

En la actualidad, el ser humano está volviendo a su esencia más

4 Kronenburg, R. (2007). *Flexible: Arquitectura que integra el cambio*. Barcelona:Blume.

2. Construcción del *tipi* a finales del SXIX.

3. Grupo de *tipis* en Alberta, Canadá (S.XIX).



nómada ya que el modelo de vida actual se basa en el constante cambio y movimiento.

Un ejemplo muy directo de cultura nómada en la actualidad son las caravanas/autocaravanas que permiten tener un hogar y poder viajar al mismo tiempo.⁵ Se destaca que el *caravanning* en primera instancia surgió como una manera práctica de acampar o instalarse en la naturaleza. Esta solución flexible tuvo mucha popularidad en la época de los 50 y 60 tanto en Europa como en Estados Unidos. Hoy en día, en Estados Unidos sigue siendo donde más se comercializa como medio para evadirse de la ciudad.

Se trata de viviendas móviles con todo un equipamiento integrado. Este permite crear espacios flexibles ya que la mayor parte de este equipamiento está colocado en el contorno dejando un espacio central libre para cualquier uso. También existe la posibilidad de que parte de este equipamiento se despliegue como por ejemplo una mesa para comer o una cama.



4. Caravana de los años 30.

⁵ Montey, X. y Fuertes, P. (2007). *Casa collage : un ensayo sobre la arquitectura de la casa*. Barcelona: Gustavo Gili.

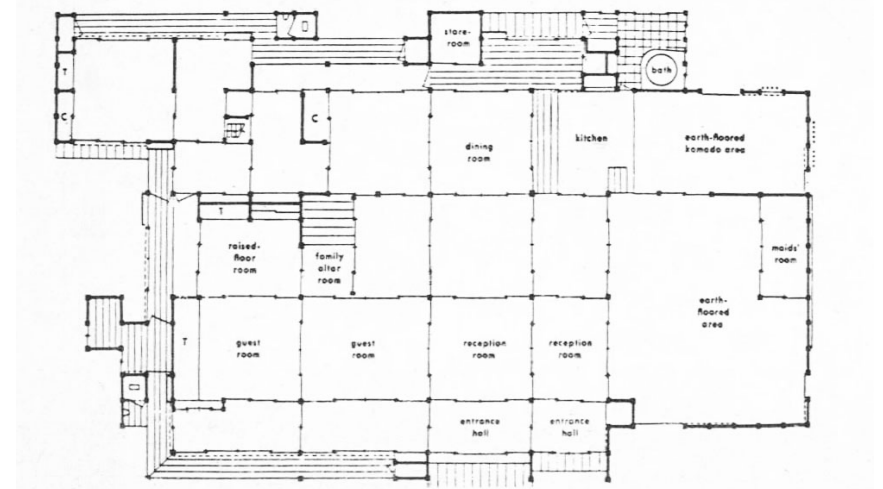
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1.3 Evolución del concepto

1.3.2 Japón y concepto de "lugar"

Previamente a profundizar en la relación entre la cultura japonesa y la flexibilidad, sería conveniente nombrar al filósofo alemán Martin Heidegger que sostiene que los lugares empiezan a existir por algo más que el simple hecho de construir.⁶ Por lo tanto, a raíz de esta reflexión podemos deducir que cualquier hecho como cambiar los muebles de nuestra habitación o cambiar la distribución de una vivienda puede cambiar totalmente nuestra noción del espacio, es decir, del lugar. Es interesante este concepto de lugar ya que en correspondencia con la flexibilidad arquitectónica, sugiere que la edificación que es permanente tiene la misma implicación en el espacialidad que los elementos móviles y temporales que pueda contener esta.

En las culturas orientales este concepto de lugar está muy presente en la vida cotidiana. En Japón se potencia el modo de vida flexible, cada familia tiene un espacio central en la vivienda llamado *tatami*, que se utiliza para espacio social, lugar de retiro privado y zona de dormir. En el contorno de dicho espacio se coloca el equipamiento que está integrado en los paramentos. Cuando hay necesidad de un uso específico se utiliza el mobiliario o el equipamiento como elemento flexible capaz de configurar el espacio según la necesidad del propietario. Asimismo, la escalera o los armarios son piezas móviles que conectan



5. Planta w

⁶ Heidegger, M. (1994). "Construir, habitar, pensar". *Conferencias y artículos*. España: Ediciones del Serbal.

distintas alturas. Vivir en un hogar como este supone comprometerse con él de una manera mucho más significativa que simplemente encender una luz o abrir una ventana. Implica reorganizar el entorno según el estado anímico o las circunstancias. El usuario se siente involucrado en la configuración de su espacio. Un claro ejemplo de flexibilidad arquitectónica en la cultura japonesa es la vivienda del terrateniente feudal Nagatomi que se construyó a principios del siglo XIX en Iwano, prefectura de Hyogo, Japón.⁷ La configuración de las habitaciones de esta vivienda es particular. No hay una jerarquía entre las habitaciones. Cada habitación tiene la misma calidad espacial y por ello, se pueden generar diferentes disposiciones. Por otra parte, no hay "circulaciones", lo que significa que no hay una noción fija de los recorridos que ordenan el espacio. Los recorridos se logran de una forma diferente de acuerdo con cada distribución de la vivienda que se genere. Por último, cabe destacar que se trata de una flexibilidad que se consigue mediante varias estrategias: la creación de una trama reticular en planta donde cada estancia se delimita por paneles móviles (fusuma) y la generación de espacios de dimensiones similares para mejorar la adaptabilidad del sistema. El "lugar" lo determina el usuario.

⁷ Itoh, T. (1967). *The essential Japanese house: Craftmanship, function, and style in town and country*. London: Harper & Row, INC



6. Vivienda del terrateniente Nagatomi, Iwano, Japón (S. XIX).

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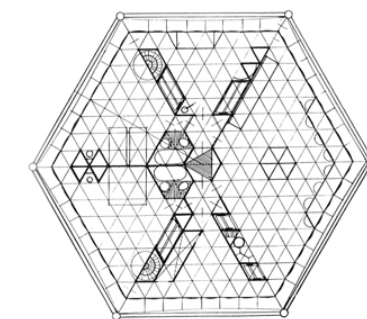
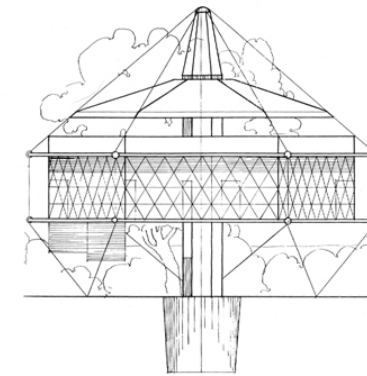
1.3 Evolución del concepto

1.3.3 El período industrial

Después de la Primera Guerra Mundial, Inglaterra precisaba viviendas de la forma más rápida y eficiente posible, por lo que se optó por la construcción estandarizada. Estados Unidos creó una casa prefabricada viable que denominaron "la casa móvil" ya que se podía llevar a cualquier lugar con facilidad. La técnica de fabricación se basaba en piezas asequibles como armazones de madera sencilla. Sólo existió un prototipo, la *Dymaxion house* de Buckminster Fuller, se trataba de un edificio de fabricación industrial que se trasladaba y erigía en pocos días.⁸ La vivienda tenía su propio generador de energía y tratamiento de aguas residuales. La idea de un diseño flexible para ahorrar trabajo.

A partir de los años 50, las técnicas de construcción industrial a mayor escala comenzaron a reemplazar los prefabricados. Estructuras de hormigón en altura, viviendas de una sola planta, edificios concebidos como grandes estructuras que contenían decenas de viviendas. Este hecho fue lo que hizo que muchos arquitectos se interesaran por la propuesta de la flexibilidad en vivienda como una respuesta apropiada al rápido cambio social. Esto dio como resultado que se crearan sistemas de partición, mega-estructuras y unidades centrales *heart units* u otros dispositivos. Yona Friedman en 1957 desarrolló el término de

⁸ Wigley, M. (2015). *Buckminster Fuller Inc. : architecture in the age of radio*. Zürich : Lars Müller.

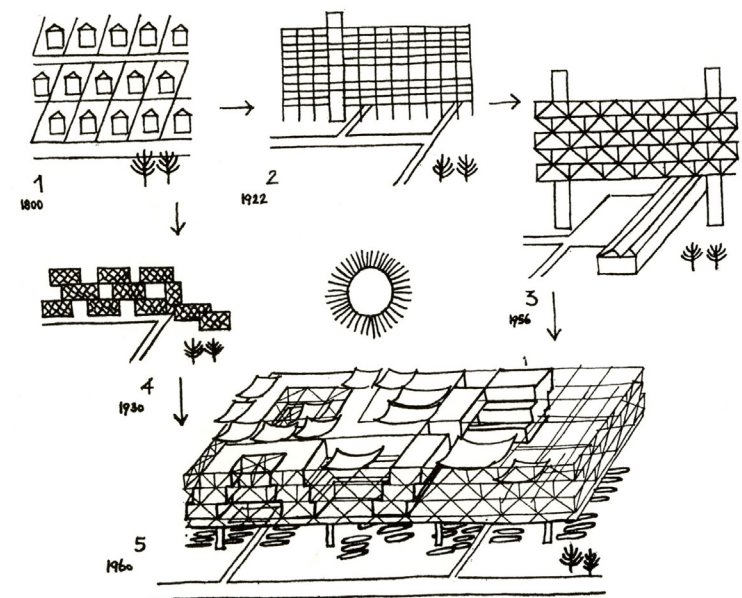


7. Buckminster Fuller, *Dymaxion house* (1933).

movilidad a través de varios artículos que publicó por todo el mundo. Estos artículos tuvieron tanta repercusión que en el mismo año, Friedman creó el grupo de G.E.A.M (Grupo de estudio de arquitectura móvil), en el cual se buscaban arquitectos que compartieran la idea de que el usuario era el encargado de decidir el uso de los edificios. Entre los arquitectos que formaron parte se encuentran Buckminster Fuller y Kenzo Tange.

*Movilidad: las transformaciones sociales y las del modo de vida cotidiano son imprevisibles para una duración comparable a la de los actuales edificios. Los edificios y las nuevas ciudades deben poder adaptarse fácilmente según la voluntad de la futura sociedad que han de utilizarlos: tiene que permitir cualquier transformación sin que ello implique la demolición total. Se trata del principio de la movilidad, término que yo he elegido tras muchos titubeos y a falta de otro mejor.*⁹

En este manifiesto, Friedman señaló que el conocimiento arquitectónico no debe ser exclusivo de profesionales y especialistas. Concibió la hipótesis de que a la hora de diseñar un edificio o de planificar una acción urbanística, los especialistas anteponen sus preferencias de tipo

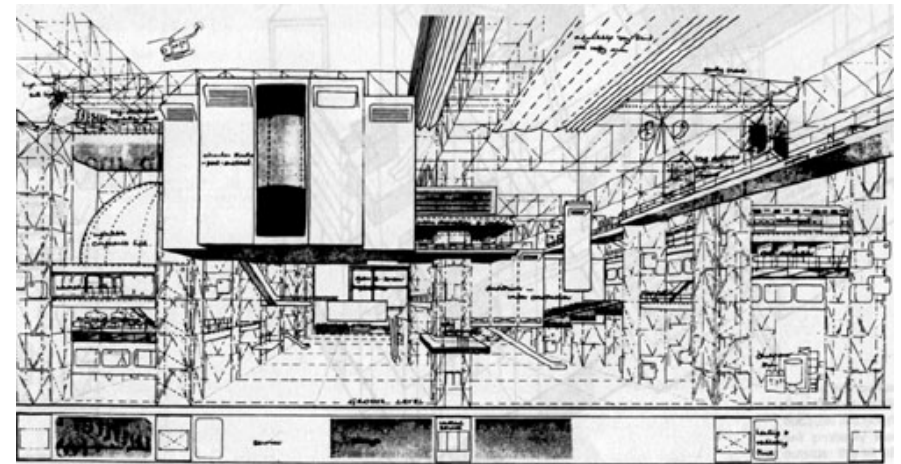


8. Yona Friedman, *Ville spatiale*, 1958-1962.

⁹ Friedman, Y. (1978). *La arquitectura móvil*. Barcelona: Poseidón.

técnica y estética a los deseos y necesidades de sus futuros usuarios. Friedman planteó como solución al problema esbozado la elaboración de sencillas guías que, de la forma más didáctica, expliquen temas relacionados con la arquitectura y la planificación urbanística. La materialización más trascendental de la teoría de la "arquitectura móvil" de Yona Friedman sería su concepto de "ciudad espacial" (*ville spatiale*). Se trata de estructuras flotantes tridimensionales en las que la disposición de sus elementos puede variar. Se busca una flexibilidad a mayor escala con cambios tanto de forma como de usos. Éstas se agregan al trazado urbano de ciudades o también a zonas no urbanizables como embalses o terrenos agrícolas. Posteriormente, el grupo Archigram, más concretamente Peter Cook, desarrolló el concepto de *Plug-in-City* en 1964. Fue uno de los proyectos que trataba la idea de las casas prefabricadas agrupadas en modelos urbanos, densos e indeterminados.

Paralelamente al grupo Archigram, Cedric Price trabajó la arquitectura como una entidad flexible limitada por el tiempo más que con una forma fija permanente. Su obra teórica-práctica más relevante fue *The Fun Palace* que realizó entre 1960 y 1961.¹⁰ Este proyecto incluía una estructura de acero visto en la que se podían ubicar grúas móviles para colocar paredes prefabricadas, escaleras y módulos de servicio según el deseo del usuario.



9. Cedric price, *The Fun Palace*, 1960-1961.

¹⁰ Price, C. (2003). *Cedric Price : the square book*. West Sussex : Wiley-Academy.

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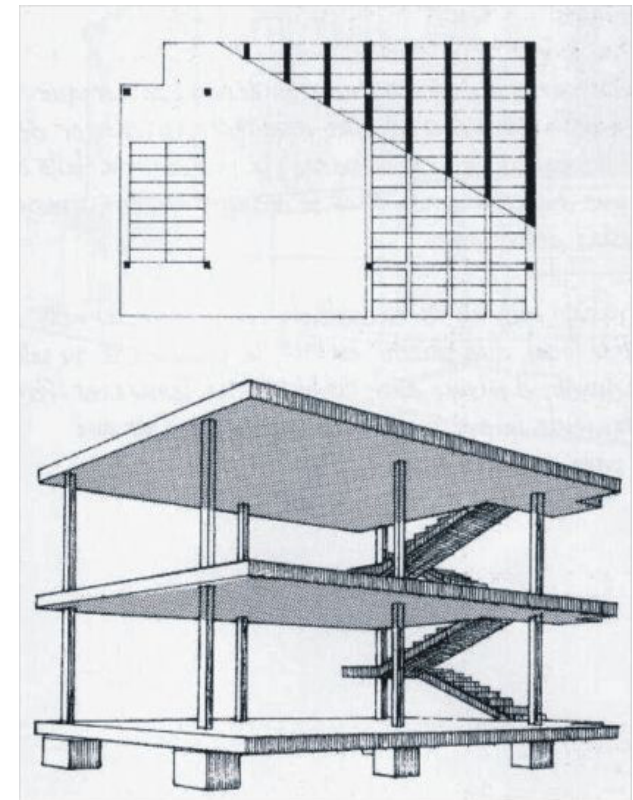
1.3 Evolución del concepto

1.3.4 La planta libre

A partir de 1890, se desarrollaron materiales innovadores de construcción como el acero y el hormigón. Los arquitectos fueron capaces de diseñar “plantas libres”. Antes de estos grandes descubrimientos, el sistema estructural de muros de carga era el más utilizado. Este sistema marcaba la posición de las particiones interiores del inmueble. Por ello, antes de la aparición de la planta libre cabe decir que la flexibilidad que se establecía era la de espacios adaptables a otros usos. Siendo está la forma más pasiva de establecer flexibilidad.

Desde el inicio de la segunda década del siglo XX, la preocupación por proponer ideas sobre una arquitectura de viviendas flexibles, se comienza a materializar con los planteamientos de arquitectos fundadores de la arquitectura moderna como Mies Van der Rohe y Le Corbusier.¹¹ En 1914, Le Corbusier desarrolló el sistema Dom-ino que se basaba en una construcción de pilares y losas. Propuso una planta abierta con ventanas corridas que permite que el espacio interior sea flexible. Entre 1923 y 1924 Mies desarrolló los proyectos de casas de campo de ladrillo y de hormigón, a partir de los cuales planteó la separación entre la estructura y los cerramientos. Asimismo, utilizó el

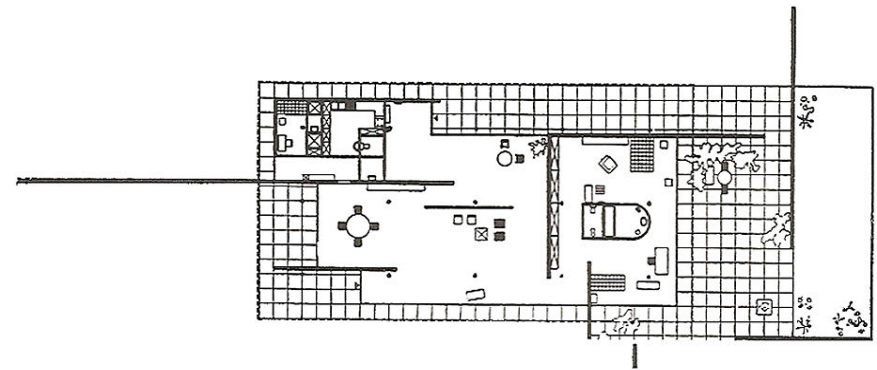
¹¹ Garcés Bravo, C. (2014). *La planta libre ¿principio de flexibilidad espacial? Casas experimentales de Le Corbusier y Mies Van der Rohe 1914-1931*. Tesis. Medellín: Universidad Nacional de Colombia.



10. Le Corbusier, Sistema Dom-ino ,1914.

sistema de planos para trabajar volumétricamente y como sistema estructural, todo ello para conseguir una planta libre. Tanto Le Corbusier como Mies van der Rohe desarrollaron paralelamente el concepto de planta libre en términos de espacialidad, que en cierta medida ayudó a materializar el espacio flexible, abierto y universal.

Por último pero no menos importante, un espacio flexible implica literalmente un espacio "multi-funcional". Por consiguiente, un espacio flexible tiene que estar diseñado para cubrir los requerimientos que dependen de las funciones previstas en el edificio. Por ejemplo, la iluminación de una galería de arte es completamente diferente a la que se utiliza en un teatro, por ello es importante recalcar que para conseguir espacios flexibles, la planta libre es una condición necesaria, pero no suficiente. El espacio necesita estar equipado con todo tipo de sistemas: de iluminación, acústicos, estructurales, etc. Por esta razón, los espacios flexibles deben estar apoyados por sistemas de instalaciones y de estructura que solucionen los requerimientos propios del espacio flexible.



11. Mies van Der Rohe, *Casa para soltero* (1923).

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1.3 Evolución del concepto

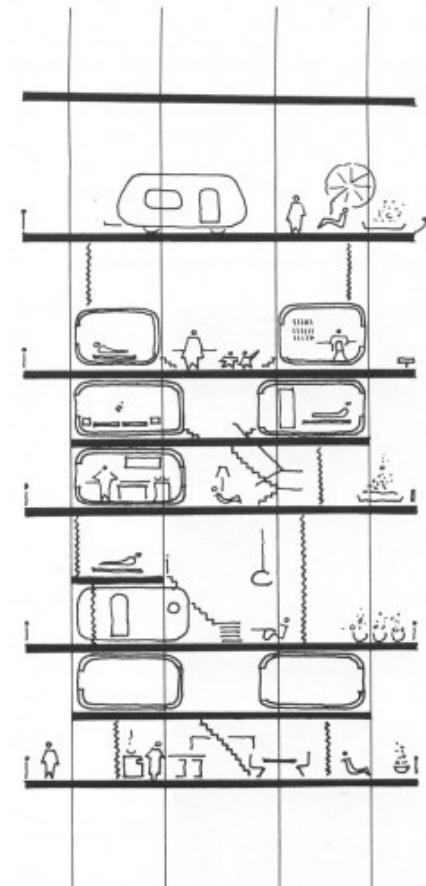
1.3.5 John Habraken y el diseño de los soportes

Paralelamente a estas propuestas se desarrolló una de las teorías que más relevancia ha tenido hasta la actualidad que es La teoría de los soportes de John Habraken. En su primer libro, *Supports: an alternative to mass housing* (1961), John Habraken analizó los efectos de la construcción masiva de viviendas en Holanda. Como la monotonía, la falta de participación del usuario, el hecho de no beneficiarse de la industrialización. Él formuló una alternativa radical: la idea principal fue separar lo inamovible y lo colectivo, es decir, el soporte que está estrictamente condicionado por ordenanzas urbanísticas, la estructura, las instalaciones y las oberturas. De lo que pueda ser transformable y dependa del usuario que sería las unidades separables o relleno llamadas infills. Habraken sostiene en su teoría que la nueva industrialización en la construcción debería permitir que el usuario pudiera tener mayor variedad de elección.

Se debe proponer una arquitectura que separe lo que permanece de lo que cambia.¹²

Durante 1964 se creó SAR, fundación para la investigación de los arquitectos. Se llevaron a cabo investigaciones del SAR entre 1965

¹² Texto recogido durante la entrevista que se realizó a finales de abril de 2008 en la Escuela de Arquitectura de Barcelona.

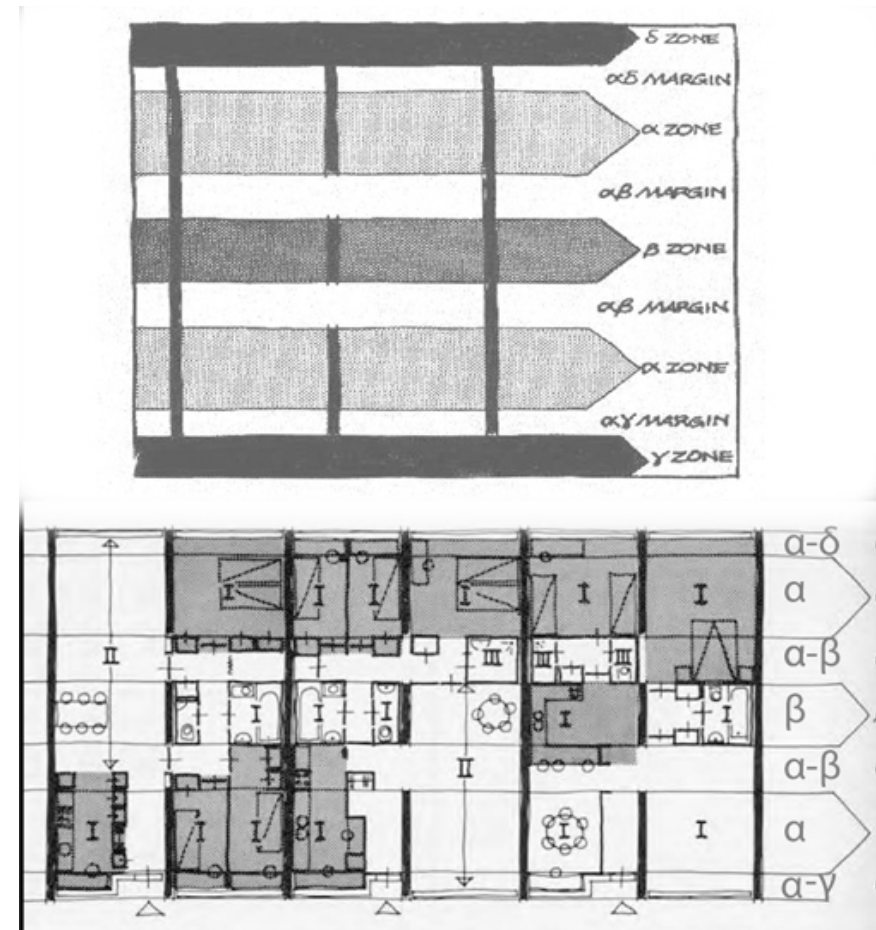


12. John Habraken, *Supports: an alternative to mass housing* (1961).

y 1975 en Holanda y que constituyen un aporte clave en la relación entre estrategias y sistemas de proyecto, y los nuevos procesos de producción empleados en la industria contemporánea. Por ello, Habraken comenzó a trabajar con un amplio equipo de investigación que propuso programas piloto y prototipos. Se consiguió a través de este equipo llevar las formulas teóricas a la práctica. Posteriormente en 1972, publicó *El diseño de los soportes* que fue coordinado por Habraken y otros tres miembros del SAR.¹³ Su metodología opera planteando la división de la crujía del edificio en un sistema de franjas (zonas), que facilitan el diseño y ubicación de las diferentes estancias de la vivienda.

- La zona α , dedicada a los espacios especiales y de uso general que necesitan iluminación y ventilación (habitaciones y salones).
- La zona β , sin relación con el exterior, alberga los espacios de servicio (cocina y baños).
- La zona γ , de uso público (interna o externa) incorpora los accesos (galerías), en caso de que sean necesarios.
- Por último la zona δ , de uso exterior α privado (terrazas).

Para concluir, en 1992 se creó una nueva organización denominada *open building* que se desarrollará en el siguiente apartado.



13. John Habraken, *Diseño de los soportes*, 1972.

¹³ Habraken, N.J. (2000). *El diseño de los soportes*. Barcelona: Gustavo Gili.

1. INTRODUCCIÓN

1.3 Evolución del concepto

1.3.6 Teorías actuales

Robert Kronenburg muestra en su libro *Flexible: Arquitectura que integra el cambio* distintas maneras de ver la flexibilidad en arquitectura hoy en día: Adaptar, transformar, desplazar e interactuar.

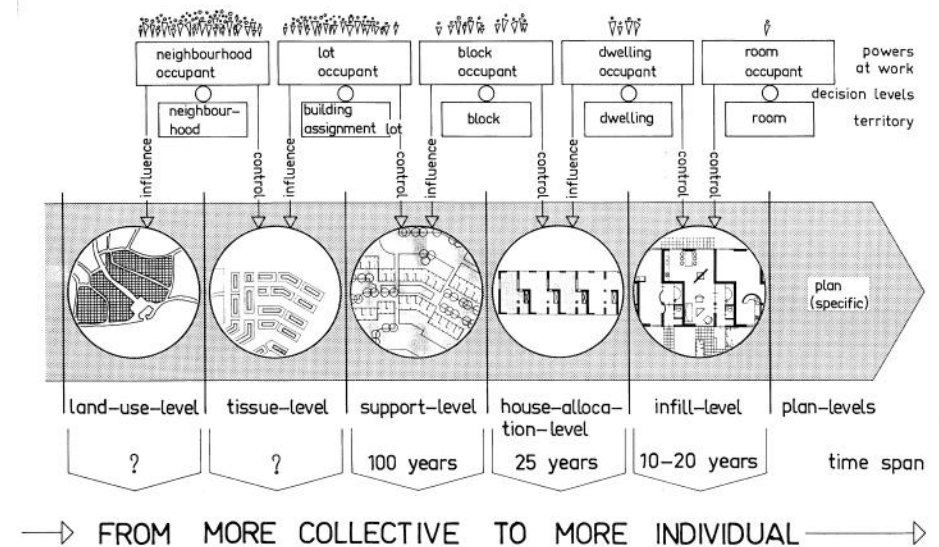
Actualmente, la mayoría de las culturas llevan una vida más o menos sedentaria. Los cambios tecnológicos, sociales y económicos están alentando a una nueva forma de existencia nómada basada en los mercados globales, la worl wide web y el transporte económico y rápido.¹⁴

Por otro lado, el concepto del *open building* mencionado anteriormente, se basa en los principios para la coordinación modular planteados por el SAR.¹⁵ Estos fundamentos permiten mediante la combinación inteligente de una serie estandarizada y versátil de elementos, crear una gran variedad de configuraciones, diversas entre sí, con una gran economía de medios. La construcción de sistemas complejos a partir de la combinación simple de unas pocas piezas básicas ya garantiza por sí misma dos objetivos principales de los procesos de industrialización: el ahorro de tiempo y la reducción de residuos.

14 Kronenburg, R. (2007). *Flexible: Arquitectura que integra el cambio*. Barcelona:Blume.

15 Bosma, K. ; Hoogstraten, D.; Vos, M. (2000). *Housing for the millions : John Habraken and the SAR (1960-2000)*. Rotterdam : NAI.

Asimismo, la estandarización flexible posibilitaría que cada uno de estos componentes pudieran ser producidos por proveedores diferentes, creando un sistema completo formado mayoritariamente a base de elementos de diversas procedencias. De esta forma, la industria pondría al servicio del usuario un catálogo de soluciones a distintos niveles (gamas) de prestaciones, calidades y precios ofertadas para cada uno de estos componentes estandarizados. Estos serían aptos de ser colocados en diferentes edificios, y que podrían remplazarse por otros que realicen la misma función, pudiendo ser reciclados y reutilizados posteriormente en otras situaciones.



14. *Open building*, Diagrama de decisiones en el sistema de edificación abierta, 1998.

2. ESTRATEGIAS FLEXIBLES

2.1 FLEXIBLE

2.1.1 Estrategia de diseño

El método de proyecto *Flexible* utiliza sistemas constructivos y tecnológicos para llevar a cabo soluciones espaciales flexibles. Su origen, comienza a principios del siglo pasado. Los primeros proyectos de vivienda flexible surgieron a partir del rápido avance tecnológico en la construcción. Los arquitectos del momento quedaron atraídos por las grandes máquinas como los navíos y aeroplanos, fue tal la fascinación que para muchos de ellos sirvieron de idea en sus proyectos. Del mismo modo, el hecho de convertir un objeto mediante medios mecánicos fue otra gran inspiración. Por ello, el término de convertibilidad fue el motivo de que comenzaran a aparecer propuestas de vivienda flexible durante esta época. Asimismo, la flexibilidad dotaba a las soluciones de una gran adaptación al rápido cambio social.¹⁶

Por tanto, cuando la flexibilidad se concibe paralelamente a los avances constructivos y tecnológicos, surgen propuestas que se pueden clasificar en: soluciones de gran escala y soluciones de menor escala. Las primeras están relacionadas con los sistemas estructurales y la composición exterior del edificio. Los principales ejemplos son: las mega-estructuras que permiten plantas libres y

las unidades centrales ('heart units') que desempeñan el mismo objetivo. En cuanto a las soluciones de menor escala, se establece una total implicación por parte del usuario. Se basan en los sistemas de compartimentación móvil, como por ejemplo particiones plegables, desmontables o giratorias.

Quizás una postura más sintética y clara de este tipo de flexibilidad sea la que aporta el artículo *Housing/Flexibility?* (Architectural Design, 1973), en el cual se marcan unas pautas generales para este tipo de sistemas flexibles.¹⁷ En primer lugar, se requiere que la compartimentación interior sea no portante. Esto permite una planta susceptible de cambiar de distribución interior y además ayuda a marcar un criterio estructural en retícula. En segundo lugar, se debe de establecer el sistema de calefacción central, para favorecer una unificación de los conductos de instalaciones. En tercer lugar, la estructura es la base del proyecto flexible, de este modo hay que garantizar la durabilidad de ésta. En cuarto lugar, se pretende crear un planteamiento previo de las relaciones entre los espacios básicos y los espacios de servicio (zonas húmedas y de instalaciones). Por último, de acuerdo con las apartados

¹⁶ Kronenburg, R. (2007). *Flexible: Arquitectura que integra el cambio*. Barcelona:Blume.

¹⁷ Rabeneck, A., Sheppard, D. y Town, P. (1973). "Housing/Flexibility?" en Architectural design, 43, p. 698-711, 717-727.

anteriores, se brinda libertad a la hora de diseñar la composición de las fachadas.

2. ESTRATEGIAS FLEXIBLES

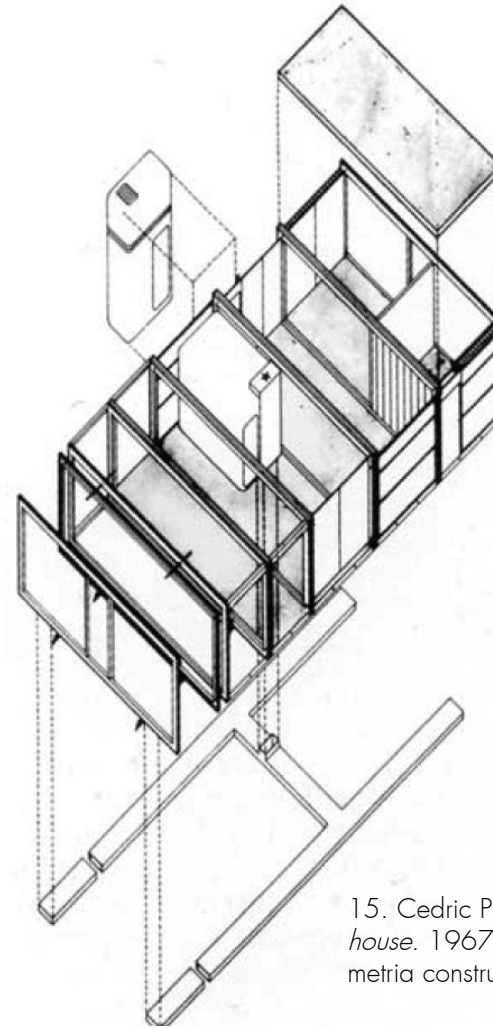
2.1 FLEXIBLE

2.1.2 Ejemplos prácticos

La visión de la arquitectura de Cedric Price se basa en el concepto de entidad flexible limitada por el tiempo más que en una forma fija permanente. Price diseñó la Steelhouse como respuesta a las necesidades crecientes de espacio. Argumentó que el principal criterio de diseño debería ser que el espacio pudiese variar para adoptar un máximo de posibles usos.¹⁸

La movilidad y el impacto medioambiental son otros aspectos importantes que configuran la casa. La vivienda puede ser asentada sin un gran impacto en el entorno ya que es portátil y posee la opción de desmontaje. Se entiende que es móvil por la configuración exterior, ideada como una caja metálica que puede descomponerse. Se podría asociar a la reutilización de con-

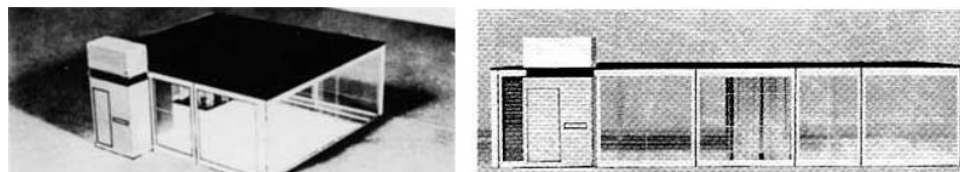
¹⁸ Mathews, S. (2007). *From Agit-Prop to Free Space : the architecture of Cedric Price*. Londres: Black Dog.



15. Cedric Price. *Steel house*. 1967. Axonometría constructiva.

ainers como nuevos espacios susceptibles de poder trasladarse. Asimismo, la posibilidad de un rápido montaje y desmontaje de la construcción se incorporan en el diseño con el fin de reducir radicalmente el daño ambiental.

Price utiliza los nuevos sistemas metálicos de construcción en seco para incorporar el concepto de flexibilidad en la tipología de vivienda. Trabaja con piezas desmontables y piezas móviles. De esta manera, implica al usuario en la configuración de su propia vivienda. La variable del tiempo es muy importante cuando se incorpora la flexibilidad en arquitectura. En este proyecto, Price genera una planta definida por un área de actividad compartida que es variable a lo largo de un ciclo de 24 h. Por ello, no se habla de una posibilidad de cambio a largo plazo sino a muy corto plazo. Se trata de un proyecto con un alto grado de transformación.

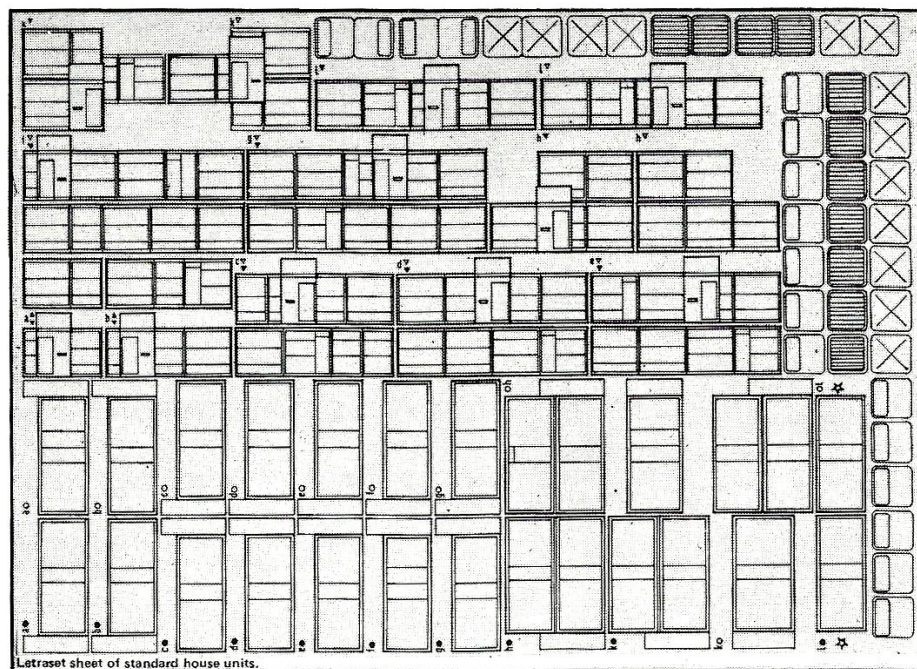


16. Cedric Price. *Steel house*, 1967.

Fotografías maqueta.

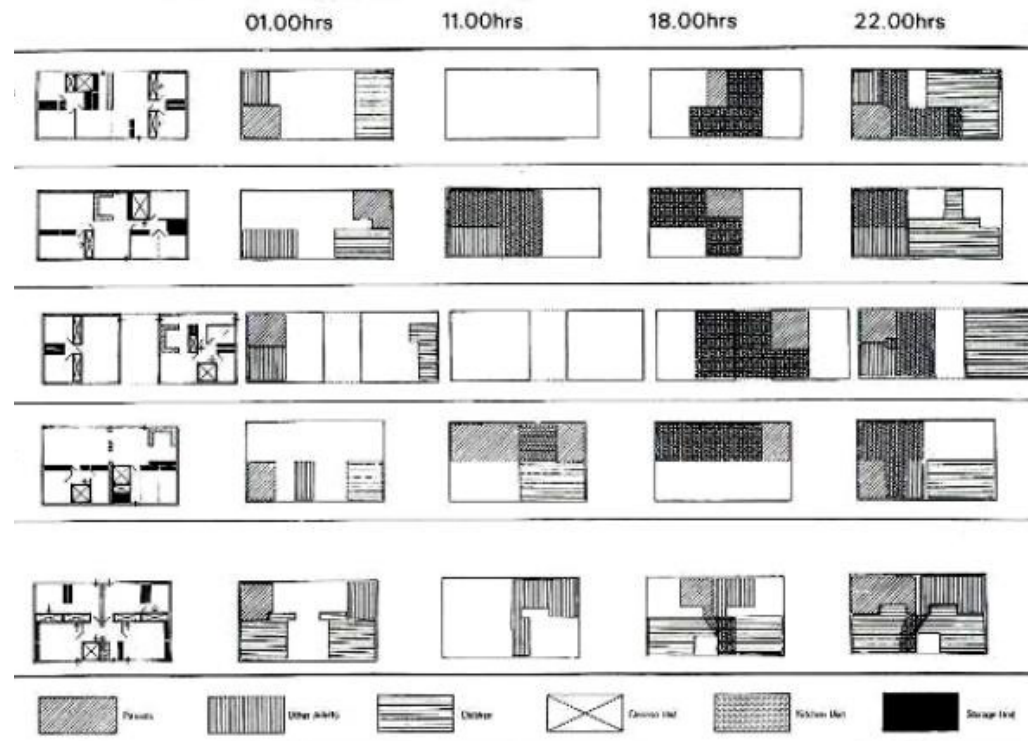
17. Cedric Price. *Steel house*, 1967.

Despiece de elementos.



De manera similar a este proyecto, la propuesta de Renzo Piano y Richard Rogers para el *Centro Pompidou* comparte la idea de concebir sistemas flexibles de acuerdo al tiempo en que transforman el espacio. En la imagen 17, Price representa mediante un diagrama la transformación de la pieza en función del momento del día.

Por otra parte, también permite la subdivisión de la vivienda en partes independientes. Por este motivo, consta de unas vías de acceso alternativas tanto interiores como exteriores. La fragmentación de la pieza puede ser permanente, por lo que se dispone de accesos externos independientes.



18. Cedric Price, *Steel house*. 1967.
Cambios de *Steel Housing* según un ciclo diario, 24 horas.

2. ESTRATEGIAS FLEXIBLES

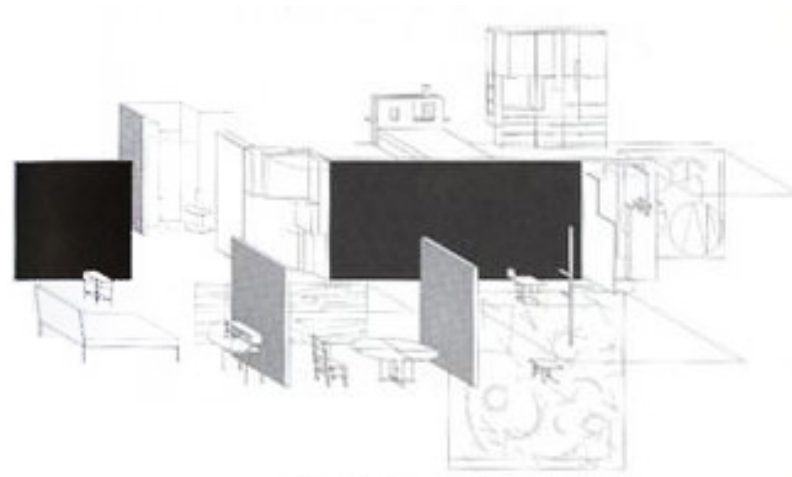
2.1 FLEXIBLE

2.1.2 Ejemplos prácticos

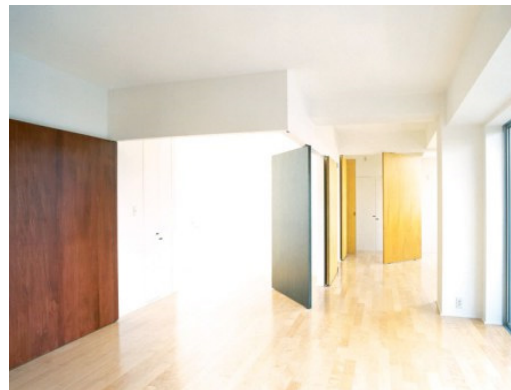
A partir de 1983, el arquitecto inglés Steven Holl experimentó con el concepto de *Hinged space*. La traducción al español es 'espacio giratorio', lo que nos hace pensar que se trata de arquitectura móvil. Este tipo de espacio lo trabajó en sus proyectos de viviendas y más concretamente en las viviendas que realizó en Fukuoka.¹⁹ El arquitecto realizó un estudio exhaustivo del desarrollo de los tradicionales conceptos multifuncionales japoneses. Un ejemplo claro de ello son los llamados *fusuma*, unos paneles deslizantes opacos o traslúcidos que compartimentan de manera flexible la vivienda. El espacio que se consigue cuando los habitantes mueven las paredes con el objetivo de crear entornos participativos es flexible.

En este proyecto estudiado, a diferencia de los demás casos, se ha trabajado desde el punto de vista de una flexibilidad interior y,

¹⁹ Holl, S. (1996). *Steven Holl: 1986-1996*. Madrid: El Croquis.

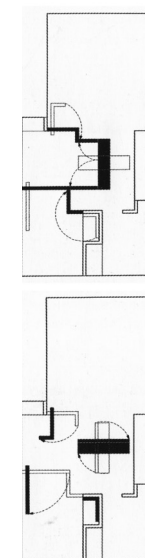


19. Steven Holl. *Anchoring*. 1975. Esquema de vivienda móvil sin elementos estáticos.
20. Steven Holl. Vivienda en Fukuoka. 1992. Diferentes formas de configurar los espacios interiores.



por tanto, de menor escala. Holl utiliza una estrategia flexible basada en sistemas constructivos de paneles correderos, giratorios y plegables.²⁰ Además se utilizan puertas, plafones y armarios pivotantes para reconfigurar la planta de cada vivienda de acuerdo con cambios de usos o de habitantes.

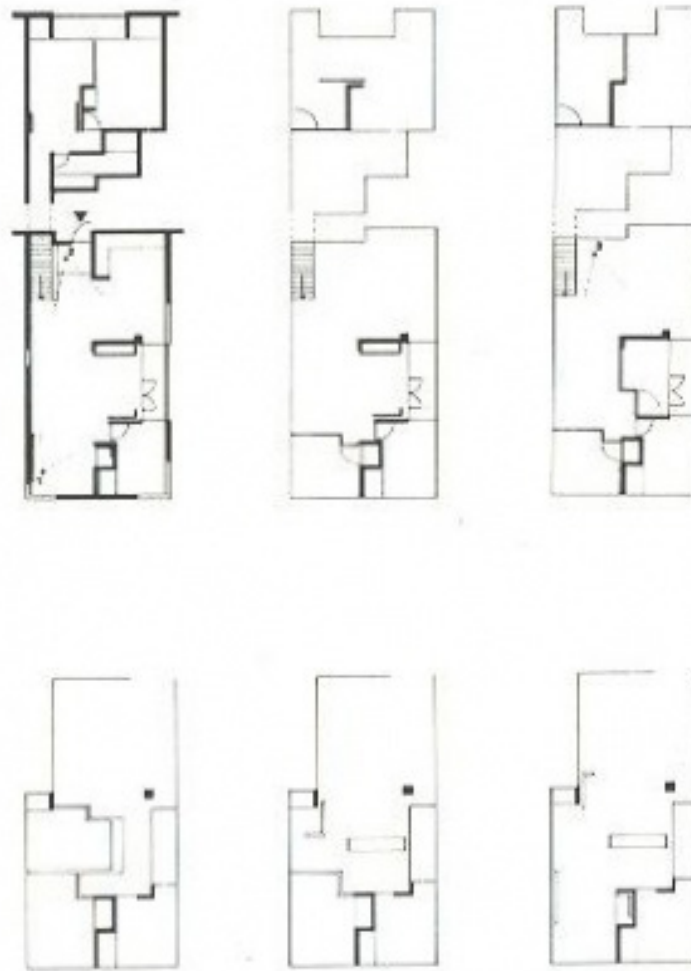
Una característica en común de los proyectos flexibles es la representación de las posibles configuraciones. En el proyecto se mostraron tres maniobras (imagen 22) posibles para la vivienda tipo dúplex y tres más para la vivienda simple. En cuanto a la vivienda simple, la primera variación consta de un espacio abierto donde salón y cocina conviven así como de un dormitorio. En la segunda, se genera una habitación más, pivotando dos paneles y un pequeño espacio de estudio tam-



21. Steven Holl. *Vivienda en Fukuoka*. 1992. Maniobras de la estrategia flexible.

²⁰ "Steven Holl Architects: viviendas a Fukuoka" en *Quaderns d'arquitectura i urbanisme*. Número 197, 1992, p. 72-77.

bién privatizado mediante la pivotación de un panel. En la tercera disposición se crea un dormitorio más corriendo un panel y volteando horizontalmente un armario. Estas configuraciones se asemejan a los sistemas que Gerrit Rietveld inventa para la casa *Schoder*. Por otra parte, el proyecto permite ampliar una estrategia que se desarrollará posteriormente: la estrategia *Adaptable*. Este proyecto consiste en cinco bloques organizados en torno a cuatro patios, ofreciendo un juego de llenos y vacíos. La edificación alberga un total de 28 apartamentos, cada uno de los cuales es diferente a los demás. La disposición de los apartamentos en forma de peine conectados mediante un pasillo longitudinal exterior se trata de un sistema adaptable a otros posibles usos. Por tanto, la forma de la edificación puede ser un factor flexible a la hora de poder ser adaptable a otros usos.



22. Steven Holl. *Vivienda en Fukuoka*. 1992. Estrategia aplicada a las dos tipologías de vivienda.

2. ESTRATEGIAS FLEXIBLES

2.1 FLEXIBLE

2.1.2 Ejemplos prácticos

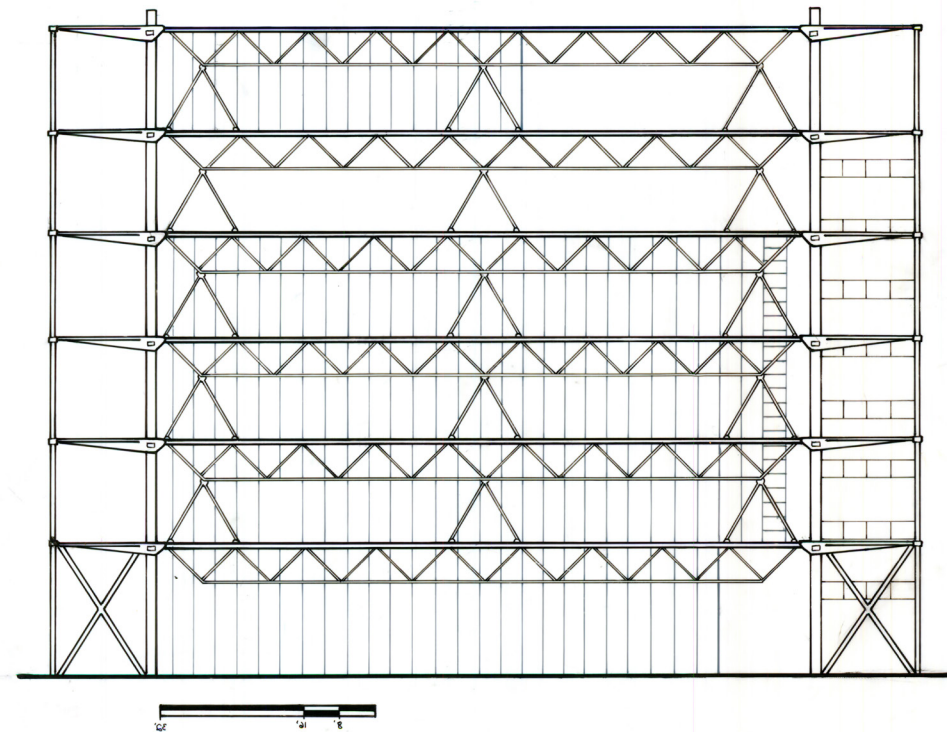
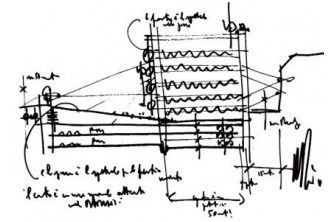
Este proyecto icónico de la arquitectura high-tech de finales de los años setenta, tuvo como principal problema ordenar la trama del barrio en el que se situaba. El conjunto edificado se situó en un barrio descuidado de la ciudad de París.²¹ La idea principal fue crear un lugar de reunión verdaderamente dinámico en el que las actividades pudiesen solaparse con espacios flexibles y bien acondicionados. Por ello, se crearon nuevos recorridos y espacios abiertos, como la gran plaza que actualmente hace de entrada al edificio.

Tanto en este caso de estudio como en los anteriores, la estrategia 'flexible' obliga a distinguir dos grados de flexibilidad: una flexibilidad aplicada a mayor escala y una flexibilidad aplicada a una escala menor. Éste es un ejemplo que contempla los dos grados.

²¹ Asensio Cerver, F. (2002). *Renzo Piano*. Madrid: Kliczkowski.

23. Renzo Piano y Richard Rogers. *Centro Pompidou*. 1970. Boceto de idea.

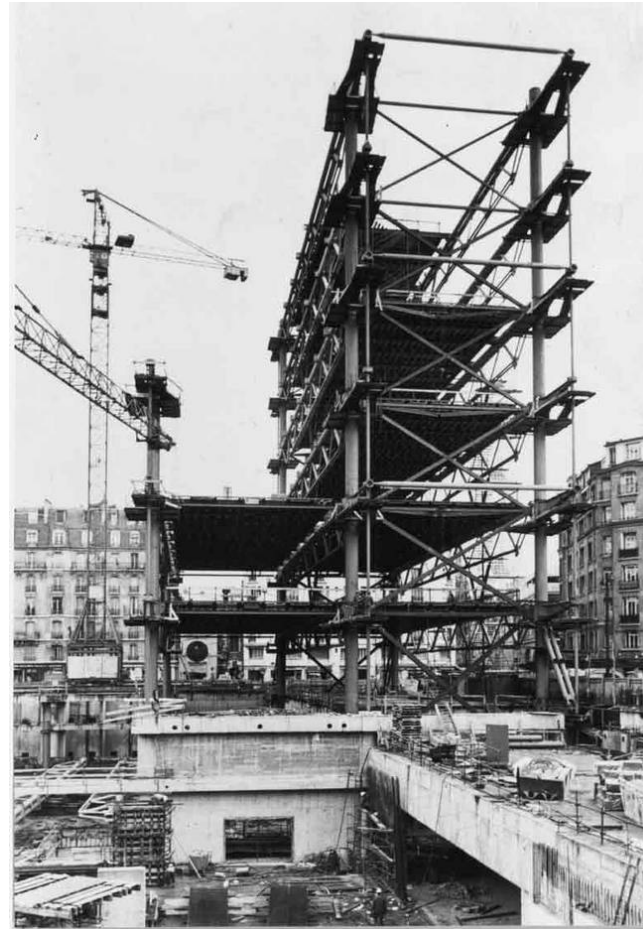
24. Renzo Piano y Richard Rogers. *Centro Pompidou*. 1970. Sección transversal estructural.



Los arquitectos tenían como objetivo reflejar la expresión del cambio en el edificio. Mediante la estrategia flexible el proyecto consigue plantas libres capaces de adaptarse a cualquier uso.

Desde el punto de vista de mayor escala, se trabaja con una flexibilidad estructural. El edificio consta de una estructura capaz de transformarse y adaptarse. Como se explica en la sección, se trata de un sistema formado por 14 pórticos. Cada uno de ellos está formado por vigas de gran canto 'Vierendel' unidas entre sí mediante tensores, que apoyan en los soportes de sección redonda. La estructura está arriostrada en sus fachadas mediante cruces de San Andrés. El sistema permite que las instalaciones se coloquen en suelo y techo permitiendo una libertad en planta.

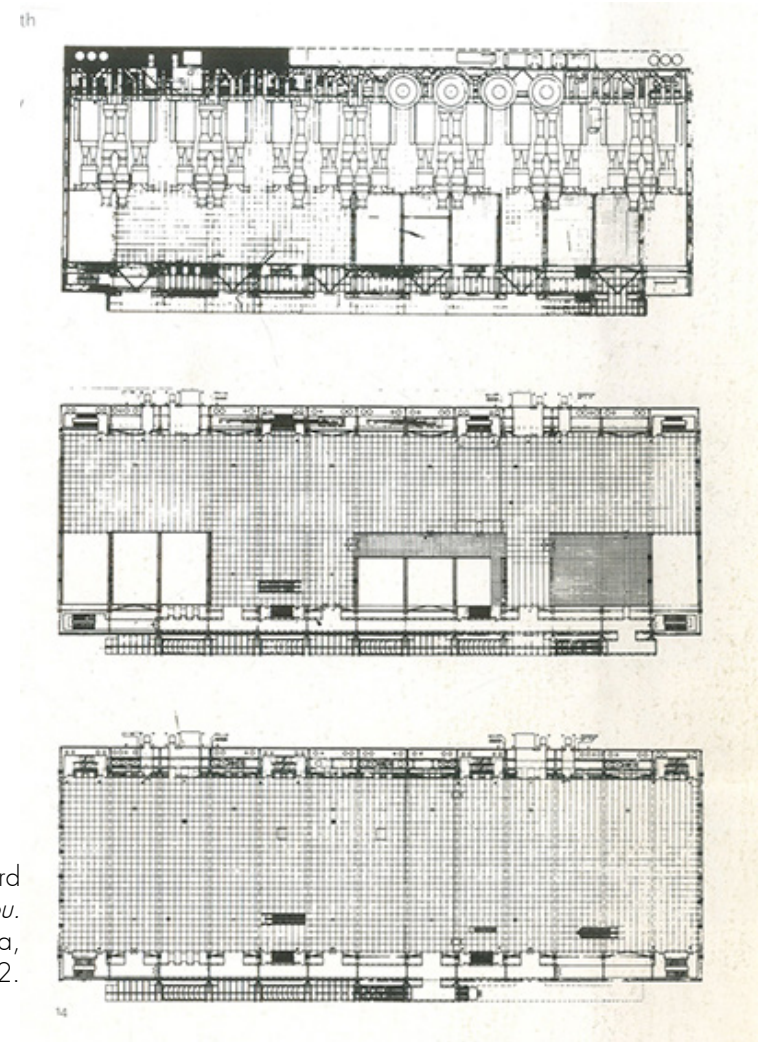
Por otra parte, la flexibilidad de menor escala la podemos encontrar en la comparti-



25. Renzo Piano y Richard Rogers. *Centro Pompidou*. 1970. Fotografía de la construcción de la estructura.

mentación y en la distribución de los servicios y accesos. La compartimentación de este proyecto se concibe a través de una jerarquía de flexibilidad. En primera instancia, los tabiques pequeños y ligeros se pueden mover en poco tiempo (1 minuto), sin embargo, los tabiques de grandes dimensiones se pueden mover en más tiempo (1 hora). Por último, los muros ignífugos son más difíciles de trasladar y están sujetos con pernos para otorgarles el potencial de un cambio característico. Por tanto, el hecho de incluir la variable del tiempo refleja la implicación de lo flexible en el proyecto.

26. Renzo Piano y Richard Rogers. *Centro Pompidou*. 1970. Planta de cubierta, Planta tipo 1 y Planta tipo 2.



2. ESTRATEGIAS FLEXIBLES

2.2 ADD ON

2.2.1 Estrategia de diseño

Esta estrategia se basa en la posibilidad de poder extender el proyecto aumentando el área de suelo habitable.²² Se trata de la forma más sencilla de generar más espacio sin tener que trasladarse. La adición de espacios sobre una base inicial como criterio proyectual siempre ha existido. El ejemplo más claro es el espacio de terraza o espacio exterior de las viviendas actuales. Ofrece la posibilidad de que la vivienda pueda extenderse cambiando el uso de éste. Antes de que surgiera el urbanismo moderno como disciplina reguladora del suelo urbano, este sistema era más practicado. Esto se debía tanto a la permisibilidad a la hora de adquirir más tierra, como a la carencia de controles y regulaciones en este ámbito. Por tanto, el problema fundamental de este sistema aplicado a la actualidad se puede mostrar en un ejemplo: un proyecto extensible de vivienda comienza teniendo espacios básicos y a medida que se van necesitando más espacios se añaden, tal como una familia crece. Sin embargo, no se tiene en cuenta que a lo largo del tiempo los costes del suelo y sus políticas pueden cambiar, es decir, puede subir el valor del suelo. Por tanto, este sistema no es del todo viable si se lleva a cabo de una forma no planificada.

Este método de proyecto puede estar precedido por una decisión

22 Rabeneck, A., Sheppard, D. y Town, P. (1973). "Housing/Flexibility?" en *Architectural design*, 43, p. 698-711, 717-727.

planificada desde el germen del proyecto o puede ser una acción espontánea. El primer caso resulta ser más ventajoso ya que a largo plazo no modifica lo edificado. Estas reformas pueden suponer un peligro ya que se pueden modificar partes esenciales de lo construido. Como solución, se plantea adquirir desde un primer momento la parcela con una superficie construida mínima. Normalmente esta área mínima está asociada a los espacios básicos y el espacio adicional corresponde con la superficie libre de la parcela. Por lo tanto, los proyectos extensibles planificados tienen, desde un primer instante, un límite superficial de adición.

El proyecto que utiliza esta estrategia lleva consigo que sus espacios sean flexibles, es decir, tienen que poder permitir esta extensión.²³ La flexibilidad aplicada a este método de proyecto se basa principalmente en un sistema estructural fundamentado en la trama o retícula. Este sistema modula el espacio de una manera uniforme y sistemática creando patrones con posibilidad de multiplicidad.

23 Cortés, J. Antonio. (2013) .*Historia de la retícula en el s.XX de la estructura Domino a los comienzos de los años setenta*. Valladolid: Universidad de Valladolid, Secretariado de Publicaciones e Intercambio Editorial, D.L

2. ESTRATEGIAS FLEXIBLES

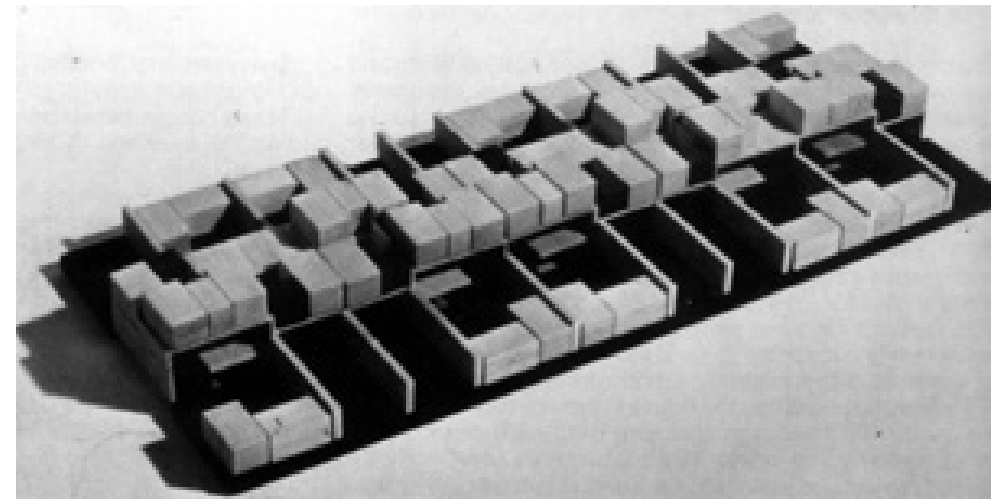
2.2 ADD ON

2.2.2 Ejemplos prácticos

El proyecto es un claro modelo de planificación con el objetivo de una futura expansión, algo que a menudo se pasa por alto en el diseño normal de la vivienda.²⁴ En una parcela alargada de tierra, los arquitectos proponen una estrecha vivienda no muy diferente de una casa adosada británica del siglo XIX. La vivienda central tiene un pequeño jardín delantero, además de una cocina con acceso directo al jardín trasero y un salón-comedor en la planta baja. La casa central en su estado más pequeño también tiene un segundo piso, que alberga tres habitaciones: una habitación más grande en la parte delantera y dos habitaciones más pequeñas hacia la parte posterior de la casa .

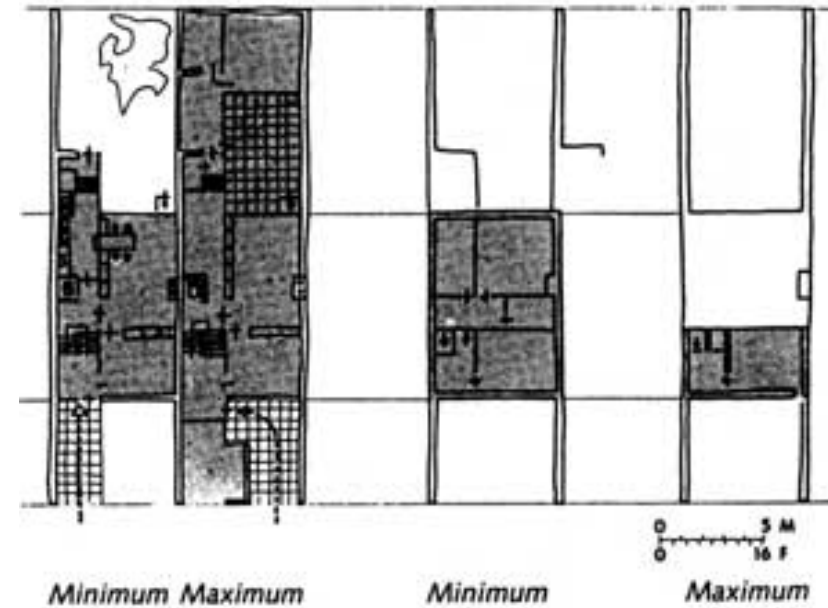
²⁴ Bakema, J. B.(1981). *Thoughts about architecture*. London: Academy Editions.

27. H. van den Broek, J.B. Bakema. *Extendible houses*. 1963. Fotografía del conjunto.
28. H. van den Broek, J.B. Bakema. *Extendible houses*. 1963. Maqueta de la propuesta.

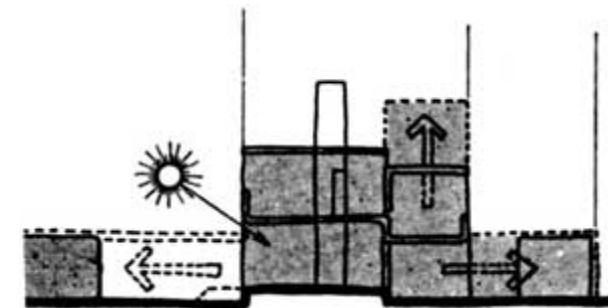


La unidad funcional más pequeña está diseñada para ser expandida en horizontal hacia la parte delantera o trasera y verticalmente hacia arriba. Hacia el frente, en el sitio del patio delantero, una habitación adicional puede ser construida, lo que podría ser un garaje, una tienda pequeña o una habitación de invitados. Hacia la parte posterior, todo el jardín trasero se puede transformar en una serie de habitaciones que se organizan alrededor de un patio. Todos los posibles cambios duplican el espacio utilizable en la planta baja. Por último, la planificación permite una segunda habitación que se construirá en la parte superior de la cubierta plana a modo de ático.

En conclusión, estos cambios permiten que la casa inicial de 85 m² pueda ser transformada en una de 130 m² sin necesidad de reconfigurar la ordenación inicial.



29. H. van den Broek, J.B. Bakema. *Extendible houses*. 1963. Planta con tres opciones de ocupación: máxima ocupación, mínima ocupación y la unión de las anteriores.
 30. H. van den Broek, J.B. Bakema. *Extendible houses*. 1963. Sección donde se reflejan las posibles adiciones.



2. ESTRATEGIAS FLEXIBLES

2.2 ADD ON

2.2.2 Ejemplos prácticos

Este proyecto participativo de viviendas sociales en Chile nació de la necesidad de realojar a 100 familias que vivían en condiciones precarias.²⁵ Fue el primer proyecto que realizaron los arquitectos chilenos, dando solución a un problema nacional: la escasez de viviendas sociales. Este problema principalmente se debe a la falta de inversión por parte de la administración y también al coste del suelo. La solución viene dada por el concepto de “vivienda incremental”. Se trabaja el concepto de estrategia de adición desde el punto de vista de la configuración exterior de las viviendas. En este proyecto se materializa la táctica desde la volumetría del conjunto. Los volúmenes de las viviendas están separados por un espacio vacío. Esta área es susceptible de poder incrementarse en beneficio de las viviendas.

²⁵ Aravena, A.; Iacobelli, A. (2012). *Elemental: manual de diseño incremental y diseño participativo = incremental housing and participatory design manual*. Ostfildern : Hatje Cantz.

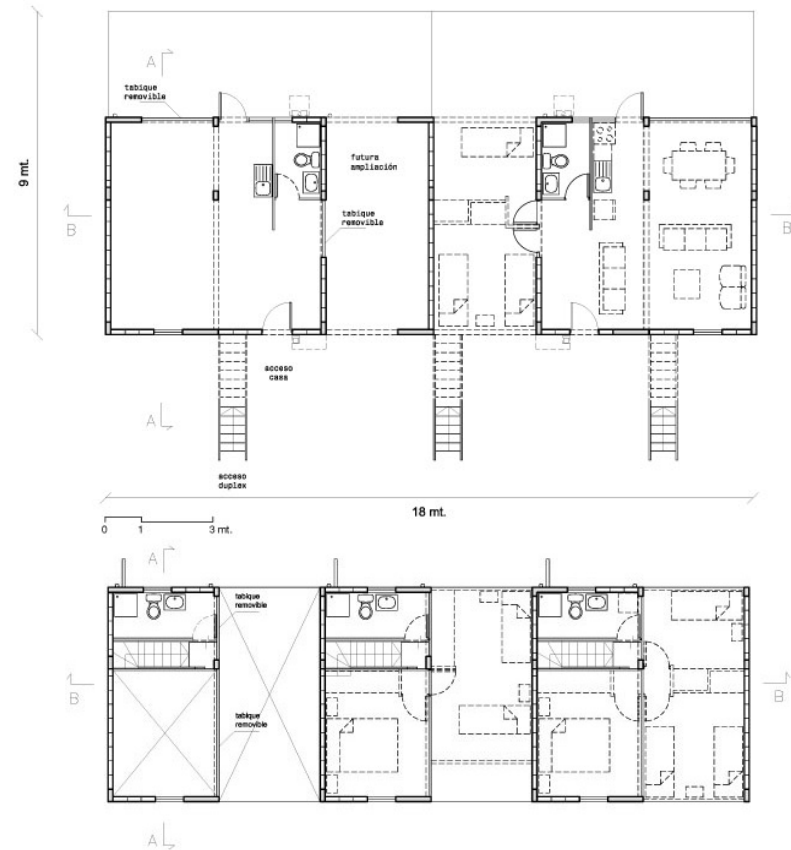
31. Alejandro Aravena . *Quinta Monroy*. 2003. Imagen del resultado de la estrategia propuesta.



Toda la estructura de las viviendas está planeada para soportar las futuras ampliaciones. Tanto las losas que conforman los forjados como los muros de bloques de hormigón son fácilmente removibles y reutilizables para la adición deseada, dando de esta forma un juego en las fachadas de espacios vacíos y llenos.

En cuanto a la tipología de la vivienda, la gran libertad que da poder ampliar hasta el doble del tamaño original brinda una gran gama de posibilidades. Puede ser utilizada como una habitación para alquiler, una oficina, etc. Las áreas comunes dentro de la vivienda tienen muy buena comunicación entre ellas. La estructura del edificio permite visuales ininterrumpidas entre cada espacio y el acceso a los servicios es fácil y sin obstáculos. No existe la necesidad de pasar por áreas privadas de la vivienda.

32. Alejandro Aravena . *Quinta Monroy*. 2003. Planta baja y superior con las posibles adiciones.



2. ESTRATEGIAS FLEXIBLES

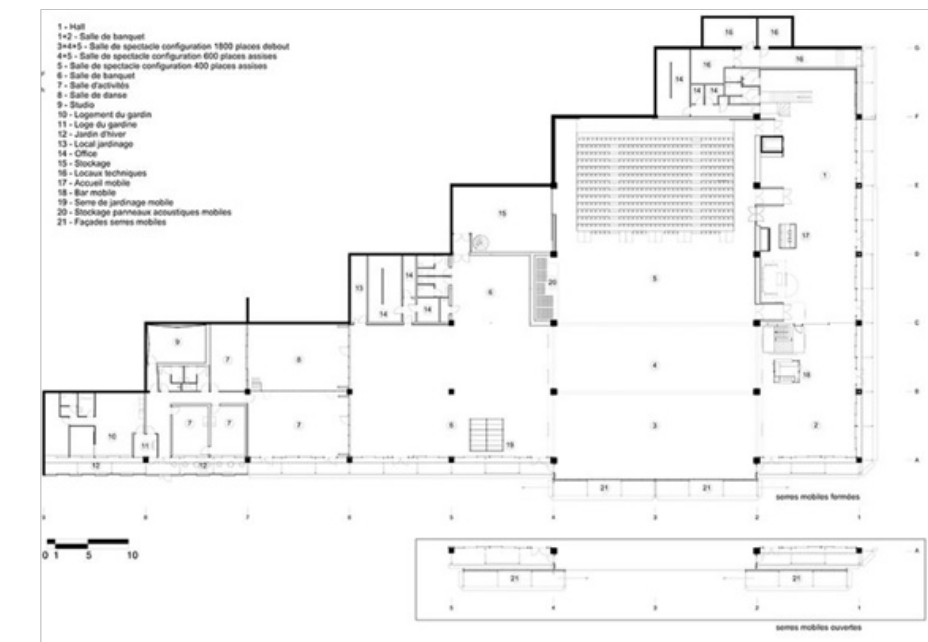
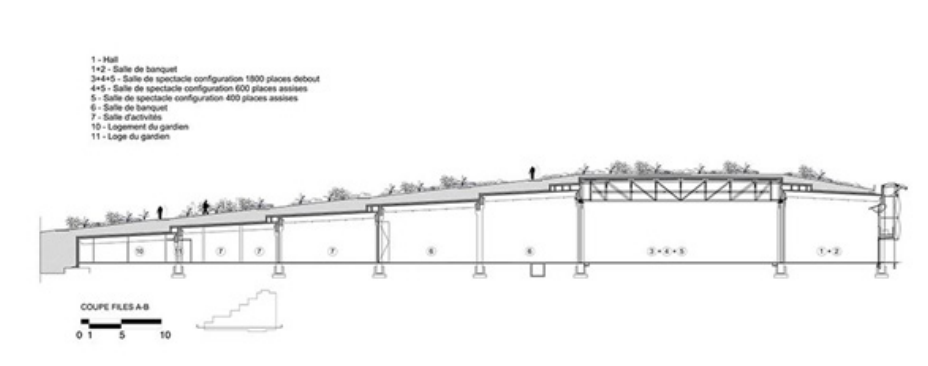
2.2 ADD ON

2.2.2 Ejemplos prácticos

La sala de usos múltiples “Le Grand Sud” es parte de la reestructuración de 28 hectáreas del sector Arras Europa en Lille. Se trata de un lugar de difusión cultural de la ciudad que también recibe nuevas organizaciones sin ánimo de lucro y eventos del distrito. El proyecto “desliza” bajo un gran techo accesible formado por un jardín público en pendiente. En el volumen de altura variable, siguiendo la pendiente del jardín, el auditorio ocupa la zona central.²⁶

Alrededor de éste, se crea un gran espacio de 2.500 m² en el espacio del parque para el resto de las funciones públicas. Perpendicular a la sala central, la fachada móvil se puede abrir a lo largo de toda su extensión, hacia el parque, creando un telón de fondo escénico. Se trata de un proyecto que maneja la flexibilidad desde la funcionalidad. A partir

²⁶ Márquez, F.; Levene, R. (2015). *Lacaton & Vassal: 1993-2015*. Madrid: El Croquis.



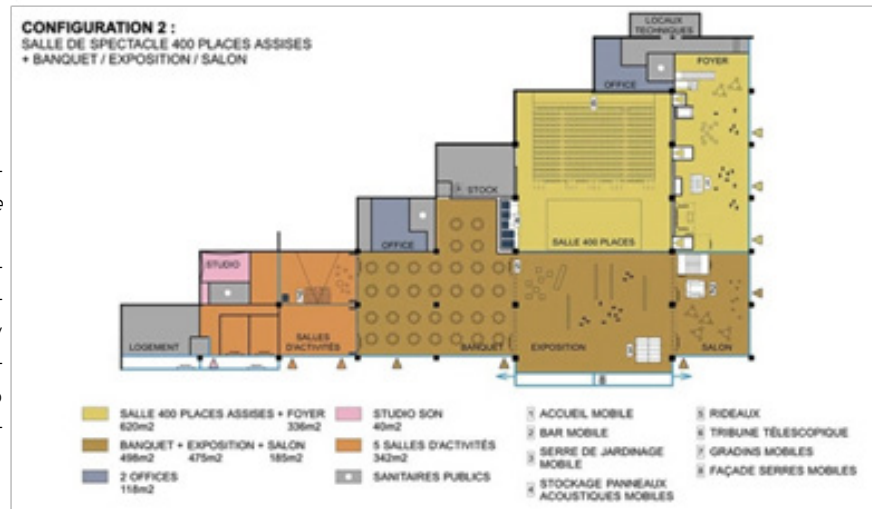
33. Lacaton & Vassal. *Salle spectacle polyvalente*. 2013. Planta baja y sección longitudinal.

de una trama estructural sencilla los espacios pueden variar de función según las necesidades. En este proyecto la idea de adición de espacios se materializa de una forma distinta. Se basa en la suma de espacios dentro de una superficie básica ya constituida. Se trabaja con una superficie modulada (límite de superficie) donde cada uso puede crecer y ocupar más espacio.

Esta estrategia proyectual se lleva a cabo gracias a:

- El sistema estructural-compositivo. La retícula de 10x13 m se interrumpe cuando se alcanza la sala de representaciones con una luz de 26 m que se salva con un sistema de cerchas metálicas.
- Un mecanismo de grandes cortinas y puertas plegables acústicas, fáciles de manipular, en un sistema de carriles, lo que permite numerosas capacidades y configuraciones.

34. Lacaton & Vassal. *Salle spectacle polyvalente*. 2013. Planta con la configuración 1 (espectáculo para 600 per.) y planta con la configuración 2 (espectáculo para 400 per.+ banquete+ exposición).



Como se puede ver en los esquemas funcionales, los arquitectos plantean una serie de configuraciones que pueden verse a la derecha en el orden de arriba abajo: la primera configuración se trataría de un uso destinado a una sala de espectáculos para un aforo de 400 personas; en segundo lugar, se configuraría la sala de espectáculos, una sala para banquetes, una sala de exposiciones y un espacio de salón; el tercer planteamiento sería para un uso de festival con un aforo de 1800 personas.



35. Lacaton & Vassal. *Salle spectacle polyvalente. 2013.* Planta con la configuración 3 (festival 1400 per.).

2. ESTRATEGIAS FLEXIBLES

2.3 ADD IN

2.3.1 Estrategia de diseño

Esta táctica se fundamenta en la ganancia de superficie útil sin llegar a aumentar el área de suelo ocupado.²⁷ Este enfoque tiene más ventajas que la estrategia de la adición de espacios ocupando suelo (Add on). La más importante es que los costes de las infraestructuras y del suelo se tienen en cuenta en la inversión inicial. La forma más habitual de poner en práctica este procedimiento es el espacio superior que generan las cubiertas inclinadas. Podría tomarse como ejemplo la tipología de vivienda con buhardilla, donde este espacio polivalente hace posible la extensión de la vivienda. Aunque este espacio es normalmente utilizado como desván debido a su falta de iluminación, existe la posibilidad de poder hacerlo habitable creando así un espacio con flexibilidad de uso. Por otro lado, como desventaja principal se encuentra el límite de adición de espacios que es más restrictivo debido a las regulaciones sobre la altura de la edificación. Además, las sobreelevaciones llevan consigo más complicaciones técnicas que la adición de espacios horizontalmente. Las nuevas cargas afectarían negativamente a la estructura existente, lo que conllevaría realizar trabajos de consolidación que aumentarían el coste. Por lo tanto, es imprescindible que, desde un primer instante, conste en el proyecto la

²⁷ Rabeneck, A., Sheppard, D. y Town, P. (1973). "Housing flexibility" en *Architectural design*, 43, p. 698-711, 717-727.

posibilidad de poder adherir espacios verticalmente.

En conclusión, la formalización del método en la práctica generalmente se trata de una envolvente donde su cubierta por su forma no plana admite la creación de un espacio polivalente. Este espacio permite que el programa pueda expandirse. No obstante existen algunas excepciones como por ejemplo las llamadas *All-roof houses*.²⁸ Esta tipología tiene como ventaja la carencia de fachadas, en consecuencia se genera más de un espacio de buhardilla. Un ejemplo de ello es el proyecto de vivienda del estudio japonés Suppose Design Office, constituido por una gran envolvente metálica a dos aguas que contiene los usos de vivienda pero al mismo tiempo convive con espacios flexibles y patios generados por esta geometría particular.

Otra aproximación a esta estrategia son los proyectos con una estructura ligera con cubierta a dos aguas que actúa como una envolvente. Se genera un espacio en el cual se pueden aprovechar todos los usos en una planta inferior y la planta que está delimitada por la cubierta se plantea como espacio multifuncional.

²⁸ Kronenburg, R. (2007). *Flexible: Arquitectura que integra el cambio*. Barcelona:Blume.

2. ESTRATEGIAS FLEXIBLES

2.3 ADD IN

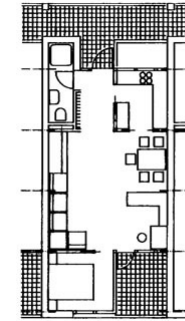
2.3.2 Ejemplos prácticos

Este caso de estudio tiene cierta relevancia en cuanto a la utilización de esta táctica ya que se utiliza de una manera diferente. Es el caso estudiado que más relación tiene con la flexibilidad hablando en términos de crecimiento vertical, porque resuelve el proyecto mediante una composición estructural de vigas clara y ordenada.

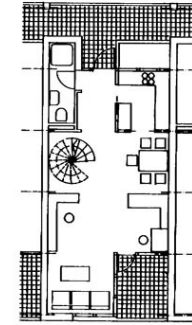
El trabajo de Schweighofer se caracteriza por el objetivo de desarrollar espacios que están funcionalmente lo más indeterminados posible.²⁹ Este proyecto propone un conjunto de apartamentos, en Berlín, que pueden adaptarse con el tiempo: el espacio de doble altura inicial puede ser llenado con una plataforma adicional para realizar una planta más.

²⁹ Kühn, C.(2001). *Anton Schweighofer: a quiet radical: buildings, projects, concepts*. Wien: Springer.

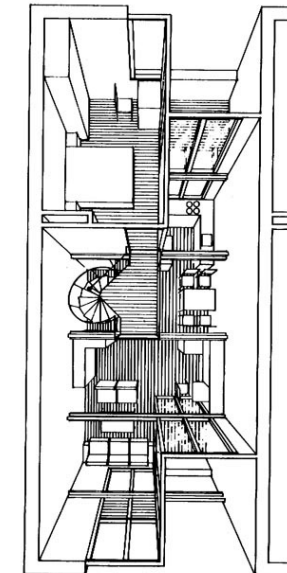
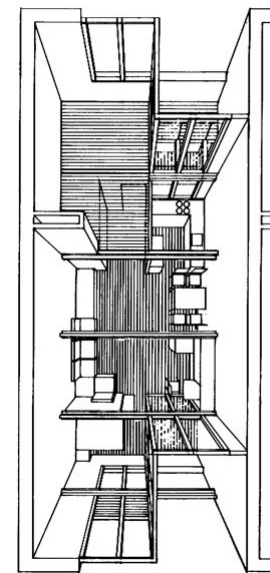
36. Anton Schiweighofer. *The growing house*. 1984. Esquemas con las posibles adiciones .



1. Primera adición.

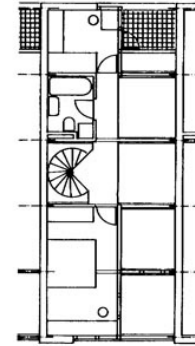


1. Segunda adición.

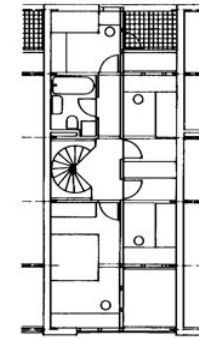


El nivel superior está supeditado por las vigas de intervalos regulares. Sobre estas vigas, el espacio se puede organizar de manera que una serie de disposiciones espaciales - son posibles - tanto horizontal como verticalmente. Por tanto, un apartamento de 49 m² se puede cambiar a uno de 97 m², que puede ser utilizado como un espacio de loft.

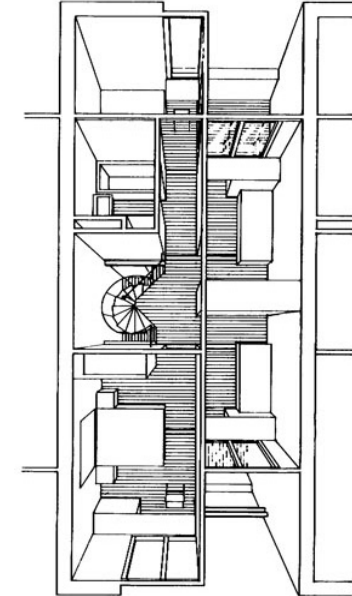
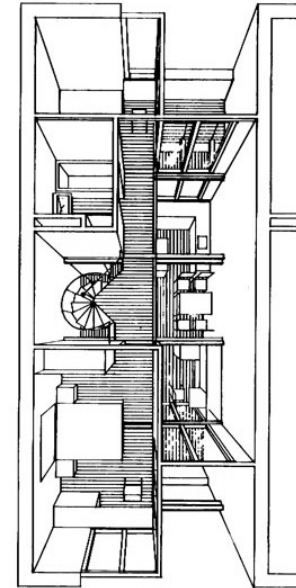
Como desventaja, la unidad sería costosa inicialmente, debido a que el usuario está pagando por exceso de espacio en la primera instancia.



1. Tercera adición.



1. Cuarta adición.



2. ESTRATEGIAS FLEXIBLES

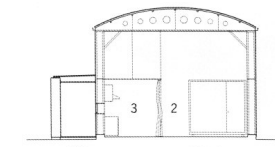
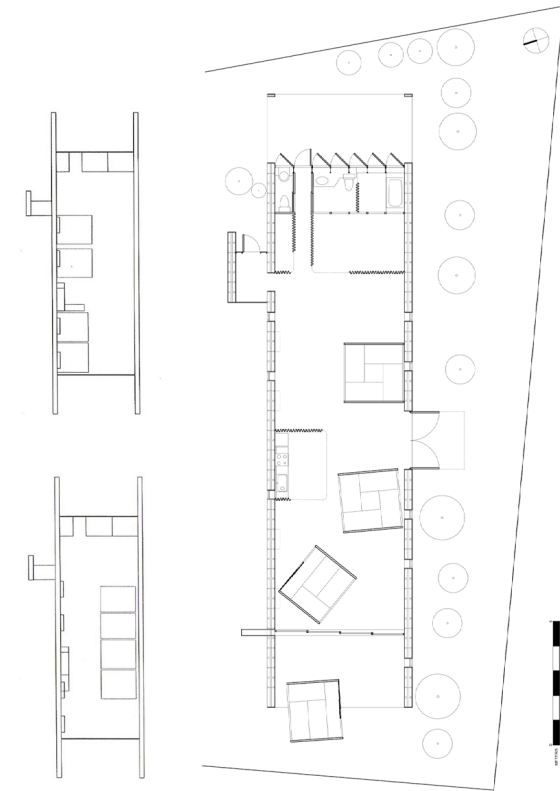
2.3 ADD IN

2.3.2 Ejemplos prácticos

Este proyecto de vivienda se define como un espacio rectangular construido con estructura de madera y utilizando el sistema *Ballon Frame*. El espacio interior principal está cerrado por un lado por zonas de servicio, como almacén, cocina y baño, y, por el otro, por una pared translúcida y opaca.³⁰

El arquitecto trabaja con dos planos totalmente definidos, el del suelo y el del techo, que están separados por bastante altura. Entre ellos se sitúan cuatro cubos que pueden moverse libremente sobre ruedas. Estos volúmenes creados de acuerdo a las proporciones japonesas tienen la función de habitaciones o zonas de descanso. Las estancias pueden agruparse o permanecer separadas, y la familia puede permanecer dentro, encima, fuera de ellas o en el espacio principal. El carácter

³⁰ Tectónica blog. *Naked house*. Disponible en: <http://www.tectonicablog.com/docs/naked.pdf>

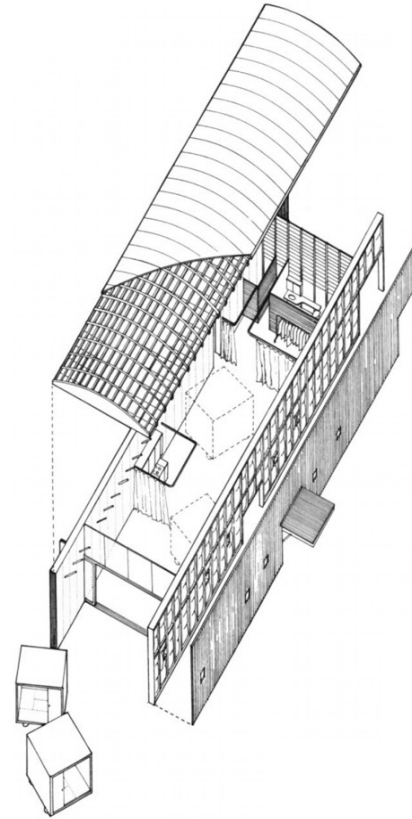


37. Shigeru Ban. *Naked house*. 2000. Planta principal con distintas disposiciones.

37a. Shigeru Ban. *Naked house*. 2000. Sección transversal.

de la casa puede reconfigurarse en un instante moviendo las estancias para abrir o cerrar espacios. Gracias al espacio restante entre estas y la cubierta, el proyecto tiene la capacidad de poder extenderse.³¹ Por tanto, la flexibilidad en términos de la adición de espacios se lleva a cabo mediante la capacidad de los cubos móviles para poder habitar su superficie superior. Por este motivo se genera una altura superior a la de los espacios en planta baja, ganando espacio global en la vivienda y dando la posibilidad de crear espacios diferentes a distinto nivel. En la misma línea que la táctica de adición de espacios también se utiliza la estrategia flexible. Esto se debe a la utilización de un sistema constructivo y de instalaciones flexible. Esta técnica debe permitir que los cubículos, dependiendo del uso y en función de la elección de los usuarios, puedan conectarse a los servicios.

31 Kronenburg, R. (2007). *Flexible: Arquitectura que integra el cambio*. Barcelona: Blume.



38. Shigeru Ban. *Naked house*. 2000. Axonometría del conjunto.

39. Shigeru Ban. *Naked house*. 2000. Imagen del espacio polivalente.



2. ESTRATEGIAS FLEXIBLES

2.3 ADD IN

2.3.2 Ejemplos prácticos

El proyecto del FRAC es una rehabilitación de un antiguo almacén para barcos en el puerto de Dunkirks (Dunkerque ,Francia).³² Su forma exterior se asemeja a una gran envolvente en forma de volumen prismático con cubierta a dos aguas. El volumen de dicho almacén resulta ser tan inmenso que se decide mantener como catalizador de usos como los dedicados a exposiciones de arte contemporáneo. De esta manera, la idea inicial de los arquitectos parisinos se fundamenta en mantener el antiguo almacén y crear un volumen yuxtapuesto a éste de la misma forma y espacio. La duplicación del almacén es la solución a la búsqueda de identidad del mismo.

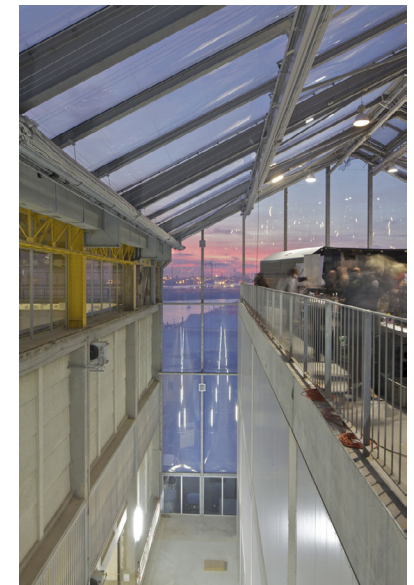
La nueva edificación se resuelve mediante una gran envolvente de estructura prefabricada y vidrio, donde en su interior alberga todo el programa. Esta manera de proyectar

³² Márquez , F.; Levene, R. (2015). *Lacaton & Vassal: 1993-2015*. Madrid : El Croquis.

40. Lacaton & Vassal. FRAC. 2013. Imágenes del espacio flexible.

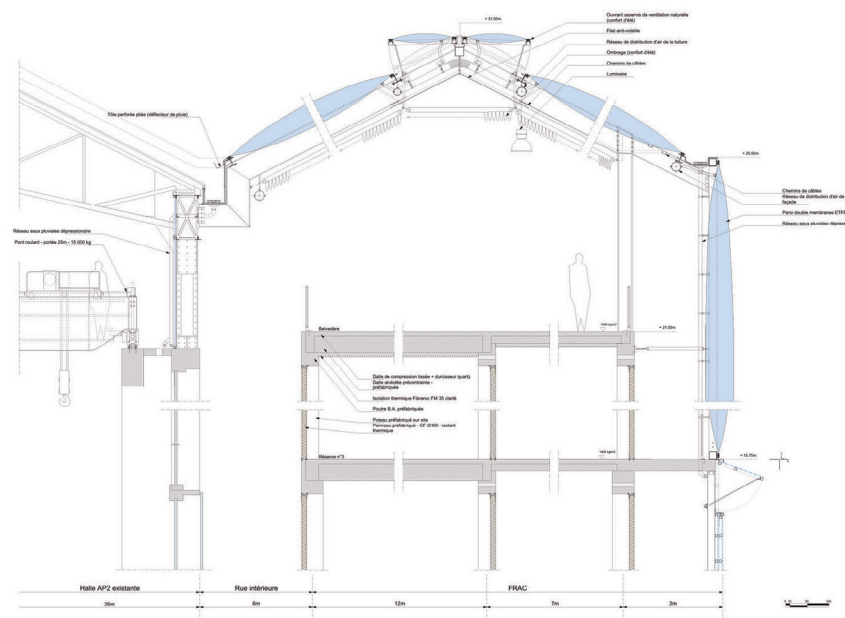


41. Lacaton & Vassal. FRAC. 2013. Imagen exterior.

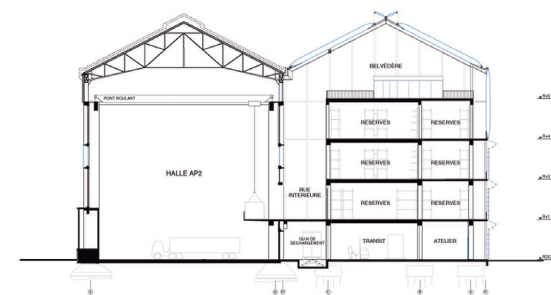


es similar a la expuesta anteriormente en el proyecto Naked house del arquitecto japonés Kengo Kuma, donde la vivienda se entiende como una envolvente de cubierta a dos aguas donde el programa se organiza de manera flexible dentro de éste. Se trata de la misma estrategia pero a distinta escala. Del mismo modo que en el proyecto de Kuma, los arquitectos franceses distribuyen el programa de manera flexible. Se separa la envolvente de los usos dejando pasar las comunicaciones verticales vistas desde el exterior. Se trabaja con plataformas libres, flexibles y cambiantes, con pocas limitaciones.

El espacio generado entre la envolvente y el volumen interior genera espacios polivalentes como el de la última planta. Los espacios delimitados por la cubierta se caracterizan por su flexibilidad, ya no se especifica ningún uso previsto. Pueden adaptarse a cualquier acontecimiento, desde una exposición de



42. Lacaton & Vassal. FRAC. 2013. Sección constructiva del espacio flexible.
43. Lacaton & Vassal. FRAC. 2013. Sección transversal.



obras pictóricas hasta una conferencia. La materialización ayuda a comprender los espacios como exteriores, adoptando así la esencia de lugares de reunión propios de los espacios exteriores.

Por tanto, se hace uso de la técnica del *Add-in* ya que se utiliza el espacio de última planta como una extensión del programa y por la manera en la que divide el espacio verticalmente, mediante plataformas cambiantes.



44. Lacaton & Vassal.
FRAC. 2013. Imagen del
espacio polivalente.

2. ESTRATEGIAS FLEXIBLES

2.4 ADAPTABLE

2.4.1 Estrategia de diseño

Cuando un proyecto arquitectónico se considera adaptable quiere decir que su propia configuración de espacios permiten múltiples usos. Esta técnica es la más utilizada a lo largo de los siglos por multitud de culturas. Esta estrategia se divide en composición muraria y composición en retícula. Dentro de la configuración mediante muros de carga, se pueden encontrar en la arquitectura tradicional claros modelos de espacios adaptables. Un ejemplo de ello podría ser la barraca valenciana, cuya forma rectangular en planta, libre de elementos estructurales, permite que la planta sea diáfana y adaptable.³³ Por tanto, el sistema estructural de muros de luces reducidas ayuda a generar espacios adaptables. Se establece una similitud entre este ejemplo de arquitectura rural y el proyecto de vivienda ya estudiado del arquitecto japonés Kengo Kuma 'Naked house', donde la composición y concepción de forma es similar. En la composición por retícula, otro prototipo de arquitectura tradicional sería la Mezquita de Córdoba.³⁴ Esta edificación originariamente era una gran sala hipóstila de 19

naves utilizada como sala de oración, con la única excepción de los habitáculos existentes en el doble muro de la alquibla (lugar donde se indica la dirección hacia donde se ora). Se comportaba como una gran retícula de pilares. La mezquita demuestra que la retícula es un sistema adaptable, ya que a lo largo de la historia se han producido transformaciones, desde la inclusión de otras edificaciones hasta la eliminación de pilares, sin que se destruya la composición principal. Estos patrones indican en primer lugar, la manera en la cual la arquitectura vernácula se ha visto eclipsada por los avances tecnológicos. Por otra parte hoy en día estos modelos podrían seguir siendo prácticos. La tecnología hoy en día permite que se creen edificios capaces de adaptarse a las personas.

En contraste con el sistema *Flexible* que se basa en el aspecto constructivo, esta técnica surge de la composición arquitectónica. A pesar de ser sistemas diferentes, ambos se complementan ya que cuando un proyecto es adaptable es más sencillo aplicar sistemas 'flexibles' y viceversa. Por tanto, cabe decir que los proyectos adaptables son la base de un proyecto donde la flexibilidad es el principal objetivo. Un ejemplo claro de esta dualidad de estrategias es el proyecto de 'Torres mixtas' de los arquitectos madrileños Ábalos y Herreros.

33 Pastrana Pavía, C. (2014). *Catálogo y puesta en valor del patrimonio arquitectónico de la Huerta de Alboraya*. Disponible en :<http://hdl.handle.net/10251/48641>.

34 Ruiz Cabrero, G.; Amador de los Ríos y Fernández Villalta, R. *Monumentos latino-bizantinos de Córdoba (Mezquita de Córdoba) 1843-1917*. Madrid : Instituto Juan de Herrera Escuela Técnica Superior de Arquitectura, Universidad Politécnica de Madrid.

2. ESTRATEGIAS FLEXIBLES

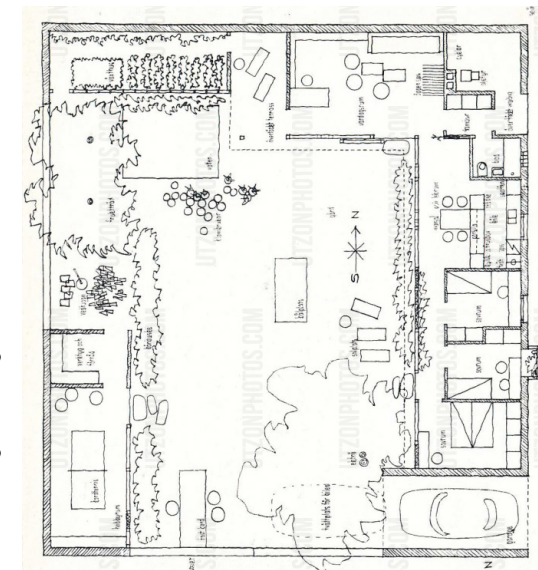
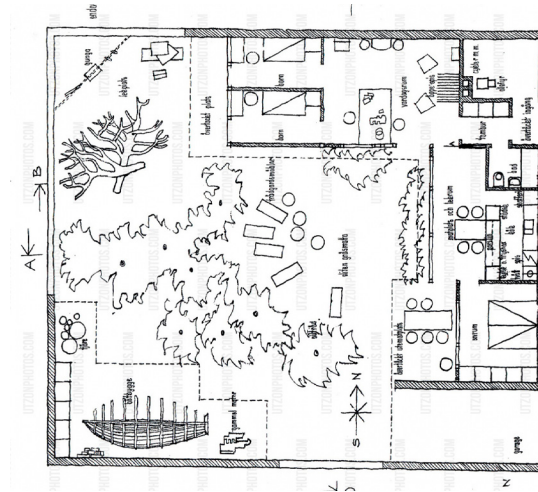
2.4 ADAPTABLE

2.4.2 Ejemplos prácticos

Este proyecto ha sido reconocido en toda Europa durante el S.XX como modelo de vivienda protegida, por sus cortes repetitivos de una sola planta dispuestos libremente en un paraje de gran calidad paisajística.³⁵ Éste es el primer proyecto donde aplica las teorías sobre arquitectura aditiva, donde una unidad es repetida 'n' veces formando sistemas de mayor escala similares a patrones de crecimiento en la naturaleza.

Las 63 viviendas tienen un área cuadrada (15m x15m) donde la superficie construida forma una 'L'. El espacio restante de esta manera se concibe como espacio libre. Este área resulta ser adaptable ya que el usuario es libre de extender la superficie ocupada. Por tanto, a parte de ser una planta con forma adaptable, la composición de la vivienda con el patio también resulta ser adaptable. Este

³⁵ Utzon, J. (2009). *Jorn Utzon Logbook: v. 5: Additive Architecture*. s.l : Blondal.



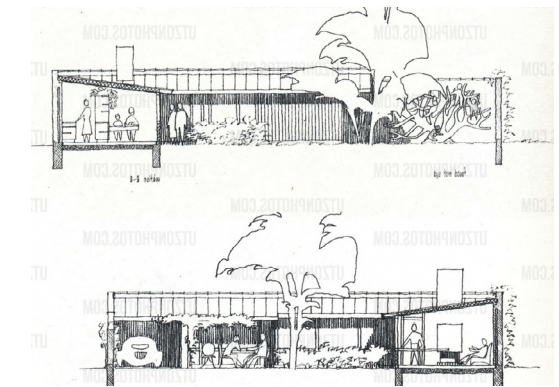
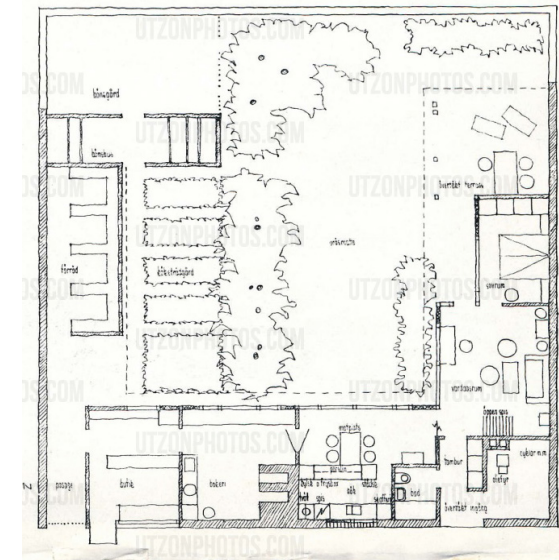
45. Jorn Utzon. *Kingo Houses*. 1958. Planta tipo 1.

46. Jorn Utzon. *Kingo Houses*. 1958. Planta tipo 2.

proyecto también se podría asociar a la estrategia de add-on, ya que se puede aumentar la superficie de suelo ocupado.

La composición de cada unidad es generada por una serie de muros de ladrillo que conforman un área privada e íntima, como si de una fortaleza se tratara. Utzon se inspira en la tipología de vivienda japonesa, creando un espacio de patio que da privacidad. El arquitecto consigue crear una tipología de vivienda adaptable que resuelve el soleamiento y permite la privacidad, con un bajo presupuesto.

Como se puede ver en los dibujos (imagen 47) en planta que realiza Utzon , plantea una posible utilización de dicho espacio de patio de manera temporal.



47. Jorn Utzon. *Kingo Houses*. 1958. Adaptación de nuevos elementos a la planta inicial.

48. Jorn Utzon. *Kingo Houses*. 1958. Secciones descriptivas del espacio flexible.

2. ESTRATEGIAS FLEXIBLES

2.4 ADAPTABLE

2.4.2 Ejemplos prácticos

Los arquitectos alemanes Wimmer and Partner han ideado un bloque de vivienda colectiva, que gracias a su diseño adaptable permite múltiples formas de vida y posibilidades de uso.³⁶ Se hace un estudio extendido de las formas de vida que se dan hoy en día en nuestra sociedad para justificar de esta manera este tipo de estrategia basada en la flexibilidad.

La edificación se compone de células habitacionales compactas que se organizan de acuerdo a una estructura abierta, esto hace posible crear espacios adaptables. El sistema estructural en trama permite que los espacios exteriores de cada vivienda puedan variar como por ejemplo cerrarse o abrirse al exterior.

³⁶ University of Sheffield School of Architecture. (2004-06). *Wohnbau "Baugruppe LiSA"*. Disponible en :<http://www.afewthoughts.co.uk/>.



49. WUP. *Wohnbau 'Baugruppe LiSA'*. 2015. Imagen exterior del conjunto.

50. WUP. *Wohnbau 'Baugruppe LiSA'*. 2015. Fotografía del corredor exterior que da acceso a las viviendas.



Cada unidad de vivienda se construye mediante muros no portantes, consiguiendo así un menor peso para la estructura. Los apartamentos son definidos por el usuario, aunque se juega con un sistema estático de espacios privados.

Por lo tanto, se establece un nuevo concepto de jerarquía de espacios en vivienda. Lo más privado ya no es la vivienda en sí hasta un espacio común que ya no es simplemente el exterior. Los arquitectos crean un espacio estático en cada unidad de proporción reducida dedicado a la intimidad del usuario (máxima privacidad). Los espacios restantes de la vivienda no estáticos se establecen en un espacio único y diáfano (espacio común) con conexión directa con el exterior mediante una corredor exterior (máxima relación con el exterior). Los arquitectos denominan este concepto como 'Das Wohnregal', una visión urbana y colectiva de los edificios compactos de vivienda.



51. WUP. *Wohnbau 'Baugruppe LiSA'*. 2015. Plantas de las distintas variaciones que puede experimentar una vivienda dependiendo del modo de habitar de los usuarios.



2. ESTRATEGIAS FLEXIBLES

2.4 ADAPTABLE

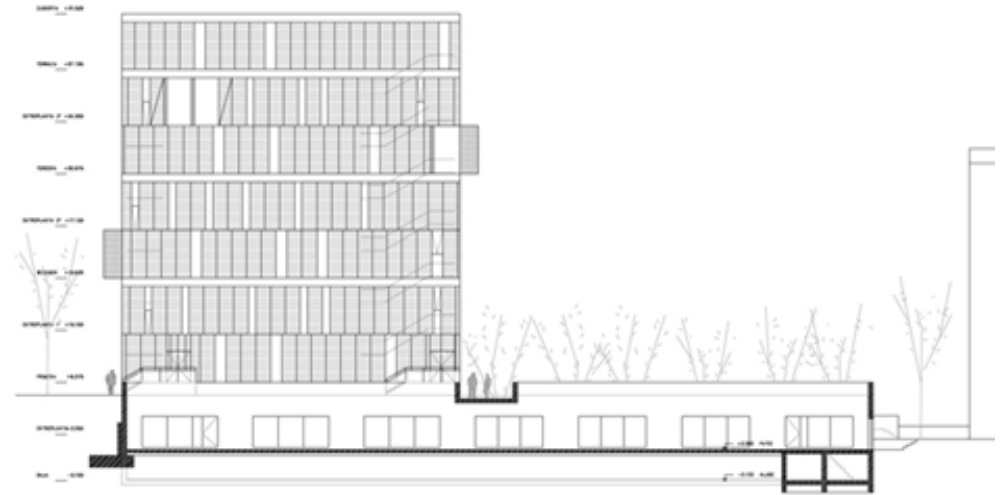
2.4.2 Ejemplos prácticos

No se pretende reproducir el modelo de biblioteca que suele utilizarse. Los arquitectos la conciben como una suma de servicios diferenciados que tienden a ser cada vez más externos.³⁷ La situación física contiene aspectos paisajísticos interesantes, por este motivo se aprovecha el desnivel de la parcela para hacer soluciones aterrazadas o semienterradas.

Este caso de estudio está influenciado por el proyecto experimental de "Las torres mixtas".³⁸ Se trataba de una tipología de torre de geometría sencilla con estructura en retícula, que contenía todo tipo de usos, desde cine a viviendas. Esta variedad de usos se debe a la capacidad de adaptación. En este caso, el volumen se define como una torre de mediano

37 Ábalos, I.; Herreros, J. (1997). Áreas de impunidad = Areas of impunity. Barcelona : Actar

38 Ábalos, I.; Herreros, J.; Beigel, F. (2002). Ábalos&Herreros (2G). Barcelona: Gustavo Gili.



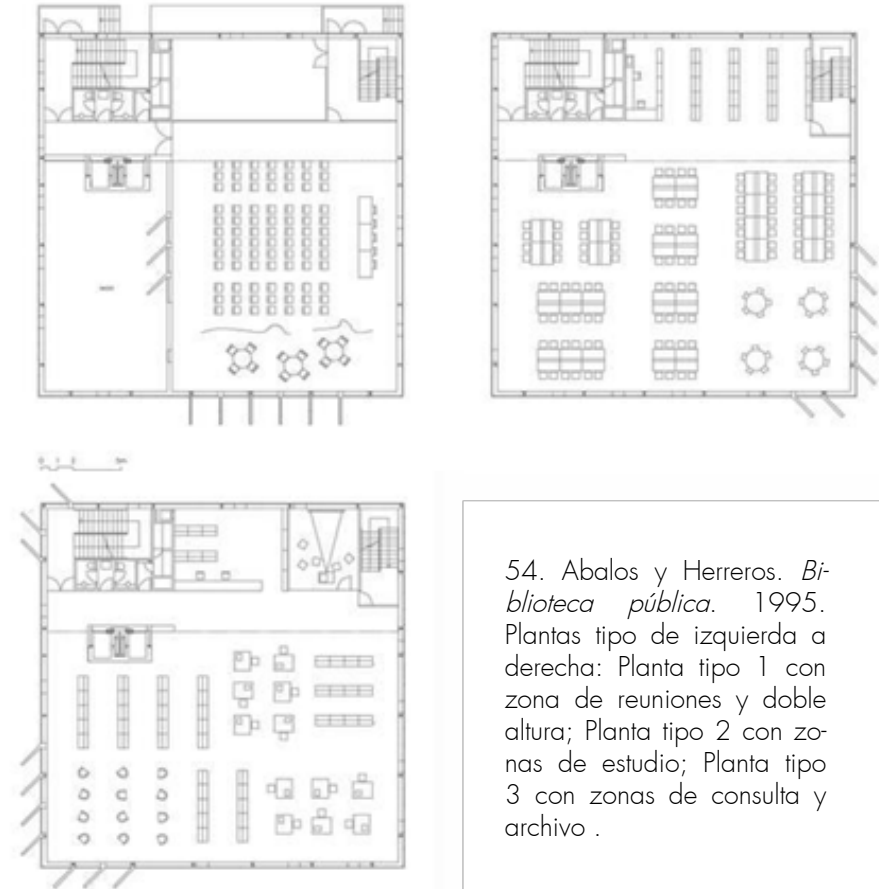
52. Abalos y Herreros. *Biblioteca pública*. 1995. Alzado donde se aprecia la composición en paneles móviles de la fachada.

53. Abalos y Herreros. *Biblioteca pública*. 1995. Imagen exterior del conjunto.



tamaño, que reúne desde cafetería y espacios libre como parques hasta los usos más propios de una biblioteca.

El funcionamiento de la biblioteca de organiza desde un cuerpo inferior que actúa como zócalo, contiene todas la actividades de préstamos rápido y se ilumina por un patio trasero. Las estancias más prolongadas son 3 y se colocan superpuestas. La organización vertical permite concentrar las comunicaciones, simplificar los sistemas constructivos y generar espacios diáfanos. Por tanto, es sensato pensar en las posibilidades que abre una organización vertical del programa no sólo en términos funcionales ,minimizando núcleos y recorridos, simplificando la construcción, ofreciendo plantas diáfanas, etc., sino también en clave representativa, como pieza central de la manzana.



54. Abalos y Herreros. *Biblioteca pública*. 1995. Plantas tipo de izquierda a derecha: Planta tipo 1 con zona de reuniones y doble altura; Planta tipo 2 con zonas de estudio; Planta tipo 3 con zonas de consulta y archivo .

Se trabaja con una estructura sencilla que genera una planta simple donde los espacios pueden ser adaptados a múltiples circunstancias. Se puede decir que gracias a un sistema estructural en retícula y una fachada continua se obtiene una planta adaptable. Por otro lado, aparecen sistemas flexibles que compartimentan pero al mismo tiempo permiten esta adaptabilidad. Sin embargo como se puede ver en la plantas, no se compartimenta el espacio en exceso, la mayoría de los espacios son diáfanos y compuestos por un mobiliario móvil.



55. Abalos y Herreros. *Biblioteca pública*. 1995. Fotografía de espacio interior diáfano..

2. ESTRATEGIAS FLEXIBLES

2.5 FURNITURE

2.5.1 Estrategia de diseño

El equipamiento también es otra táctica para poder transformar el espacio. El mobiliario es un factor esencial de diseño general de espacios. Los arquitectos interesados en los espacios flexibles normalmente crean sistemas de mobiliario que conllevan esta idea de flexibilidad. Este mecanismo lo utilizaron los arquitectos metabolistas durante los años 60 en Japón. Estos concebían el mobiliario como elementos integrados en la vivienda.³⁹ El grupo nació en el seno de la segunda guerra mundial con el objetivo de crear arquitecturas de ideales democráticos. Crearon diseños de vivienda en masa donde se cuestionaban temas sobre la habitabilidad, como por ejemplo eliminar el estereotipo de usuario. Una característica esencial fue el apoyo de las grandes tecnologías aplicadas al diseño. Sobre el tema del mobiliario integrado para dar flexibilidad a los espacios, desarrollaron la idea de la vivienda que se descomponía en tres partes: esqueleto, órganos y piel. Los 'órganos' se asociarían al mobiliario integrado con la opción de ser móvil. Las viviendas no se compondrían por muros sino por el mobiliario.

Esta experiencia con mobiliario flexible también fue representada en la exposición que se produjo en el año 1972 en el MoMa de

Nueva York llamada *Italy, the New domestic landscape*.⁴⁰ Dentro de los arquitectos italianos Joe Colombo expuso su propuesta de unidades independientes conformadas en plástico cumpliendo diferentes funciones con la posibilidad de incorporarse en cualquier espacio. Esta muestra tenía como objetivo exponer nuevas formas de concebir la vivienda en la sociedad post-industrial. Las propuestas se mostraban cambiando los valores de privacidad y territorialidad, e incentivando los aspectos de sociabilidad entre los usuarios, mediante diseños de mobiliario modular.

No obstante, esta estrategia tiene un menor grado de importancia que las demás metodologías de proyecto expuestas. Por lo tanto, se trata de un método de proyecto complementario a los demás. En muchos casos de estudio de propuestas flexibles, sobre todo en vivienda, se establece un equipamiento acorde a los ideales flexibles. No se trata de diseñar mobiliario independiente, desmontable o transformable, sino que esta táctica se basa en un equipamiento integrado que permite una mayor flexibilidad en la propuesta. Este es diseñado específicamente para cada caso. Por otro lado, hoy en día, el mercado del mobiliario interior consta de multitud de opciones, en la mayoría de casos modulares, adaptables, etc.

39 Koolhaas, R.; Ulrich, H. (2009). *Project Japan: Metabolism talks...* Colonia: Taschen.

40 Riva, M. (2010). *"Design e comunicazione audiovisiva industriale"* (Tesis doctoral). Politécnico de Milán, Facultad de diseño, Milán.

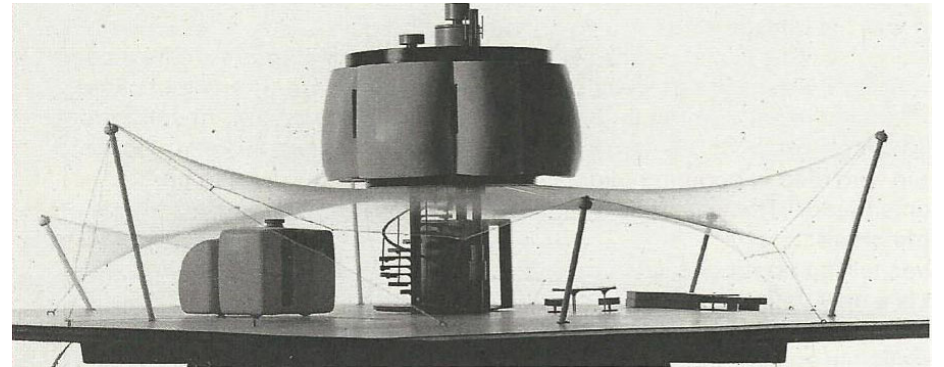
2. ESTRATEGIAS FLEXIBLES

2.5 FURNITURE

2.5.2 Ejemplos prácticos

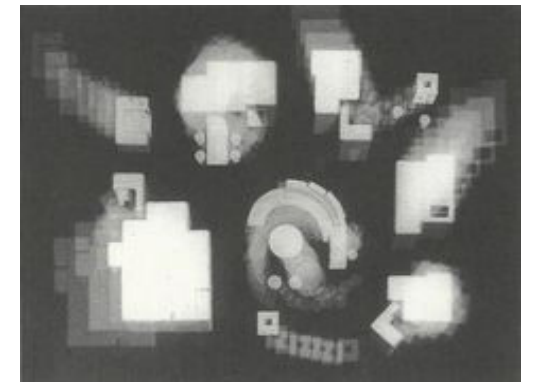
Kenji Ekuan fue ingeniero industrial y figura central del movimiento metabolista japonés. La catástrofe de Hiroshima fue lo que le incitó a dedicarse a crear elementos públicos. Posteriormente trasladó su técnica de diseño y sus ideales a proyectos de vivienda experimental. En 1964 Ekuan creó la 'Pumpkin house' después de haber experimentado con proyectos de menor escala.⁴¹ El proyecto constaba de un núcleo principal donde se encontraban elementos como la cocina y los baños, el espacio alrededor de este estaba ocupado por elementos independientes de mobiliario que completaban las funciones de vivienda. Este espacio libre estaba cubierto por unas lonas ligeras que permitían un contacto directo con el exterior. Esta vivienda estaba diseñada para dos personas, aunque ofrecía la posibilidad de extenderse gracias a una estructura expansiva. El sistema estructural estaba constituido por un

⁴¹ Koolhaas, R.; Ulrich, H. (2009). *Project Japan: Metabolism talks...* Colonia: Taschen.



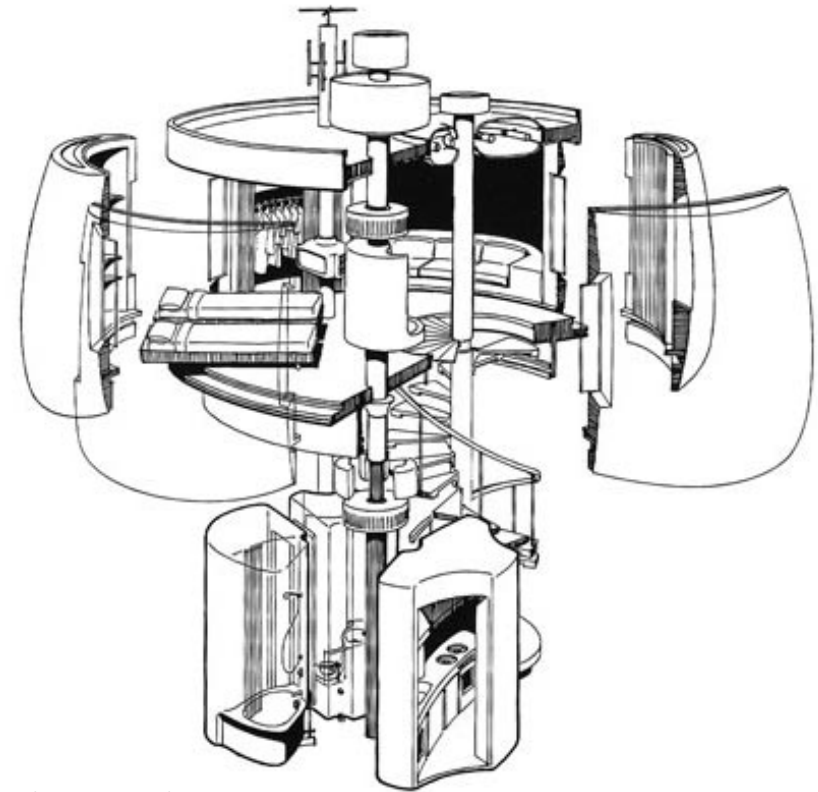
56. Kenji Ekuan. *Pumpkin house*. 1964. Imagen de la maqueta.

57. Kenji Ekuan. *Pumpkin house*. 1964. Bocetos sobre el movimiento del mobiliario a lo largo del tiempo.



núcleo principal del cual partían unos pórticos formados por tensores metálicos y pilares metálicos. La expansión se producía hacia el exterior y también hacia el interior. La expansión interior se basaba en una mini-cápsula para una persona más. Esta se descomponía en diferentes piezas de mobiliario. El habitáculo se compone de una estructura vertical donde se adhiere una escalera de caracol y también a este se le acoplan elementos de mobiliario como si de piezas de 'lego' se tratara. Por lo tanto, este proyecto utiliza el mobiliario como estrategia principal de diseño.

Por otra parte, la expansión exterior se basaba en la eliminación de barreras entre el interior y el exterior. Esta mini-cápsula recuerda al proyecto de la torre *Nagakin* del también arquitecto metabolista Kisho Kurokawa, donde las cápsulas que componen la torre tienen un mobiliario integrado.



58. Kenji Ekuu. *Pumpkin house*. 1964. Axonometría explosionada de la mini-cápsula.

2. ESTRATEGIAS FLEXIBLES

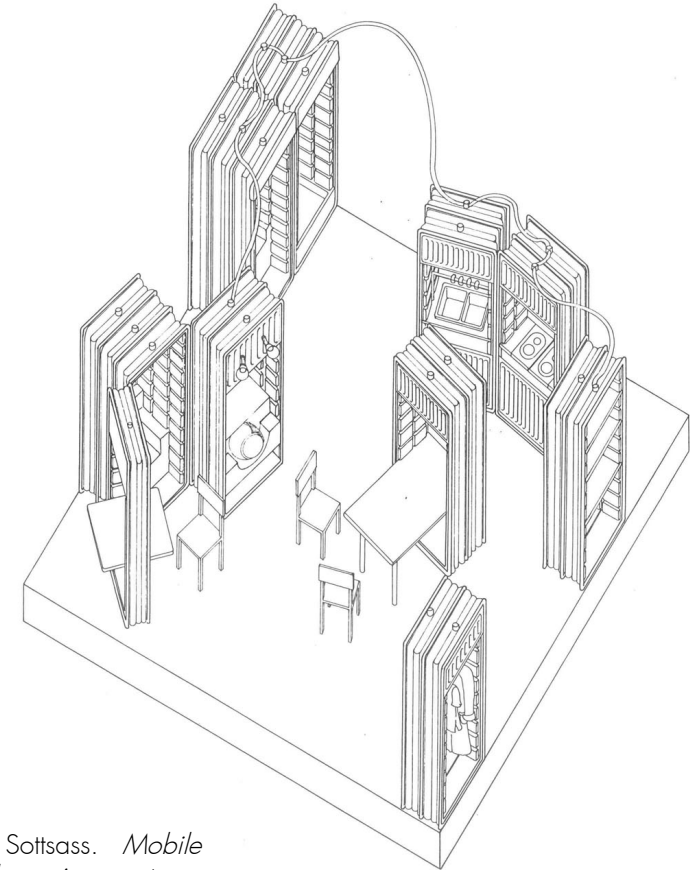
2.5 FURNITURE

2.5.2 Ejemplos prácticos

'Mobile and flexible environment module' es una reflexión social sobre la habitabilidad. Se rompió con la manera tradicional de organizar una vivienda, pero también se quiso eliminar valores sociales como la rutina o la asociación del género a diferentes actividades. La solución que dió al problema es una vivienda capaz de permitir que los usuarios creen sus espacios en función de sus experiencias sociales y sus necesidades. Se trataba de una vivienda activa en constante movimiento, donde cada día es una vivienda diferente. Sottsass decía que los usuarios tienen que poder transmitir como se sienten a través del mobiliario.

El arquitecto italiano a finales del s.xx desarrolló para la exposición de 1972 del MoMa de Nueva York, una serie de módulos compuestos por plástico equipados de acuerdo a las funciones de la vivienda.⁴² Los módu-

⁴² Museum of Modern Art, Department of Public Information. (1972). Resumen de exposición, *Italy: the new domestic landscape*. New York: MoMa.



59. Ettore Sottsass. *Mobile and flexible environment module*. 1972. Axonometría de la vivienda experimental.

los podían moverse, deslizarse gracias a unas guías y podían conectarse al suministro en la parte superior. Cada contenedor reflejaba una función: una cocina, una nevera, un armario, una ducha, una librería, etc. Esta descomposición de los elementos que comúnmente componen una vivienda, favorecía la libertad que tenía el usuario de organizar los espacios en función de su cultura y su experiencia social.

En la exposición se incluía un video en el cual se demostraba mediante modelos reales de la propuesta (imagen 60) que era posible y real vivir en estos espacios.



60. Ettore Sottsass. *Mobile and flexible environment module*. 1972. Modelo real para exposición.

2. ESTRATEGIAS FLEXIBLES

2.5 FURNITURE

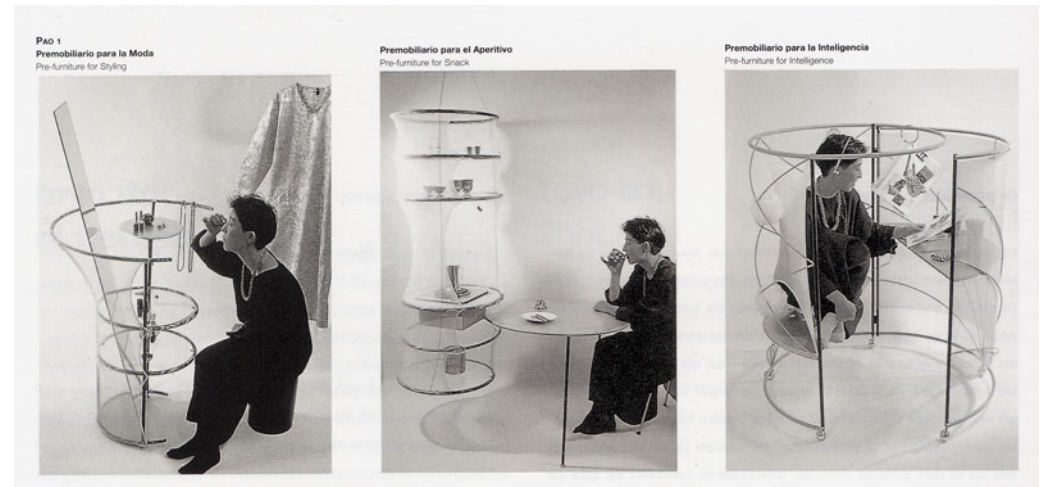
2.5.2 Ejemplos prácticos

'Pao for the tokyo nomad girl' fue un conjunto de instalaciones realizadas entre 1985 y 1989 por Toyo Ito, que cuestionaron el modo de habitar imperante en el contexto de una sociedad tardo-capitalista y post-industrial, así como su relación con un entorno y realidad en plena crisis, económica y de valores, especialmente en Japón.⁴³

Este prototipo de vivienda experimental para un estereotipo de chica joven que habita en la ciudad de Tokio.⁴⁴ El pensamiento de Toyo Ito advierte que la gran ciudad ha absorbido funciones y necesidades que anteriormente se realizaban en las viviendas. Pone como ejemplo el espacio de comedor y cocina que hoy en día es sustituido por los restaurantes de comida para llevar y comida rápida.

43 Gleiter, Jörg H. (2010). *The architect's eye. Interview with the japanese architect toyo ito*. Zona 6 (Supplement to Abitare).

44 Ábalos, I. (2000). *La Buena Vida. Visita guiada a las casas de la modernidad*. Madrid: Gustavo Gili. pág. 150-154.



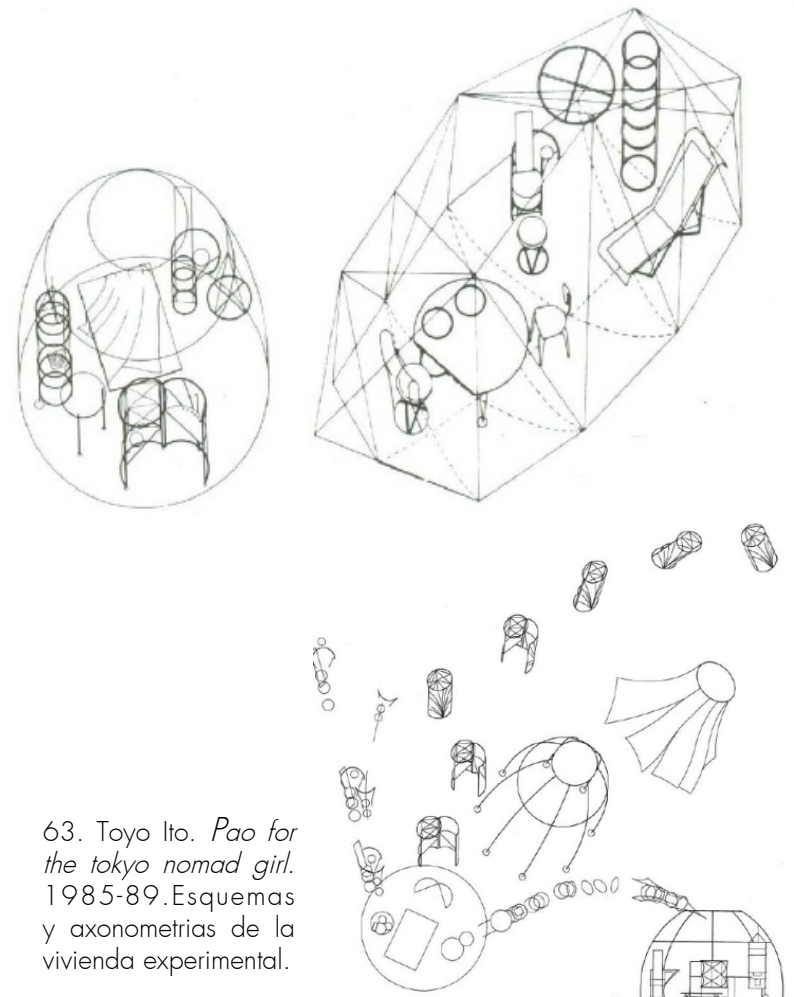
61. Toyo Ito. *Pao for the tokyo nomad girl*. 1985-89. Imágenes de las instalaciones.

62. Toyo Ito. *Pao for the tokyo nomad girl*. 1985-89. Collage que recoge la instalación y la ciudad de Tokio.

Los conceptos de nomadismo y flexibilidad están muy asociados. Un espacio flexible donde los elementos que lo componen permiten cambios constantes, es completamente asociado a un estilo de vida nómada. Actualmente los habitantes de las grandes ciudades habitan más tiempo fuera de casa que en ella. Según Ito las viviendas solo abastasen las necesidades de descanso y de refugio. En estos dos conceptos basa el diseño de las piezas de la vivienda.

Toyo Ito realiza un análisis de los posibles usos que generaría una chica nómada:

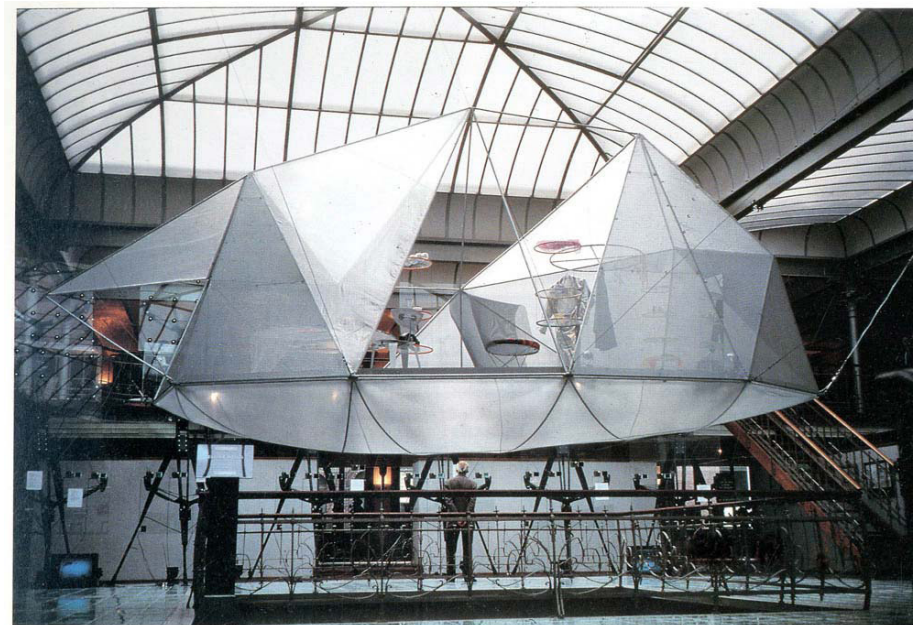
- Elimina la zona de cocina y comedor, porque se sustituye por lugares de comida para llevar y comida rápida.
- Suprime la zona de aseo, porque se supone que la chica utiliza servicios públicos.
- Excluye la zona de estar ya que la chica



63. Toyo Ito. *Pao for the Tokyo nomad girl*. 1985-89. Esquemas y axonometrias de la vivienda experimental.

utiliza espacios públicos.

Este proyecto se desarrolla bajo un pensamiento un tanto radical desde el punto de vista del concepto de vivienda. Por tanto, la vivienda se basa solo en espacios donde pueda haber intimidad. Se reduce a un refugio que contiene una cama, una basura y una serie de piezas estructurales de mobiliario. El caso de estudio se trata de estas piezas estructurales ya que se utiliza el mobiliario como estrategia para generar un espacio flexible y cambiante. Hay tres piezas que cumplen tres propósitos: vestirse, comer y meditar.



64. Toyo Ito. *Pao for the Tokyo nomad girl*. 1985-89. Fotografía de la instalación cuando se realizó la exposición.

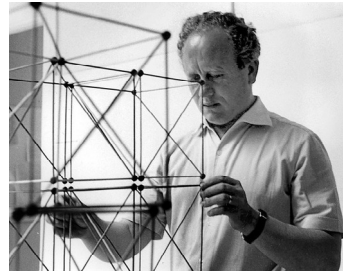
2. ESTRATEGIAS FLEXIBLES

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2.5.2 Ejemplos prácticos

El arquitecto Fritz Haller está inseparablemente vinculado con el sistema de muebles USM, un icono del diseño suizo que apuesta por soluciones flexibles.⁴⁵ El interés de Haller por la geometría, la estandarización y la prefabricación y su permanente búsqueda de estructuras que pueden ser adaptadas a las necesidades cambiantes de sus usuarios se produjo con el desarrollo de este sistema.

El Sistema Modular USM Haller, en primera instancia se utilizó para el pabellón de oficinas en Münsingen donde Haller aplicó sus ideas sobre naves flexibles con la visión genial de un sistema modular de acero.⁴⁶ El resultado fue un producto flexible que se adap-



65. Fritz Haller.
66. Fritz Haller. *Pabellón de oficinas en Münsingen*. 1961. Vista exterior.



45 University of Sheffield School of Architecture. (2004-06). *Fritz haller*. Disponible en : <http://www.afewthoughts.co.uk/>.

46 Azpilicueta, E; Araujo, R. *El mito industrial*. Tectónica blog . Disponible en : <http://www.tectonica-online.es/>.

taría a las crecientes necesidades del negocio y del espacio de USM.

Los Sistemas Modulares de USM se basan en componentes estandarizados, con los cuales se pueden construir innumerables soluciones. Se pueden adaptar a las situaciones del espacio existentes y ajustar según las necesidades, para que el amueblamiento siempre corresponda a la situación de vida personal. Se componen de barras de acero inoxidable unidas por piezas esféricas en la que se puede ensamblar por cuatro caras. El diseño se completa con tapas de múltiples colores y materiales.



67 Fritz Haller. *USM Haller*. 1963. Mueble modular.

68 Fritz Haller. *USM Haller*. 1963. Pieza esferica para ensamblar los modulos.



3. CONCLUSIÓN

La sociedad actual en términos de movilidad y sociabilidad se caracteriza por la fugacidad del tiempo y por la dependencia de conexión con el resto del mundo. Se establecen miles de desplazamientos al día y se realizan millones de interconexiones entre cada individuo y el resto del mundo. El estilo de vida del individuo se basa en continuos cambios derivados de distintas experiencias. La solución arquitectónica flexible absorbe los posibles cambios transformándolos en espacios definidos por los usuarios. La tipología de vivienda hasta el momento es el espacio que más cambios sufre a lo largo de su vida, por lo que la flexibilidad como modelo proyectual siempre ha estado asociada a este tipo de espacios. En contraste con la sociedad actual, las experiencias vivenciales se realizan normalmente fuera del espacio doméstico por lo que es necesario que se estudie la forma de aplicar la flexibilidad a los espacios más públicos.

Por otra parte, la sostenibilidad en la arquitectura y su relación con nuestro entorno son temas de reciente discusión. En la esfera arquitectónica actual se habla de arquitectura sostenible principalmente desde un punto de vista tecnológico. Se estudian e investigan soluciones que incorporan sistemas tecnológicos como pueden ser los paneles solares o los materiales inteligentes. En este trabajo se defiende una sostenibilidad entendida desde el espacio y su posibilidad de variación.

La flexibilidad es un instrumento para poder crear espacios cambiantes y polifuncionales con posibilidad de adiciones a otros espacios como ejemplo espacios verdes. Es una manera de relacionar la arquitectura con el entorno desde el germen del proyecto y no como un condicionante más. La arquitectura flexible articula la naturaleza con los espacios. Un ejemplo claro de arquitectura sostenible entendida desde la flexibilidad es la producida por Lacaton & Vassal. En sus proyectos se utilizan las estrategias *Flexible*, *Add on*, *Add in* y *Adaptable*. El método Flexible lo recurren en todos los proyectos cuando incorporan sistemas móviles de particiones y cuando utilizan sistemas constructivos sencillos con posibilidad de desmontaje. La táctica *Add on* la utilizan en proyectos como la casa Latapie (Floriac, 1993), la Universidad de Artes y Ciencias Humanas (Grenoble, 1995-2001), la casa en Coutras (2000), las viviendas sociales en Mulhouse (2001-2005) y la Escuela de Arquitectura de Nantes (2009). La fórmula la aplican cuando amplían el espacio útil añadiendo estancias acristaladas de bajo coste. El sistema *Add in* se emplea en el proyecto de FRAC (2013) cuando se genera un espacio polivalente en la última planta del edificio. Por último, el procedimiento *Adaptable* se manifiesta en sus proyectos mediante el sistema estructural estándar que está abierto a futuras reconfiguraciones.

Nathalie Janson describe la sostenibilidad producida en el proyecto de la Escuela de Arquitectura de Nantes (2009):

Paradójicamente , es justamente este impulso primario por crear más espacio lo que hace que el edificio sea sostenible desde el punto de vista ecológico ,social , y financiero .Los volúmenes a doble altura sin programa ,diseñados a discreción por los arquitectos ,proporcionan a la escuela unos espacios adaptables y multifuncionales que permiten que en el futuro se pueda cambiar el programa del edificio en lugar de tener que destruirlo y construir otro nuevo.⁴⁷

Por otro lado, Iñaki Ábalos establece el concepto de belleza sostenible en su texto 'La belleza termodinámica' donde se habla de un tipo de estética asociada a la sostenibilidad que tiene que ver con cómo se configuran los espacios y no de qué elementos tecnológicos se pueden añadir al proyecto para que sea más sostenible.⁴⁸

47 Janson ,Nathalie.(2011). "Lacaton & Vassal Architects: Sustainable Space Makers", en AAVV, *Nantes School of Architecture ,University Building in France* .Zúrich: Holcim Foundation for Sustainable Construction,

48 Ábalos ,Iñaki. (2010). "La belleza termodinámica", 2G, núm. 56 (Ábalos +Sentkiewicz). 2G: Barcelona.

Como conclusión, la intención principal de este trabajo es abordar posibles soluciones arquitectónicas que puedan resolver tanto el problema del nuevo estilo de vida junto con una mejor relación con el entorno. Por lo tanto, después de nombrar las estrategias marcadas como son: Flexible, Ad don, Add in, Adaptable y Furniture, se prosigue a verificar qué maniobras flexibles son más adecuadas para aplicar a distintos usos y cuáles son estos.

En primer lugar, dentro del método de proyecto que se ha denominado Flexible se estudia el 'Centro Pompidou' (Richard Rogers y Renzo Piano, 1970) como caso de estudio de tipología distinta a la vivienda. El proyecto utiliza una táctica perfectamente aplicable a distintos usos. La flexibilidad se consigue mediante sistemas tanto constructivos como estructurales una flexibilidad tanto en la escala menor como en la mayor. Este método parte de una estructura que se adapta a los cambios y que además permite salvar grandes luces. Este sistema estructural admite particiones móviles u otras técnicas similares. Por último, esta fórmula en comparación con las demás, es la más adecuada para edificaciones de mayor escala, como podría ser un centro cultural, educativo o sanitario. Como se puede observar el proyecto expuesto es un espacio multifuncional, como denominan sus autores,

un contenedor cultural.⁴⁹

En segundo lugar, el procedimiento Add on se basa en la composición del proyecto prácticamente en planta y en la adición horizontal de espacios. Una composición que viene acompañada en la mayor parte de los proyectos de una estructura basada en la retícula. En el proyecto mostrado, 'Le salle d'espectacle polyvalente' (Lacaton & Vassal, 2015) se basa en un sistema reticular donde los usos ocupan un número de módulos según el espectáculo requerido. Este tipo de estrategia se adapta más a usos en constante movimiento como puede ser un teatro o sala de conciertos. En comparación con la técnica Flexible, este método requiere menos medios y menores costes para poder materializarlo.

En tercer lugar, la táctica de diseño Add in se plantea como una solución de adición de espacios, en este caso, en vertical. Esta fórmula como Add on tienen que estar presentes desde el comienzo de un proyecto para que las adiciones estén reguladas y planificadas. Esta solución no tiene una aplicación tan directa en la actualidad como en el resto de estrategias. El caso de estudio que se muestra para otras

tipologías es 'FRAC' (Lacaton & Vassal, 2013), edificación que utiliza el espacio entre la cubierta y la última planta como espacio polivalente, es decir, una extensión de los usos. Por lo tanto, esta maniobra se plantea como solución complementaria a soluciones como Add on o Flexible ya que estas independientes de las demás podrían solucionar todo un proyecto en todos los aspectos.

En cuarto lugar, el sistema Adaptable se fundamenta básicamente en la configuración de espacios que permite múltiples usos. Esta táctica permite que se varíen los usos a lo largo de la vida del edificio. El ejemplo de la 'Biblioteca de pública' (Abalos & Herreros, 1995) demuestra cómo esta técnica flexible se puede aplicar a usos diversos. Se puede aplicar mediante un sistema en retícula o muraría. Esta respuesta flexible se caracteriza por materializarse en formas geométricas sencillas. En resumen, esta solución se puede aplicar a tipologías de menor escala como vivienda, cultural, educativo, sanitario o administrativo.

Por último, la estrategia Furniture también entraría dentro de las soluciones complementarias, ya que se utiliza el mobiliario como medio para utilizar el espacio de la manera más flexible. El ejemplo del 'sistema Haller' (Fritz Haller, 1963) aplicado a tipologías como la industrial manifiesta que el mobiliario modular puede ser una respuesta

49 Asensio Cerver, F. (2002). *Renzo Piano*. Madrid: Kliczkowski.

adecuada para organizar espacios fácilmente, con la posibilidad de reconfigurar o desmontar.

La arquitectura hoy en día se clasifica más por autores y tipologías edificatorias que por patrones o estrategias de diseño. Se ha visto necesario realizar este recopilatorio de estrategias con el fin de establecer patrones flexibles en diversos proyectos para poder aplicarlos a intervenciones actuales.

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5. ANEJOS

5.1 Anejo 1

“Housing/flexibility?”¹

Esta compilación aparece en el número de noviembre de 1973 de la revista *Architectural design*. En primer lugar, se expone el contexto histórico del concepto de flexibilidad en vivienda. Se discute la posición del arquitecto frente al espacio interior de la vivienda. Nombra a los “Libertarian architects”, representados por John Habraken y los hermanos Arsène-Henri, como los iniciadores de la idea de que el usuario tenga autodeterminación frente al espacio interior de su vivienda. Además los autores sostienen que las propuestas de flexibilidad en vivienda tienden a ser algo complicadas como para tener algo de apoyo político. Por lo que sugieren que se incentive la creación de un dominio privado donde los usuarios satisfagan sus propias expectativas. En consecuencia, se necesitan de propuestas flexibles que lo permitan.

En primera instancia, Francia durante los años la primera mitad del S.XX trabajó en vivienda flexible. Jean Prouvé realizó importantes proyectos en los cuales el diseño en planta tenía la intención de ser modificable. Las viviendas Meudon de 1938 ideadas para un concu-

so, y que posteriormente 1200 de ellas fueron pedidas por el gobierno después de la II guerra mundial. Tenían las dimensiones de 8 x 8 metros y se construían rápidamente, tanto que se podían construir en un día por 4 personas cualificadas. Las viviendas tenían los componentes mínimos que podían ser movidos por una sola persona. Esta libertad de configuración del espacio interior también se reflejaba en el exterior ya que se basaban de paneles intercambiables. Ya en 1940 planteó edificios de oficina que en planta tenían núcleos estructurales fijos donde se colocaban las zonas húmedas y perimetralmente situaba un muro cortina. Esta solución es muy utilizada actualmente para diseñar una planta con libertad de configuración interior.

Los hermanos Arsène-Henri, Luc y Xavier, en 1955 desarrollaron las particiones móviles y las pusieron en práctica en proyectos de vivienda pública. Plantearon una serie de principios en torno al acto de habitar: cualquiera debería ser capaz de poder equipar su casa como desee, incluyendo el hecho de cometer errores ya que forman parte de la libertad; cada persona tendría que ser capaz de expresarse en función de sus elecciones, su casa debería ser personalizable; cada persona debería ser capaz, en su casa, de ser creativo organizando su espacio dentro del cual se encuentre a si mismo reflejado. Estas ideas se materializaron en el proyecto de viviendas de Montereau en 1971.

¹ Rabeneck, A., Sheppard, D. y Town, P. (1973). “Housing/flexibility?” en *Architectural design*, 43, p. 698-711, 717-727.

Se trataba de una torre de 10 plantas, que gracias a un sistema de placas alveolares creaban un área sin obstrucciones para que cada unidad de vivienda estuviese libre de paredes transversales o columnas intermedias. En cada planta, cuatro unidades se agrupaban en torno a un núcleo central que contenía la escalera comunitaria y un ascensor. Cada unidad de 13,5 x 6,3 metros se dividía en unos módulos de 90 cm. El único elemento que se definía en el espacio es un núcleo de 0,9 x 1,8 metros, justo enfrente de la puerta de entrada, dentro del cual se situaban todas las funciones de servicio. Un balcón se desarrollaba alrededor de todo el perímetro de cada unidad, proporcionando un espacio externo para cada habitación.

Cuando los autores nombran Suecia, mantienen que el proyecto que realizó Mies Van der Rohe en la exhibición *Weissenhofsiedlung* en Stuttgart el año 1927, fue el punto de partida de la experiencia sueca. El diseño que Mies propuso en planta tuvo su representación en este país, donde el núcleo de comunicación se situaba en el centro y de este derivan dos viviendas por planta. Cada vivienda constituía una planta libre sin interrupciones.

Cabe señalar la importancia de la gran cooperativa de vivien-

da HSB fundada en 1923. En 1973 los autores viajaron a Suecia para visitar algunos de los proyectos que realizó HSB, y remarcar los siguientes aspectos: La elección del diseño inicial es el aspecto más importante sobre la flexibilidad; La flexibilidad es posible pero necesita esfuerzo, la idea de que se puedan realizar cambios se tiene que valorar muy positivamente por los ocupantes; Y por último, la flexibilidad funcional en términos de recolocación de los usos, es importante ya que es un recurso económico ya que puede mantener la ocupación máxima.

Los autores vuelven a mencionar el proyecto de Mies Van der Rohe para la *Weissenhofsiedlung* cuando hablan de Alemania. Aunque también destacan otros proyectos que se exhibieron como la vivienda que realizó Adolf Rading. Su interior estaba diseñado como un único espacio de estar, que podría ser subdividido por paneles móviles. Por otra parte, el proyecto de Le Corbusier y Pierre Jeanneret que realizaron en 1928-1929, denominado "*Projet d'un immeuble locatif*", ya trataba la idea de lo transformable. Las viviendas tenían la posibilidad de que las camas pudieran ser sacadas de debajo de un pasillo elevado que era compartido con la vivienda contigua.

En el caso de Holanda destacan las obras de John Habraken y de Gerrit Rietveld. Al primero de ellos le dedicaremos un punto en el trabajo ya que es una obra de mucha relevancia en el desarrollo del concepto de la flexibilidad. El precedente con respecto a la flexibilidad en Holanda podríamos decir que es Gerrit Rietveld, con su proyecto de vivienda de 1924. Consistía en una gran planta libre con las zonas húmedas situadas junto al muro perimetral y una caja de escalera central. Deslizando las particiones desde el perímetro hasta el hueco de la escalera se ofrecía una variedad de posibilidades espaciales.

En Suiza resaltan el sistema 4D que como principio central del sistema era la estandarización de los métodos de construcción más bien que de la construcción del sistema. La idea era incorporar la noción de tiempo. Las decisiones sobre diseño de las viviendas, el mantenimiento de estas y las fachadas son reversibles durante la vida del edificio.

Por último, Gran Bretaña, en el cual los autores destacan la Appliance house que es un proyecto de Alison y Peter Smithson. Se desarrolló mediante pequeños proyectos durante 1958-59 en el cual la vivienda se basaba en una serie de cubículos. Estos tenían la función de dispositivos con conexiones para: la preparación de comida, los sanitarios, la comunicación, el almacenamiento y el mantenimiento.

El almacén de los cubículos era la propia estructura de la vivienda. Podemos decir que existe una clara relación con los proyectos de Jean Prouvé de 1940.

Asimismo, tres proyectos realizados en 1968 por Richard y Su Rogers con John Young son un claro de flexibilidad en vivienda. La casa Zip-up que en planta permitía la alteración del plan en un día. Las particiones móviles eran de yeso con juntas articuladas.

5. ANEJOS

5.2 Anejo 2

"Housing/flexibility?" en Architectural design, 43, p. 698-711, 717-727.



HOUSING flexibility?

Andrew Rabeneck
David Sheppard
Peter Town

'There have been well over one hundred serious attempts to predict the nature of the *house of the future* since the turn of the century. Some were merely demonstrations of a principle, never intended to go further than the drawing board; others were actually put into limited production. The attention of the designers had typically been centred on the potentialities of one product, one structural form, one process of

the many in the total industrial complex, one way of organizing life or land. For most of these designers have been convinced that their dramatization of a solution to some one aspect of the problem of home design would break the roadblock that stands in the way of changes needed in the building industry. But for the most part, they have been unaware of the depth and complexity of the roadblock; hence no

individual has been able to integrate the influence of all the relevant elements in the design and production of houses into a single unified design concept.'
Burham Kelly, *Design and the Production of Houses*, McGraw Hill, London, 1959, pp 61-2; as quoted by Valerie A. Karn in *Standards for New Housing*, Centre for Urban and Regional Studies, University of Birmingham, June 1971, p. 4.1.

planned to be carried out over a short period of time within a restricted space; for example, daily?

- There has been virtually no increase in living space standards in the UK since 1918.¹
- The pressure of building costs and political production norms resulted in a severe drop in space standards, from 1950 until Parker Morris recommendations were made mandatory in 1967.
- The talent of housing architects since World War II has been almost solely devoted to solving the two problems of 'architecture' defined by Durand around 1800: the problem of private building, which is to provide the optimum accommodation for the smallest sum of money; and the problem of public building, which is how to provide the maximum accommodation for a given sum.²
- Meanwhile the economics of materialism and consumption have forced small-scale service industry either out of business or out of the reach of ordinary people, who must now do all their own housework, laundry, gardening, maintenance, and often hairdressing and car repairs as well.
- Industry has provided people with tools and appliances to make these chores palatable but it cannot provide the space to do them.
- Admass provides each member of the family with leisure aspirations to be fulfilled at home. But again, nowhere to do

- what Habraken calls the 'perfect barracks'.
- Architects 'miniaturize' to cram the swelling brief into the unchanging area, and rooms become pathetic cells.
- The home has become a cross between a motel room and a storage bin for the clutter of the (often clashing) life-styles it has to contain.
- The process of mass housing has been institutionalized, and thereby the product of mass housing. Only the architectural expressionism varies (compare the Smithson's Robin Hood Lane with Darbourne and Dark's Lillington Street).
- The public sector response to housing design problems has been to research user needs as a means of generalizing the condition of 'invisible' clients of public housing architects.
- Research ranges from the kind of anthropometric studies that lead to 'Space in the Home', to attitudinal responses about 'privacy' or 'satisfaction'.
- While the purpose of such research is well meaning, the results have in effect become a new shorthand for architects working within tight constraints; an alibi for thinking about how people live without communicating directly with them.
- Unless the process of mass housing is changed the research results will serve only to perfect the product of that process --

- In this product all ambiguity and choice is removed from designs, each 'need' is satisfied and no privacy of life-style remains.
- A proliferating response by architects to this 'tight-fit functionalism' has been to propose flexibility or multi-use of restricted space as a means of providing opportunities for choice or personalization.
- The range of solutions offered has been wide, but there has been little agreement on the types of changes or choice likely to be required, or the limits which people might accept.
- In the pages that follow we are showing examples of live projects throughout Europe that reflect a wide range of interpretation of 'flexible' housing.
- Having visited many of the projects shown and having talked with occupants and architects, we feel that nevertheless many important questions remain unanswered.
- We are concerned that many of these solutions address tight standards more than the act of dwelling.
- We are concerned that the cost of ingenious technical solutions for providing flexibility often ignore simpler alternatives.
- Can effective use of space be made when several functions are

- We think that there is now a sufficient number of realized flexible housing projects to allow us to learn from the results and to develop new directions in housing design, and a new concept of the housing process.
- We should learn from Habraken's analysis of the housing process, from Arsène-Henri's sympathetic and practical approach to occupant participation, from HSB's pragmatic approach to planning freedom in Sweden.
- To those who continue to say 'build first and ask questions later' we would say that this country is currently in the process of building a housing stock that will fall short of people's expectations, let alone their aspirations, in the very near future. As long as our national housing budget is related to norms of cost and standard units rather than to effective demand in terms of performance and occupant expectations, it will remain a poor national investment.
- In the February issue of AD we shall be analysing the underlying themes of the projects presented here, what they achieve, and whether they suggest new directions for the future of housing policy and design in the UK.
- Included in the present issue is a review³ of the literature of current research into user needs, contributed by Maureen Taylor. Her review highlights our fundamental ignorance of the act of dwelling and the dangers of abusing research results. It provides a content for asking new questions of social research, a starting point for a fresh set of assumptions about homes fit for humans.

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¹ Hole, W. V. and Attenburrow, *Houses & People*, HMSO, 1966, Chapter 9.
² Collins, P., *Changing Ideals in Modern Architecture*, Faber & Faber, London, 1965.
³ See page 730.

Historical context

'It is thus not to be wondered at that the adaptable house — the house which could easily be altered as circumstances changed — is a recurring theme in the evidence we received and in our own thoughts. At the present stage of development, such a dwelling is some way from paractical reality, because of the high cost and other difficulties. With the greatly increased rate of social and economic change, the adaptable house is becoming a national necessity. Not only would it be valuable for the family staying in one house for most of its life: it would allow much easier and perhaps more satisfactory adaptation to the changing general needs. We see the investigation of the practical possibilities of doing it easily and at reasonable cost as one of the most important lines of future research into the development of design and structure. The sooner it is started the better.'¹

That was in 1961 and very little has happened since then in this country.

Lewis Womersley pointed out in 1970 that the main achievement of the Parker Morris Committee's work in technical terms has probably been the general adoption of whole-house heating from a central source.² Nevertheless the Committee's report made the point that additional space was the first priority — space to accommodate the consequences of a rapidly improving standard of living in terms of activities, equipment and possessions. Womersley has pointed out that this priority has not been met: while in the last 50 years we have witnessed fantastic changes in science and technology and tremendous advances in materials — the living standards, our dwelling space standards have stood still in real terms.³

At the same time several writers have pointed out that space in the home is one of the cheapest amenities of a house, seen in relation to the cost of the necessary elements of any house.

'Additional space is comparatively cheap, for the cost is not loaded with heavy overheads such as plumbing and equipment, and so may amount to much less than the average cost per square foot.'⁴

'It should never be forgotten that space, too, is the cheapest commodity in the dwelling, for once the expenses of kitchen, bathroom, staircase, services and drainage have been provided for a dwelling of minimum size, additional area can be added at a cost per square foot very substantially less than that of the initial small house. The minimum

home, therefore, whilst being cheaper can usually be shown to give also the minimum value for money — a poor investment in the national sense.'⁵

... it should not be taken for granted that space cutting results in *pro rata* savings. Experience shows that the expensive parts of the home, site preparation, services, kitchen and bathroom, are not affected by reduction in total area, and that nothing approaching a *pro rata* saving can in fact be made.⁶

'Thus it can be argued that to cut space standards is a particularly poor way of saving costs. Not only does it have an irrevocable effect on the standard of the house but also the savings are relatively small compared with the loss of size. Savings on equipment or finish, it may be argued, can not only be made good later but the saving in cost is also proportional to the cut in standards.'⁷

Many people responsible for housing in this country, reading the quotations given here, would agree with the sentiment, and yet the size of homes built continues to diminish inexorably. We think that something has gone wrong.

Whilst this is undoubtedly true in terms of symptoms such as land prices, mortgage rates, cost yardsticks, standard density ranges, and so on, we feel that it is futile to attack these in isolation. We must look rather for *causes* of the present predicament. While many factors have contributed to these causes, as architects we shall concentrate on the contribution of our own discipline.

What we shall be discussing is the architect's attitude to the relationship between internal space in the home, his view of the way people live in it and his approach to designing it. A central point to remember is that in our highly specialized world in which each adult assumes several roles, the home is the one place where a person is *not* expected to leave something of himself behind upon entering. It is the framework within which self-fulfilment is to be realized, even if the means to achieve it are to be found elsewhere, such as at work. Astronauts and office workers abandon parts of their personae voluntarily in order to achieve the benefits that will allow them to be complete people at home.

It is against such a reality, fostered by social thinkers at the turn of the century such as Tönnies,⁸ that we have to appraise the role of architects as agents in the provision of housing. During the last century, in this country, architects have tended to follow social theory rather than lead it. Housing has been



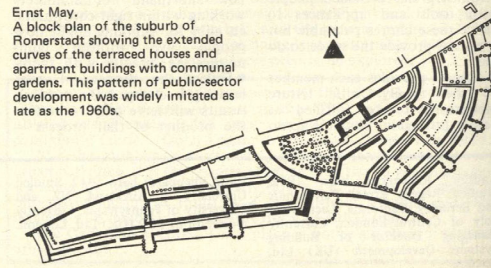
M.H. Baillie-Scott, Meadway, Hampstead Garden Suburb 1908-9.

designed in conformity with legislation resulting from the efforts of social reformers; architects have served change rather than instigating it.

This phase has lasted in England beyond the advent of Modern Architecture in Europe. As late as the mid-1920's, the L.C.C. was building housing estates which echoed the precepts of the social reformers (Robert Owen, Titus Salt, George Cadbury, Owen Lever, Ebenezer Howard, William Morris, the Webbs) and their architects. The suburban English Vernacular architecture exemplified by Unwin and Baillie-Scott remained the prevalent style, partly through the auspices of the Garden City Association, until the publication of the Tudor Walters Committee Report of 1918, advocating the 'self-contained cottage' as the appropriate expression of mass housing. This gave a new momentum to English Vernacular, particularly in the private sector, long after the invention of Modern Architecture on the Continent. The millions of homes completed to Tudor Walters recommendations before the outbreak of World War II mostly reflect a pastiche of the architecture of men such as Baillie-Scott. The Englishman's castle had become a three bedroom semi-detached house, with bay window, recessed porch, pebble dash and brick exterior, the evocation of half-timbering...

Meanwhile... on the Continent, Modern Architecture was invented. Through various influences: Frank Lloyd Wright, the Futurists in Italy, the German Expressionists, Loos, Choisy, Gurdet, Perret, etc., and particularly as a consequence of the first World War, a *purified* architecture developed. Inspired by the radicalism of the artists before the War, architecture purged itself of all allusions to past styles. It used concrete, steel and glass to forge a style beyond style, a revolution. As in all revolutions, it became necessary to be able to distinguish between revolutionaries and reactionaries without having to look too closely. While there remained differences as to what might be an appropriate social architecture, the modernists were relatively certain about what was not. Modern Architecture housing was recognizable in its planning, in its technology and in its appearance. It became possible to discuss architecture in terms of 'true' or 'false'.

In Germany and the Netherlands, the 'true' Modern Architecture gained impetus through the work of men such as Ernst May at Frankfurt and Martin Wagner at Berlin. The major opportunities for modern architects in these countries lay in the field of mass housing. But this was not the case in France or Britain, which ironically provided the prototype of suburban development that found wide application in Germany (May had worked in Raymond



Ernst May. A block plan of the suburb of Romerstadt showing the extended curves of the terraced houses and apartment buildings with communal gardens. This pattern of public-sector development was widely imitated as late as the 1960s.

Unwin's office).⁹ In these two countries, Modern Architecture gained a foothold through the patronage of wealthy clients. France was politically and economically depressed after the War, and in England the Tudor Walters report had already set the pattern of inter-war development. In England, Modern Architecture was exemplified by the work of Connell, Ward &

Lucas, while in France Le Corbusier was building studios and villas for artist friends and wealthy patrons (which he subsequently posed as models for mass housing, as Collins has remarked¹⁰).

The clients of this architecture volunteered — enthusiastically — to subscribe to the criterion of 'true' Modern Architecture. They were clients who could choose their

architecture.

In England, very little Modern Architecture housing was built between the Wars, and practically none in the public sector. There was a hiatus in the development of Modern Architecture. During and immediately after World War II, housing activity was dominated by the criterion of expediency, and architectural style was secondary to production. It was not until after the New Town Act of 1946 and later the 1951 Festival of Britain, that architects who had been trained after the War took up the banner of Modern Architecture in a big way. The inter-war projects of Le Corbusier and Gropius were pored over by the eager adherents, many of whom had served in the War and had developed from that experience a sense of social responsibility for the rebuilding of Britain. It was, in a sense, natural that the very best of them should go to work for public agencies such as the London County Council and the New Town Development Corporations. They brought to the work the same zeal and certainty about Modern Architecture that had inspired their Continental masters twenty years before, and the politically neutral (if leftist) public agencies seemed to be the most skillful and appropriate agencies of social change.

But, by doing this, housing architects almost unwittingly ceased to be the servants of social change, they joined the ranks of authority. They became what Turner and Fichter call 'radical authoritarians'.¹¹ Because their architecture was very different from the Tudor Walters vision of mass housing, it served as a metaphor for architecture's contribution to social change. This was convenient: novelty of architectural imagery was mistaken for a new and deeper understanding of the way people live and aspire to live.

It is true to say that Modern Architecture had been only superficially concerned with social and cultural questions of housing. Its main interest lay in the most appropriate expression of the Machine Age, in stylistic terms, with a minimum of actual social research. This emphasis on *expression* failed to provide Modern Architecture with a substantial *theoretical basis* from which to confront social or political issues.

Since originally it had stood for the negation of past styles by *revolution* rather than the *evolution* of a new style, it could not convincingly *symbolize* anything, but only *express* an architects' vision of modern life, through a series of

metaphorical allusions.¹² So what is new? Architects in 1973 put Barcelona chairs (1929) in the lobbies of office buildings as metaphors for a heroism that has since vanished from the buildings themselves. The obsessive pre-occupation with style has prevented architects from tooling-up to confront the real problems of their subject, as the poverty of housing research attests.

Because housing is a socio-political act before it is an architectural one, architects and planners remain politically impotent; they have become willing cogs in a machine that drastically oversimplifies the act of living in housing in the name of expediency and assumed efficiency. The tighter the constraints on housing become in terms of standards and cost yardsticks, the more remote from the act of living becomes the architect's contribution, reduced to a jigsaw-puzzle of style and standards.

Ironically, many of the arguments used 50 years ago in forging Modern Architecture find parallels in today's 'efficient management style' of housing authorities. For example an architecture devoid of any ornament may tend to be cheap. Or again, minimum areas, particularly in kitchens and bathrooms, can be related to Le Corbusier's romantic notion of these rooms as metaphors for laboratories. Tight-fit planning for economic reasons echoes the old slogan, 'form follows function', but today dropped up by preposterous 'activity data studies'. Small windows 'express' bedrooms, large ones 'express' living rooms.

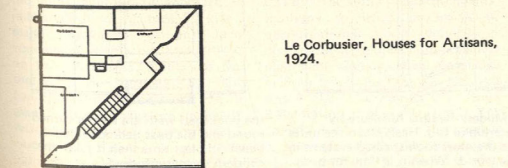
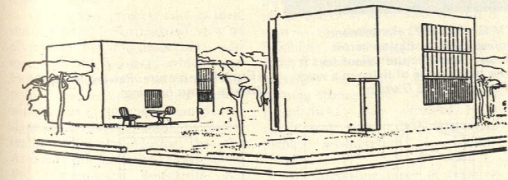
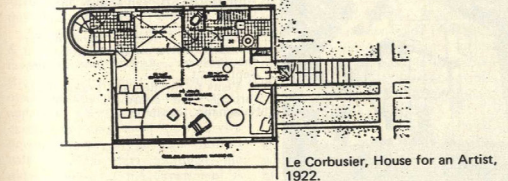
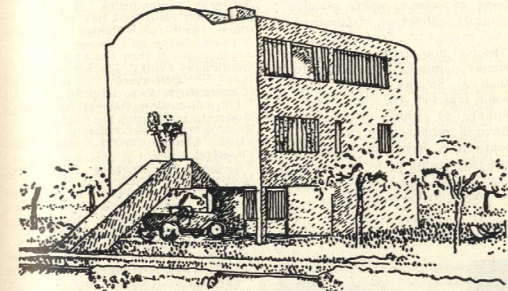
These analogies show that the feeble aims of Modern Architecture can be fulfilled within a housing machine that is becoming increasingly constrained and totalitarian in socio-political terms.

Some researchers and architects have already taken note of the inadequacies of the mass housing product and the inability of architects to significantly affect that product. Pawley has called these people 'libertarians', and he distinguishes them from 'behaviourists', the advocates of 'tight-fit functionalism'.¹³

He quotes Amos Rapoport writing about public sector housing:

'The designs generally have fewer elements that can be personalized, show less opportunity for change — fewer surfaces which can be repainted; fewer forms which can be modified; fewer parts which can be changed — than in the average spec-built home...'

'Often there are no spare



bedrooms for visitors, and where they do exist, they are not large enough for other activities. One living space is often provided for all activities, so that different leisure activities cannot go on simultaneously, and there is no room for equipment, clothes, books and hobbies. Kitchens are too small to accommodate new and larger appliances as they become available and accepted.

He's right: where do you put the Bejam Freezer, the Hoover Keymatic, the darkroom, the gardening tools, the carpentry bench?

Libertarian architects, notably Habraken, have recognized the futility of mass housing and proposed approaches that will, they feel, allow people to assume responsibility for their own homes. Their fundamental principle is self-determination for the occupant, although the means proposed to achieve it vary considerably. Among libertarians, there appear to be two main conceptions of the occupants of housing which tend to be mutually exclusive: they need self-determination either for social reasons (i.e. so the home can adapt to 'life-style', family changes, etc.), or for consumerist reasons (i.e. because of the increase of possessions, equipment, home-servicing).

These partial views result in approaches to 'flexible' housing which tend to be lop-sided. Fifty years of fascination with machines-for-living-in dies hard. The results are usually some form of the fallacy of 'freedom through control'. For example, Habraken's systems of zones, margins, and detachable units preserve an implicit control over the occupant. As Arsène-Henri points out (see p.703), the occupant's freedom must include the freedom to make 'mistakes' and 'bad' plans, that is, departures from a norm of 'good' or 'correct' plans. Architects seem to find it impossible on the one hand to leave the hardware alone, and on the other to recognize what Rittel has called the 'symmetry of ignorance'

between designer and designed-for.¹⁴ When it comes to home life, everyone is his own expert.

In short, most libertarian proposals are about hardware. Objectives seldom find a more positive expression than antitheses of the present products of mass housing (an important exception is to be found in the work of Landau and Price¹⁵), in other words, more space, better amenities, and freedom of choice. This form of libertarian proposals tends to be too technical and over-complicated to have any political potential. We would suggest that the goal of a housing policy should be: 'To provide a private domain that will fulfil each occupant's expectations.'

Such a goal permits the independent consideration of ends and means in social and economic terms. The extent to which various proposals contribute to the goal can be debated and issues raised. For example, why should the domain be private and in what sense? Or, why satisfy expectations when people are grateful for legislation that ensures the satisfaction of basic needs? Only by couching the discussion of issues in such terms, and by making politically useful housing proposals, can architects hope to have any effect on housing policy, to fulfil their relatively new-found sense of social responsibility.

To be honest today, most architects would have to abandon any pretence of social responsibility and admit they are interested only in putting up buildings. Indeed, architectural education is only just now beginning to provide students with tools that might enable them to confront housing problems intelligently.

If architects do claim a genuine concern for housing problems, they must learn to talk to social researchers, economists and politicians, and to understand what these people have to say to them. This is an essential prerequisite for

thinking creatively about the complex but fundamental relationship between people and their homes.

Finally, 13 years too late, we should take note of the Parker Morris recommendation quoted at the beginning of this article. We must put on to the back-boiler the proposals for quick technological fixes aimed at getting a quart out of a pint pot. These proposals, born of the ideals of Modern Architecture, are still no more than metaphors for a distorted view of other people's home life.

In the national sections which follow we have gathered, from first hand experience where possible,¹⁶ projects realized or in construction that exemplify current ideas about 'flexible' housing. Some of these are simply architects' technological fixes, such as Steidl's Munich project; some represent the clients' view of housing as capital, such as in the Swedish projects; and some others represent a deeper understanding of the relationship between people and their homes, such as the work of Arsène-Henri and Habraken.



M Graves' 1973 Hanselmann House, USA. Imitation heroic Modern Architecture: client says it gives him a sense of living in a work of art. (House & Garden)

Notes

¹ *Homes for Today and Tomorrow*, HMSO 1961, para. 28.
² Womersley J. L., 'The Housing/Dwelling Unit', *AA Quarterly*, Vol. 2, No. 2, April 1970.
³ Womersley J. L., 'The Housing/Dwelling Unit', *AA Quarterly*, op. cit.

⁴ *Homes for Today and Tomorrow*, op. cit., Chapter 1, p. 2.
⁵ Womersley, op. cit.

⁶ Yorke, E. R. S. and Whiting, P., *The New Small House*, Architectural Press, London, 1953, p. 9.

⁷ Centre for Urban and Regional Studies University of Birmingham, *Standards for New Housing*, Valerie A. Karn, June 1971.

⁸ Tonnies tried to differentiate between communities, in which people felt emotional ties with each other as full human beings (*Gemeinschaft*) and group life, in which men felt their ties in terms of emotionally neutral, specialized tasks they performed together (*Gesellschaft*), the social contract.

⁹ For a discussion of the evolution of modern mass housing see Pawley, M., *Architecture Versus Housing*, Studio Vista, London, 1971, especially Chapter 2.

¹⁰ Collins, P., *Changing Ideals in Modern Architecture*, Faber, London, 1965, p. 249.

¹¹ Turner, John F. C. & Fichter, R., eds, *Freedom to Build*, Macmillan, New York, 1972, available from AD.

¹² This distinction is convincingly argued in Venturi, R., *Learning from Las Vegas*, MIT Press, 1973.

¹³ Pawley, M., *Architecture Versus Housing*, op. cit., p. 96.

¹⁴ 'Son of Rittelthink', an interview with Horst Rittel in *Design Methods Group Occasional Paper No. 1*, Jan. 1972.

¹⁵ Landau, R., 'Evolutionary Housing: Notes on the Context and the Problem', *Architectural Design*, Sept. 1971.

¹⁶ Visits to Sweden and France made through the courtesy of Strafo Hausmann, Strasbourg.

(Ernst May picture: Pawley, M: *Architecture Versus Housing*)

France

France is about on a par with Sweden in its development of flexible housing, although recent government initiatives have given the concept a major boost since 1971, when France first achieved over 500 000 new unit starts.

The impetus for development of flexible housing is the 'Plan Construction', launched in 1971 by the Ministère de l'Équipement with a budget of £11m to encourage research and innovation in construction. Also the 'Programme Architecture Nouvelle', which got under way at the beginning of 1972, aims at innovation in housing architecture offering subsidy to technical/developer teams for up to 1500 prototype units a year. Projects should be low (HLM) or moderate (ILN or Prime) income housing between 30 and 300 units.

Stimulus statements accompanying the announcement of the Plan Construction include research themes of 'the psychological attitude of the public to housing problems' and 'the use of space in housing', among others.

These announcements were a sufficient spur to architects interested in flexible housing that *Techniques et Architecture* were able to publish some 30 projects in varying stages of development earlier this year.¹

Many of the projects shown in T & A display an architectonic fascination with either a mega-structure (structure d'accueil) or open component (système ouverte) approach. With a few notable exceptions most will not survive beyond the prototype stage (not all will get that far) although the didactic value of the experiment is considerable. Many areas need not be explored again.

Only a few projects take as their starting point an articulated view of present or possible home life. In many of the projects which take building technology as a starting point, the occupant seems almost superfluous to the conception, 1. It is significant that the most successful realized flexible housing, by the Arsène-Henri brothers, plays down the technological aspect, as the Swedes have done.

In the current arguments about the most appropriate approach to industrialization, Maurice Silvy is a major proponent of an 'open component approach'.² Jean Prouvé, on the other hand, points out that there is no analogy for this conception of industrialization in manufacturing industries generally. Assembled products are developed as ensembles within a particular industry (e.g. refrigerators) having

only the most basic components in common (e.g. electric motors, nuts and bolts). He does not believe that the potential of capital intensive industry for housing can be realized via an 'open component approach, and that 'closed' systems incorporating a variety of models, remain the best hope.³

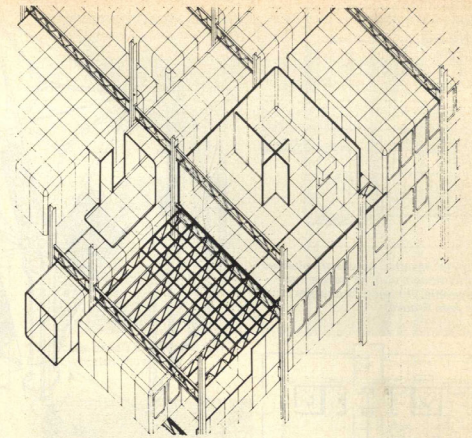
There have been several significant unrealized projects and theoretical studies relating to personalization of the dwelling. The best known in England is Philippe Boudon's study of Le Corbusier's Pessac development at Bordeaux.^{4,5,6} an attempt at a 'value-free' analysis of modifications made to houses by their occupants, 2, ironic responses to Le Corbusier's well-intentioned aim to standardize the dwelling.

Another study has been published by Atelier 3 under Philippe Vuarnesson.⁷ Apparently unaware of the work of Habraken in Holland, they propose traditionally built support structures and industrialized detachable units. A wide variety of building forms for the permanent structure has been developed and evaluated, based on a limited number of basic unit types, 3.

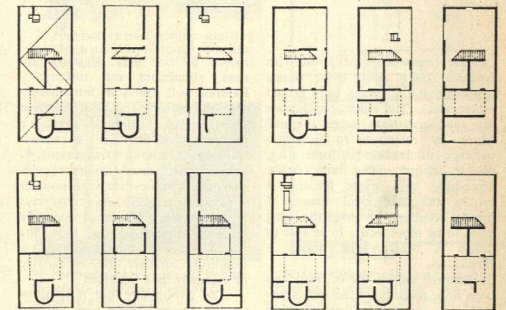
The detachable units proposed (in some detail in the book) include partitions, casework, bathrooms, and are tested for flexibility quite fully against the unit types. In addition, a computer has been made to develop a computer aided design tool to test the permutations possible in a given unit type against an occupant's criteria, with plans and a schedule of detachable units as output.⁸

J. Belmont has written a book⁹ about his concept of flexibility, which is based on the concept of choice for the occupant in location, orientation, area and planning of his home before moving in. In his view, as in Sweden, this is seen as the most valuable aspect of flexibility. He envisages a dialectical process between the prospective occupant and the developer or housing management, resulting in a personalized plan achieved with components to suit his budget and planned adaptation to family changes.

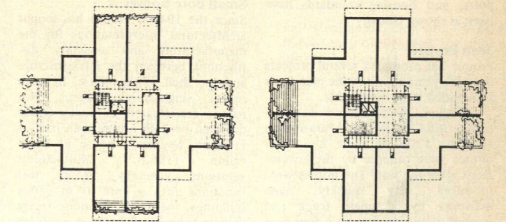
An interesting piece of research relating to the personalization of space has been published by the CSTB.¹⁰ The study sought occupants' reactions to living in spaces of unconventional form defined as double-height volume, non-rectilinear plan form, sloping ceiling, or change in floor level. One example surveyed was Le Corbusier's Unité d'Habitation at Marseille (1952). The study's conclusions were that there is a strong resistance to innovation; people refer to traditional models



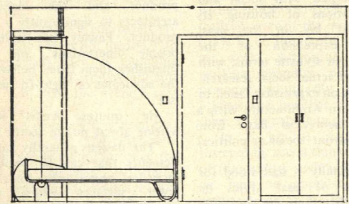
1. Living space as the gridding residue of technical imperialism. (Techniques et Architecture 293)



2. Ground floor modifications encountered at Pessac. Le Corbusier's original plan is top left. (P Boudon: Pessac et Le Corbusier)

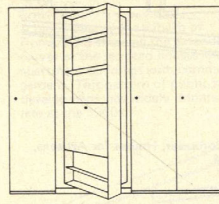


3. Atelier 3. Basic plans for 12-storey tower block building type based on a 5.4m x 5.4m structural grid. Five other building types are proposed. (Recherche pour un Habitat Personnelisé)

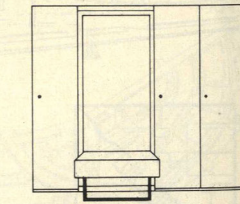


Erich Mendelsohn's folding tubular steel bed, sleeping car, reading lamp and telescopic table, in guest room of

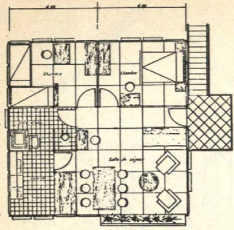
his own house. (FRS Yorke: *The Modern House*)



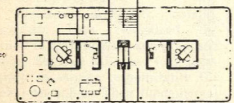
Modern flexible furniture by Interlücke Ltd. Heals claim the units are the most sophisticated systems in the world: 'When it is time for bed,



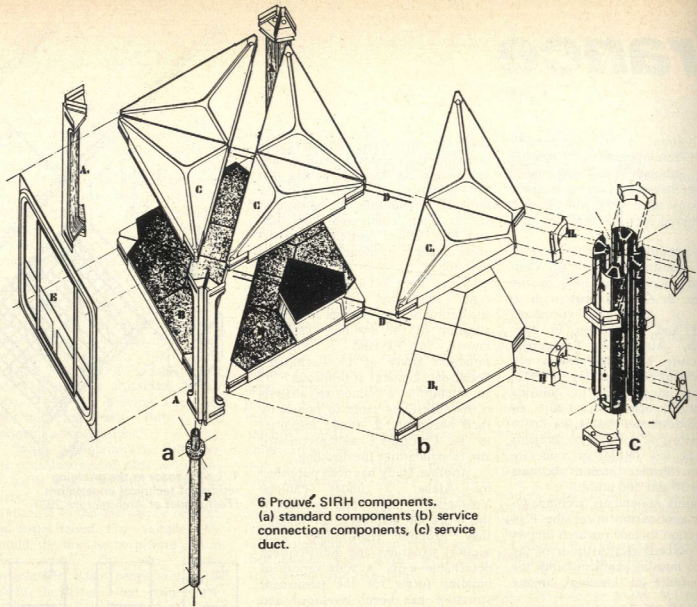
the bookshelf walls are simply turned round and the beds behind pulled down - in less time than it takes the children to get undressed.'



4 Prouvé. Meudon houses are planned on 1m module with all panels interchangeable. (Huber & Steinegger, eds: Jean Prouvé)



5 Prouvé. Plan is in the form of a miniature office building with wet rooms in fixed structural cores and curtain wall at perimeter. (Huber & Steinegger)



6 Prouvé. SIRH components. (a) standard components (b) service connection components, (c) service duct.

(several respondents at Lyon with irregular seven sided living rooms insisted that the rooms were in fact rectangular). The other conclusions are that occupants judge 'original' forms by reference to their experience of traditional forms (e.g. double pitched ceiling more readily acceptable than single because it evokes the traditional image of 'roofs'); occupants preferred the living areas to be non-specific to be able to define a dining area within it themselves.

Because such a lot of work has been done recently we can only show here projects already realized or in construction. It is worth remembering, though, that the government is serious about flexible housing, housing output as a whole has risen by about 35 per cent in the last ten years, and housing standards have risen as shown below.

Jean Prouvé

Prouvé has produced several projects over the years in which the plan form is intended to be modifiable.

Meudon 1938. Designed for a competition for sectional housing on airfields, 1200 of these 8 m x 8 m houses were ordered by the government after the war. The houses were produced very quickly, each delivered by a single truck and assembled in one day by a four-man team. 'Many people still use these little light houses which frequently change their location as well as their occupants'.¹²

They are made up of a minimum of components any of which can be

moved by one man. Materials are steel, aluminium and timber. Exterior wall panels are interchangeable and provide freedom of choice among solid, window, door or translucent. There is a similar freedom of interior arrangement, 4. Despite their unconventional appearance these houses are very popular with their occupants. As Prouvé says 'I am certain, despite a generally accepted preconception, that the masses instinctively recognize what is beautiful; moreover, they are capable of analysing their reactions'.¹³

The government did not follow up the design, despite very detailed estimates to indicate a competitive price and despite the opportunity to reactivate some aircraft factories which had been shut down.

Small core houses

Since the 1940's, Prouvé has sought architectural interpretations for the manufacturing and assembly distinctions between the infrastructure and the shell of the house. In more recent single-storey houses, wet rooms are treated as boxes freely disposed beneath a long span roof as in Mme. Seynave's house at Beauvallon (1962).¹⁴ Multi-storey solutions generally group wet functions into a core as in office buildings, with the rooms freely disposed around them. Such a project is the Collective Apartments of 1955.

5. A much more recent project (1972) with architect Sandor Majercsik, is known as Constructions Modulaires S.J.R.H. This is a form of fully industrialized construction

using eight basic components (mostly in steel, aluminium and plastic) designed to be assembled into a wide variety of building forms based on a planning module of 3.8 m, but capable of making volumes up to 7.6 m square, 6.¹⁵

In all these projects, Prouvé does not make a big 'fuss' about flexibility; it is seen as an obvious necessity for the personalization of the home on one hand, and as a natural benefit of his approach to building technology on the other. It is something we should take for granted. I am sure he would say that the theoretical difficulties architects get into are more the result of the crude means by which they attempt to achieve flexibility, adaptability, and extendability, than the result of genuine design difficulties.

The Arsène-Henri Brothers, Luc and Xavier

In 1955 they put movable partitions, fixed over a continuous floor finish, into an industrialized public housing project of 720 units in Rheims. The project was conventional in other respects, and it taught them that to progress in the study of flexibility of layout, one must consider also the shell of the building. For the last ten years they have been undertaking such studies and, more recently, realizing some important projects. Their starting point is the argument that if one accepts the notion of Mr. Average, Mrs. Average, family-type, and thence dwelling-type, school-type, etc. then this represents a subtle form of the negation of

personal experience and, therefore, forms part of the insidious alienation brought about by materialism.

'Not to reckon with the originality and unique character of each person is to negate one dimension of Man and, personally, we find that unacceptable'.¹⁶

Three principles are stated, based on this central belief:

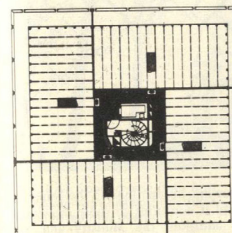
1. 'If there is a finite space in which each person ought to have the right to his liberty without impinging on others, then it is in his home, private, inviolable and secret. So, the first point: everyone should be able to fit out his home as he wishes, including the right to make mistakes as part of that freedom (provided, of course, he does not inhibit the freedom of others... for example, the need for acoustic separation).

2. Rather than running after some ideal model (which movie star would you like to resemble?) wouldn't it be better to respect the differences that exist between people and to allow them to develop as a function of each person's tastes, tendencies, reflections, ideology. So, the second point: each person ought to be able to express himself as a function of his choices. His home should be personalizable.

3. Each of us possesses a powerful creative potential which our materialism tends to stifle. Everything we do should embody a creative dimension, have some original dimension, be unique, new. If not, we are confined to the conditioned reflex to received information. By copying, recopying, imitating, reproducing, we don't



7 Montreaux. Note variation in facade resulting from occupants' choice of position of panels.



8 Building plan showing 4 flats, location of service core, and 900mm grid. (Batir)

exceed our animal tendencies, whereas we know that our creativity allows us to go further. So, the third point: each person should be able, in his home, to make a creative act by organizing his space, based on the context within which he finds himself. Even being a co-author brings a measure of satisfaction.¹⁷

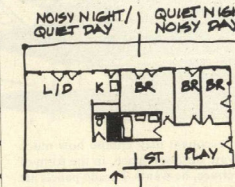
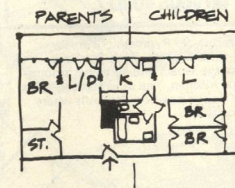
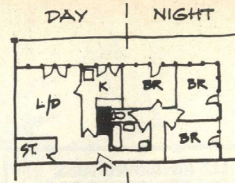
These basic ideas underlie all Arsène-Henri's work which is described briefly here, but which is more fully discussed elsewhere.^{18, 19}

Montreaux

A project of 37 flats within the context of a massive housing project near Paris at the ZUP of Sarville in the department of Seine-et-Marne for 6600 dwellings, 7.

Technically, the starting point was economic long span concrete floors, giving 40-120 m² unobstructed area without cross-walls or intermediate columns. Next, a planning module of 900 mm was established to give the maximum number of planning permutations with a minimum of components:

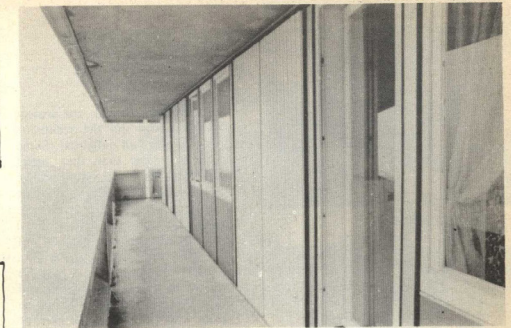
- passageway, shower or w.c. of 900 mm;
- bathroom of 1800 mm;
- bedroom frontages of 1800, 2700, 3600 mm;
- living room frontages of 3600, 4500 mm, etc.;
- storage of 900 or 1800 mm.



9 Variety of zoning within flats

The building plan form shows how cores relate to each flat of 82 m² net area, 8. The core is prefabricated and allows wet functions and mechanical ventilation to tap in on three sides, the fourth being opposite the entrance to the flat. The aim was to ensure an implicit zoning within the flat which could be day/night, quiet/noisy, parents/children indifferently, in such a way that a minimum of partitioning (between core and façade) would define the zones. 9. Party walls are 150 mm in-situ concrete.

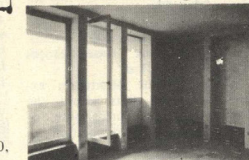
A balcony 1600 mm wide surrounds the building and façades are made up of interchangeable panels between structural mullions 120 mm x 120 mm on the 900 mm grid. Panels may be solid, fully or partially glazed, fixed or opening.



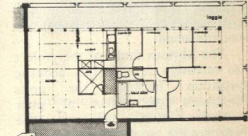
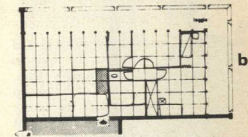
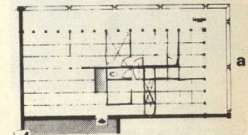
10 Facade panels and sliding full-height wooden shutters.



11 Flat before partitioning, showing moulded ply-trim in foreground and air-extract in core.



13 Perimeter heating results in high threshold. Socket outlets are provided on each column.



12 Sketches done during a planning session between architect and occupant. (a) after 25 mins... (b) after 45 mins... (c) the final version. (T & A 292)

Short-term changes to the façade are achieved by means of simple sliding shutters on a continuous track, 10.

The partitions are, frankly, crude, 2500 mm x 900 mm hollow core chipboard 35 mm thick, veneer faced and with cover-strips. They are held in place by friction screws and skirtings and trim are in moulded plywood, 11.

Occupants in 1970 paid about 600 francs a month including service charge to cover basement parking, rooftop communal room, landscape upkeep. Occupant scope of choice extends to plan form and external elevation. The first floor is given over to flats for the handicapped (a study showed that if flats were sufficiently flexible to accommodate their special

individual needs, they could be given flats of their own for half the price of institutional care).

Ten hypothetical flat plans were used to illustrate possibilities to prospective occupants. They were designed to show different concepts of eating, cooking, entertainment, storage, accommodating children, etc. In the end, no family adopted any of the plans shown, and no two plans are the same. The sociologists involved in the experiment say that people got the hang of designing layouts on squared paper very easily, particularly if doing it in the actual space, 12.

Two important points were made by M. Perianez.²⁰ First, the plans produced by occupants would never



14 Formal parlor.



15 Informal living room adjoins kitchen. Note wallpapering between cover strips over partition joints.

have been made by architects and very few of them can be seen as variations on well known plan types. Secondly, in the course of follow-up research, the sociologists were acutely aware that beyond the front doors of these flats, they were entering a total private domain. The experience finally reached the point of embarrassment.

The obvious faults of the project are relatively few. Perfect acoustic insulation between the units diminishes the effect of poor insulation within the unit. The balconies are too narrow to use fully, and the precast balustrade cuts off sun and view. The perimeter heating means stepping over a high threshold to gain access to the balconies, 13.

On the whole, though, the project is very successful and the occupants interviewed were all delighted. Some were paying more than they could really afford for the freedom to live as they wished. A typical comment was 'Coming here I realized a dream. That is, I wanted two living rooms: one for entertaining as a place to put our good furniture but where, obviously, the kids would not be allowed so as not to spoil it, 14, and another as a sort of family room, so to speak where we can spend most of our time, 15. I achieved that and I am pleased'. Or again, 'We adapted our flat to what we always wanted but had never been able to achieve. For example, we designed it around this furniture which would never fit in elsewhere.'

Several other projects are under way.

Bordeaux-le-Lac

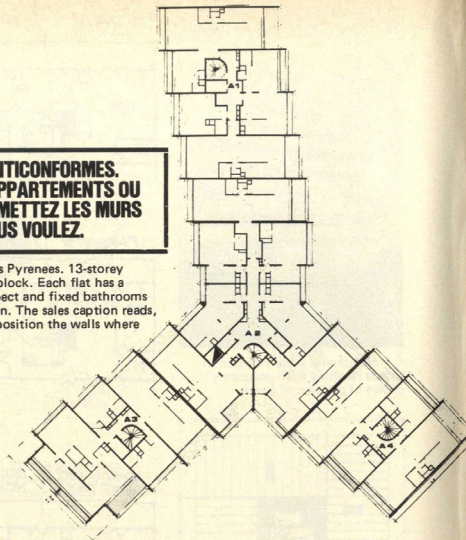
Now on site, this is a project of 1000 units which forms part of a vast 15 000 unit project in 3000-unit neighbourhood units. With François Ambroselli, Arsène-Henri has developed three new building types:

1. 'Cubes' of three-five storeys with four flats per floor, measuring 25 m x 25 m, 16.
2. Slab-blocks 13 m deep and between 6 and 7 storeys high.
3. Seventeen-storey tower blocks with six flats per floor.

Based on the Montereau experience, corner flats afford the greatest flexibility. Furthermore, for other types of orientation a free-standing core is not especially advantageous. Therefore, all cores relate to the public circulation. The main difference from Montereau is that the flexible façade has been divorced from the structure. Thus,

LES ANTICONFORMES. 235 APPARTEMENTS OU VOUS METTEZ LES MURS OU VOUS VOULEZ.

17 Rue des Pyrenees. 13-storey Y-shaped block. Each flat has a double aspect and fixed bathrooms and kitchen. The sales caption reads, 'You can position the walls where you wish'.



the occupant may choose how much private outdoor space, in the form of a terrace, he wants. Façade panels are in toughened glass, either transparent or opaque in bright colours to choice. Opening lights and french doors are horizontal sliders.

The planning module remains 900 mm and the flats are for sale although through subsidized (Credit Foncier) loans.

Rue des Pyrénées

Three hundred private-sector flats nearing completion in the centre of Paris, 17. A thirteen-storey Y-shaped block known as Les Anticonformes, the structure is less radical than in the public schemes (load-bearing r.c. crosswalls at 6 m centres). All flats have double aspect. As at Bordeaux le-Lac, the horizontal sliders behind a precast concrete grid (for 'visual hygiene' purposes here, to tone down differences between occupant's choices of panels). Fixed bath and kitchen are in PVC tile and the remainder is uniform carpet.

The sale price is fixed on an area basis, irrespective of the quantities of partitions, doors or cupboards selected by the purchaser.

It is worth noting here that a major achievement of the Arsène-Henri brothers is to have set a precedent with Montereau for an elaborate waiver procedure to get around planning and building regulations, the former not normally allowing construction to start until all partitions and elevations are shown on drawings and the latter not

allowing occupation of the building until it conforms to those drawings! In addition, the Ministry and the CSTB have to give waivers on minimum room sizes allowed to count as habitable rooms.

La Défense

The most recent project is for 500 units in a single massive 33-storey Y-shaped zigurat. A typical floor will have 18 flats. With single aspect only, the flats are planned between 6.30 m crosswall spacing and range from 44 m² to 108 m².

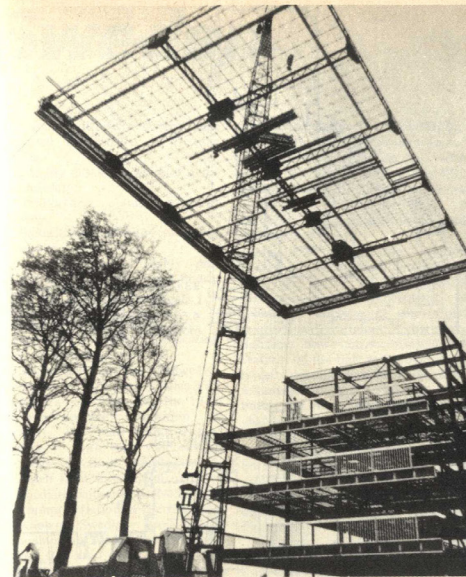
Arsène-Henri points out that heating systems are a particular problem for flexible projects. Any form of perimeter convectors or radiators once installed is pretty well irreversible, and for this reason he would like to go all-electric as GEAI have done at Elancourt with their electric heat pumps within the HLM cost limits.

GEAI system

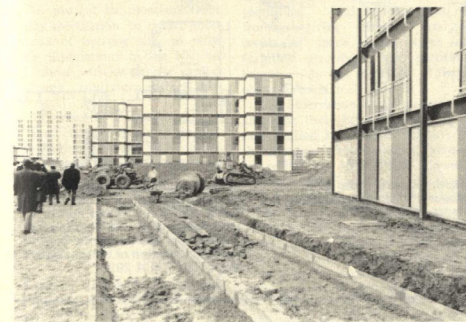
Designed by Lods, Depondt, Beauclair, GEAI is a high-technology building system which is incidentally flexible in layout, and which has been continuously developed since its inception in 1962 by an industrial consortium.

The first project was in 1966 for a prototype, which led to 500 units being built at the ZUP of Grand'Mare at Rouen to HLM cost limits.^{21, 22}

The basic idea of GEAI is to adapt office building technology and planning to housing, with a maximum proportion of off-site



18 GEAI. Space frame floor unit, complete with distribution ducts being lifted into position.

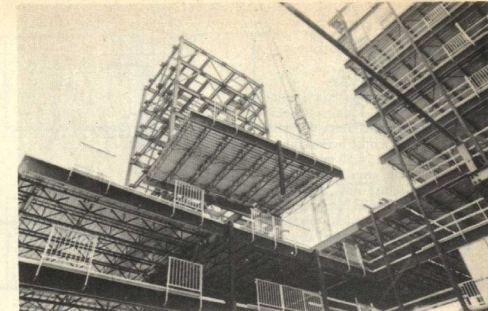


19 GEAI. Aluminium exterior shutters as part of this high-technology building system.

work (83 per cent claimed for the latest version), and a maximum of adaptability.

The original version used steel space frame floor units 3.60 m x 2.40 m supported on vertical lattice columns, 18, with a floor of polished cast stone on neoprene sleepers. Ceilings were, and still are, pressed vermiculite. The façades, where much of the money has gone are aluminium faced sandwich panels

and full-height sliding windows with exterior sliding aluminium shutters, 19. Little money remained for partitions. Party walls are two thicknesses of 90 mm hollow-core chipboard with a 300 mm airspace, and within the flats 35 mm is used as at Montereau. The main reason for this is to eliminate the need for wet trades, rather than to provide flexibility, although since move-in in 1969 15 per cent of tenants (i.e. 75)

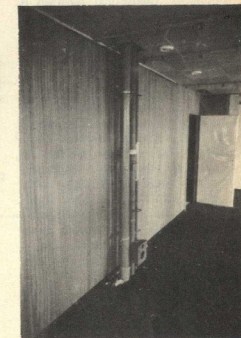


20 GEAI. Simpler beam and deck floor construction 120m² pre-assembled on ground.



21 GEAI interior. Central circulation core and service stacks are fixed to structure. Floors are chipboard.

22 GEAI interior. Note carpet throughout. The steel service stack, fixed to structure and suspended ceiling, is complete with partition head fixings.



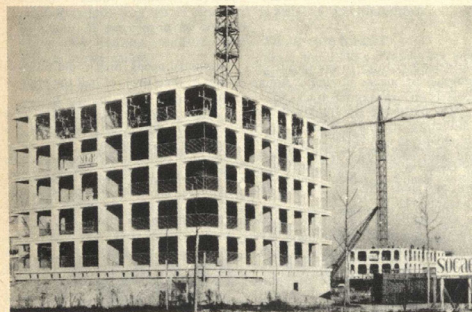
have modified the original layout. There is no pre-planning by occupants.

The more recent version of GEAI, improved with development funds under the Plan Construction, uses a simpler beam and deck floor, 20, with carpet throughout over flooring-grade chipboard, 21, 22. Increased spans of 7.20 m allow floor sections of 120 m² to be made up on the ground and lifted into place. Four hundred units are being completed at Elancourt within the town of St. Quentin en Yvelines, and more are nearing completion at Rondeaux-Dambourne. Although the partition quality is disappointing, the general quality of building is very high, and remarkable within the cost achieved (740-810 F/m² at 1972 prices).

None of the GEAI projects has involved active occupant participation in planning to date. Quite a few occupants have, however, made modifications on moving in. The constructional grid of 1200 mm x 1200 mm is largely ignored in partition layout, although use of a 900 mm x 900 mm grid as in the Arsène-Henri projects would have made modular planning simple.

Partition joints are tongue and groove plus glue which, although demountable without damage, gives a more permanent feel to the walls than the nailed on cover strips of Montereau. (The latter have the disadvantage of making wallpapering difficult, although occupants interviewed were not bothered by the end result.) Occupants of GEAI buildings feel that although they had little control over the initial layout, they could alter it if they wanted to. Warm air heating ducted through the ceiling space can conform to rearrangement of layout, and ensures proper ventilation of the rooms. A major advantage of the high degree of industrialization is that the subdivision of the building can be modified during assembly, and this has been done at Rouen where adjacent 5-room flats were changed to 7-room and 3-room by the HLM housing management office, to suit local demand. Also, at Elancourt some ground-floor flats have been taken over as offices, and the façade panels will be replaced to suit the user.

GEAI projects have been completed for 490 units in Chicago and 230 at Brockport, NY, in the USA.



16 Bordeaux-le-Lac. 25m x 25m x 5-storey 'cube' building during construction. (7 & A 292)

Combinatoires Urbaines

Designed by Henri Maillard a pilot HLM project of 203 units is being built at Toulouse-la-Terrasse, with the help of Plan Construction funds. In this project a 4.50 m x 4.50 m structural module gives L-shaped flat plans each with one or more half-module triangular terraces, 23.

The partition planning module is 900 x 900 mm. Several forms of construction are possible using the basic structural system and for a second project users are participating at the cluster-planning stage.

Maillards' theoretical position is similar to Arsène-Henri in that he is aiming for the emancipation of the individual's creative abilities with respect to his home. However, whereas Arsène-Henri aims at the creation of support structures *within* which users organize their homes, Maillard envisages the building up of spaces from simple structural components. This activity would be collective by the users, while the interiors would represent their individual expressions. The architectural quality of the environment created in this way would be a result of these choices with a minimum of intervention by the 'isolated' expert.²³

Espace construit adaptable

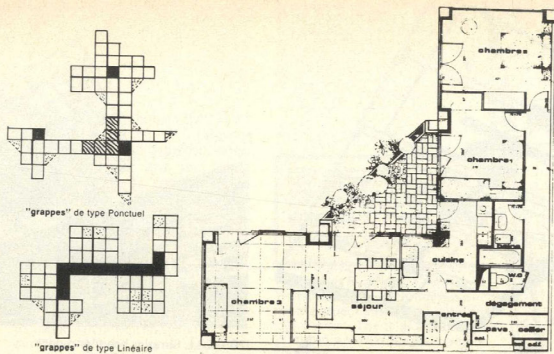
This project by Bernard Kohn and Georges Maurios has led to 100 units to be built at Val d'Yverres with Plan Construction participation. This is the culmination of a long period of research.²⁴

The constructional principle is space 'parcels' of 15 m² built up from individual subsystems within a tartan grid of 3900 mm x 750 mm x 3900 mm + 750 mm, the narrow bands consisting of V-shaped beams to collect and distribute horizontal services which rise or drop in the hollow columns 750 mm x 750 mm, 24. Bathrooms, kitchens, partitions, façades, are chosen from a catalogue and are designed for interchangeability.²⁵

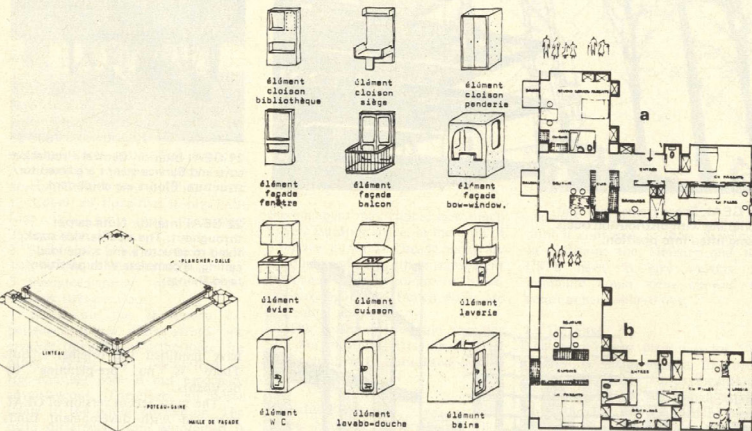
The prospective occupant will purchase a number of serviced space 'parcels' and unserviced space for expansion. The architects will assist him in the choice of catalogue components and planning of his flat, as well as the budgeting of the total purchase price.²⁶

The type and number of units in a building are not predetermined but are able to conform to demand thanks to non-loadbearing party walls.

The basic principle of participation by the occupant, then, is one of consultation with the architect and developer - the 'helping hand'. It is expected that the Val d'Yverres project will be occupied during 1974.



23 Combinatoires Urbaines. L-shaped flat plan based on 4.50m x 4.50m structural modules. (T & A 292)



24 Espace construit adaptable. Construction principles of the 15m² space 'parcels'. (T & A 293)

25 Espace construit adaptable. Catalogue of interchangeable interior elements. (T & A 293)

26 Espace construit adaptable. Plans by occupants: (a) for a couple with two girls of 5 and 7 years, (b) for same family with a studio provided for their grandparents. Note the change in location of the catalogue elements. (T & A 292)

Notes

¹ 'L'Architecture évolutive', *Techniques et Architecture* 292 and 293, April, and May-June 1973.
² *Techniques et Architecture*, 293, op. cit., 'Voie pour une Industrialisation Ouverte'.
³ *Techniques et Architecture*, 293, op. cit.
⁴ Boudon, P., *Lived-in Architecture* (translated by G. Onn), London, Lund-Humphries, 1972, discussed in: Jameson, C., *Le Corbusier's Pessac: A Sociological Evaluation*, *AA Quarterly*, Vol. 4, No. 3, 1972, and Pawley, M., *Architecture versus Housing*, London, Studio Vista, 1971, p. 90.
⁵ Atelier 3, *Recherche pour un Habitat Personnalisé*, Paris, Eyrolles, 1971.
⁶ The program is a 'Branches and Bounds' type of hierarchical

decomposition, written in Fortran IV for a Univac 1108 or Digital PDP 10.
⁷ Belmont, J., *Propositions d'habitat*, Vincent, Paris, 1972.
⁸ Division des Sciences Humaines, Etablissement de Nantes: *Perception des Volumes Intérieurs*, Cahiers du Centre Scientifique et Technique du Bâtiment, No. 139, May 1973, pp 27-31.
⁹ Maximum areas permissible within HLM category (low cost and subsidized), Source: *Journal Officiel de la RF Décret du 14 Juin 1969*.
¹⁰ Jean Brouvé, *Prefabrication, Structures et Elements*, London, Pall Mall, 1971.
¹¹ Ibid.
¹² See AD, November 1963.
¹³ *Techniques et Architecture*, 293, op. cit., project described in more detail.
¹⁴ The program is a 'Branches and Bounds' type of hierarchical decomposition, written in Fortran IV for a Univac 1108 or Digital PDP 10.
¹⁵ Belmont, J., *Propositions d'habitat*, Vincent, Paris, 1972.
¹⁶ Division des Sciences Humaines, Etablissement de Nantes: *Perception des Volumes Intérieurs*, Cahiers du Centre Scientifique et Technique du Bâtiment, No. 139, May 1973, pp 27-31.
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¹⁸ Jean Brouvé, *Prefabrication, Structures et Elements*, London, Pall Mall, 1971.
¹⁹ Ibid.
²⁰ See AD, November 1963.
²¹ *Techniques et Architecture*, 293, op. cit., project described in more detail.
²² The program is a 'Branches and Bounds' type of hierarchical

Sweden

In Sweden different forces have motivated an interest in flexible housing.

1. A highly developed sense of social responsibility.
2. Architectural and research curiosity.
3. Diminishing availability of skilled site labour.
4. Competition in a highly productive housing market and hence, need to offer inducements to prospective occupants.
5. Overproduction of housing in certain areas requiring re-allocation of use of some large projects.

The starting point for the Swedish experience is very clearly Mies Van der Rohe's contribution to the 1927 Weissenhofsiedlung exhibition at Stuttgart. The plan form of this building, with each stair serving two flats per floor, double aspect, and open floor interrupted only by intermediate columns, survived intact with minor variation in the first two well-known Swedish projects at Gothenburg in 1954, 1, and Uppsala in 1964, 2.

Since that time, the cause of flexible housing has been advanced to the greatest degree by the giant housing cooperative HSB,¹ founded in 1923. The main aim of HSB has been to protect its members from property speculation, to ensure good standards of housing and, as with housing associations in the UK, to enable those without private capital to occupy equity-generating property.

In February 1973 we visited four HSB projects which are described below. The main lessons to be learnt from interviewing occupants and HSB officials are that:

1. Choice of initial layout is the most important aspect of flexibility to the user (particularly when he has a choice between flexible and non-flexible flats) i.e. the creation of his flat.
2. Flexibility in use is possible but demands some effort. The idea that changes can be made if desired is valued highly by occupants; his decisions are reversible.
3. Functional flexibility in terms of re-allocation of use (e.g. play centre) is important to the developer to maintain maximum occupancy in competition with other developers.

From the point of view of an individual developer such as HSB, flexibility was not originally seen as an end in itself. Dry partitioning and factory-produced casework were used primarily to economise on site labour and reduce the skill required in fixing. Dry partitions were also seen as a way of avoiding surface cracks due to creep in large panel structures. Gothenburg and Uppsala were

consciously designed as flexible, but it was not until these projects gained renown for their success with occupants that developers like HSB related their own concerns about dry construction with the idea of flexibility, which they then adopted as a marketing aid.

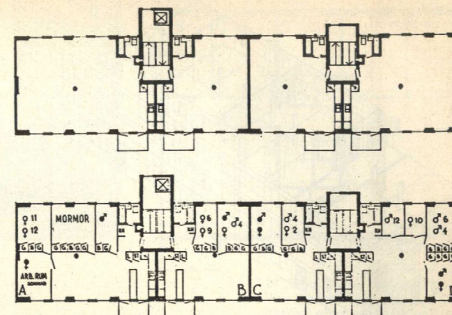
Fortunately, in the interim, Olsson and Nilsson had conducted a thorough survey of the Uppsala scheme, in the Department of Building Function at the Lund Institute of Technology.² This study describes how tenants assessed the features of the flats and the different layouts possible, how they had taken advantage of the structural flexibility, and their justification for the changes made.

The 'Diset' block at Uppsala was compared with other similar projects, both those planned and constructed using the Skarne 66 system of construction (Orminge, see below) and the 1954 project at Järnbrott, Gothenburg.

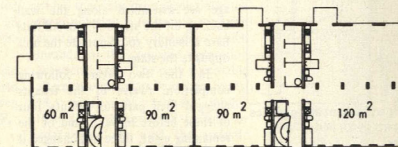
The value of these studies was an increased sensitivity to the relationship between shell design and movable partitions in terms of maximizing the range of possible layouts. Analyses were made of plan areas not permitting the erection of partitions, and possible uses of frontage giving different arrangements of space, 3. Analyses of furniture placements and partition layout, showed the effect of fixed elements on plan choice.

An observation to be made from analysing these layouts is that it is rare to find any 'radical' layouts in the Swedish examples. Since there is no restriction on flat size allowed, examples may be found of single retired people making very large living spaces in what could be a three bedroom flat, but the planning is likely to be conventional in all other respects. The popular architect's conception of flexibility permitting the expression of different life styles through plan form is not given much credence in the plans seen. While this may result in part from limitations of the basic flat configurations, we think it is primarily attributable to the similarity of aspirations and expectations among the socio-economic group who are attributed to an HSB development in a given location.

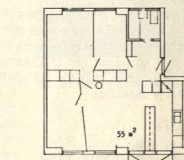
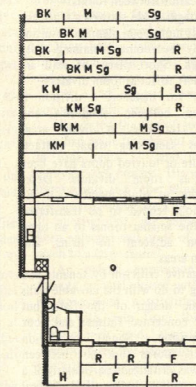
This is not an attempt to correlate socio-economic homogeneity and life style. On the contrary, just because a group of housing occupants lives in the same place, pays the same rent and chooses fundamentally similar plan types, this does not mean that they are all the same people. Their experience of their homes in the light of their cultural or racial differences,



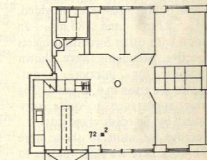
1 Järnbrott Gothenburg. Experimental flats by T & A William-Olsson in 1954. (Figs 1 to 3, Olsson & Nilsson: *Flexible Dwellings in Blocks of Flats*, 1970)



2 Diset, Uppsala. Experimental flats by Bertil Olsson & Rolf Nilsson, 1964.

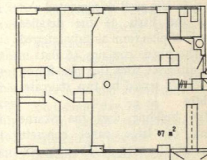


4 Järnbrott 55m² flat with layout suggested by architect.



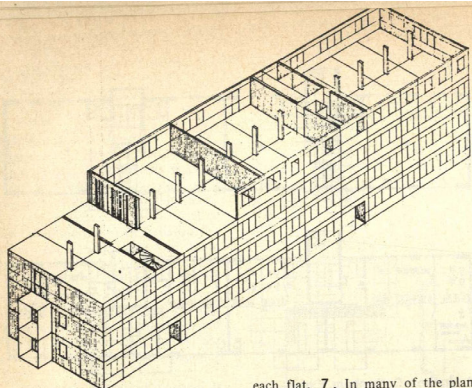
5 Järnbrott 72m² flat with suggested layout.

3 Järnbrott 72m² flat; analysis of alternative use of frontage.

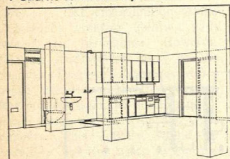


6 Järnbrott 87m² flat with suggested layout.

their families, the circumstances from which they came, and their future aspirations, remains different and private. This is particularly so in countries with highly developed social services and small income differential, such as Sweden, where there are fewer outward signs of differences between socio-economic



7 Skarne structural system.



8 Permanent equipment along service wall for shower room and kitchen.

groups than in a country like the USA.³

The message for architects, then, is that in a flexible scheme even if everyone chooses basically the same plan, that is no reason not to make the scheme flexible. It is the act of choice that is important.

PROJECTS

Järnbrott, Gothenburg, 1954

This project by Tage and Anders William-Olsson was intended as flexible housing, and is the most directly derivative of Mies 1927 Weissenhof plan.

Three unit sizes are provided, 55 m², 72 m² and 87 m². In common with other Swedish projects prospective occupants were shown suggestions for interior layout. Examples are given in 4, 5 and 6. The exterior appearance is quite conventional by Swedish standards.

Because we want to show more recent work here we refer readers to the quite thorough documentation of this project that is available.^{4,5}

Diset, Uppsala, 1964

This project, by architect Axel Grape, is also well documented and forms the basis of the detailed analysis of plan form already referred to.⁶ The block contains 16 flats in three different sizes (see plan 2) on four floors served by two staircases and lifts.

The building uses the Skarne system of large panel concrete construction, with loadbearing external walls and crosswalls with an intermediate row of columns giving a relatively unobstructed floor area to

each flat. 7. In many of the plan types created, the columns serve as space defining elements and as 'anchors' for movable cupboards and casework. In all flats services such as ventilation, water supply and drainage are assembled along the wall backing on the stairwell. 8. All flats have a laundry room outside the unit opposite the stairs.

In the two years following completion, twelve of the tenants changed their partition layouts, four of these before move-in, and of the remaining eight, three had changed it more than once.

Interviews suggested the main advantages to the tenants to be variation of number, size, shapes, positions, connection between and demarcation between rooms.

Changes made showed a tendency towards more open planning resulting in only bedrooms remaining fully enclosed. Short pieces of wall are often left to act as room dividers.

Where, for instance, a division is required between children's and adults' territory in living areas without sacrificing visual contact, furniture or louvred doors have been used as room dividers. Desks belonging to adult members of the household tended to be transferred from the smaller rooms to an open position adjacent to living and kitchen areas.

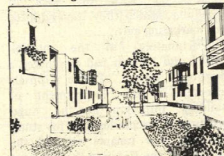
Negative criticism by tenants had nothing to do with the movable walls or basic design of the flats, but mainly concerned finishes and poor workmanship. Sound insulation between rooms (but not between flats) was criticized, particularly if a family had a lodger, but several tenants considered the sound insulation no worse than in other modern flats of traditional (i.e. non-flexible) design.

To quote Olsson and Nilsson: 'The results of this study support the assumption that the potential adaptability provided by movable walls and fixtures is popular with the tenants and that the mere knowledge that the layout of the dwelling can be altered, if so desired, has a positive effect on residents' satisfaction with their accommodation.'⁸

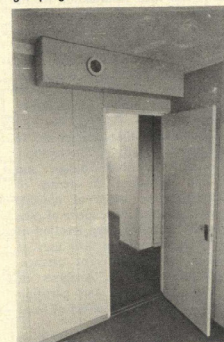
A final conclusion of Olsson and



9 Orminge. Typical group of 3-storey blocks planned around natural landscaping.



10 Orminge. Page from design brochure, showing concern for grouping of blocks.

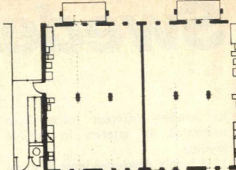


14 Orminge. Detail of ducted vents to overcome strict ventilation requirements.

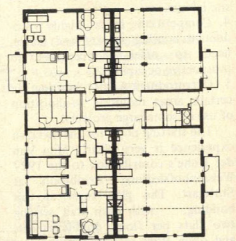


16 Orminge. External treatment.

Nilsson's study is that flexible dwellings entail a risk. The risk that developers and designers will use it only as a marketing device without sufficient detailed study of the variations possible within the basic design.



11 Orminge. 2-storey terraced block showing shell and suggested layouts. Note wet service walls.



12 Orminge. 3-storey block showing shell and suggested layouts.

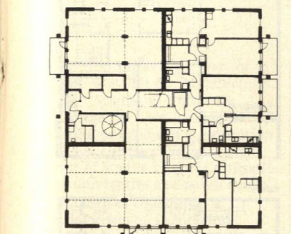
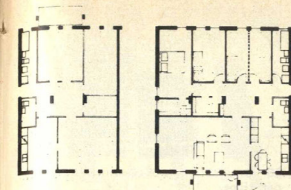


15 Orminge. Detail of blind between bedroom and living area. Plants are used to tie all spaces together visually.



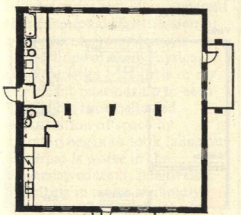
17 Orminge. Flat design by occupants during building.

Orminge, 1967
This is a large HSB development in a suburb 20 minutes from Stockholm designed by Joran Curman and Ulf Gilberg. By 1975 it will have a population of 6200 persons at a density of 232 p.p.a.

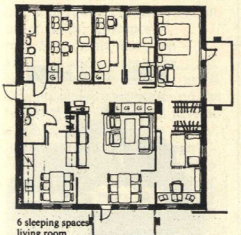


Ground floor
2 No kitchen + 3 rooms 81 m² living floor space + 4 m² storage space
2 No kitchen + 2 rooms 61 m² living floor space + 4 m² storage space
1 No kitchen + 1 room 38 m² living floor space

13 Orminge. 5-storey block showing shell and suggested layouts.



6 sleeping spaces
living room
workroom



17 Orminge. Flat design by occupants during building.



18 Tensta. Regimented layout on a difficult sloping site. Note balcony units that clip on to structural system.

The plan, prepared in 1963, is based on an outer parking and movement loop on which are located shopping, offices, hospital, etc., an inner housing area loop, and inside that a park and school zone.

Most housing is in two- and three-storey blocks of not more than 12 flats and great care has been given to landscaping between blocks. 9, 10.

The system of construction is Skarne 66, similar to that used at Diset, Uppsala. It is made up of loadbearing external sandwich panel walls with a striated natural concrete finish, and 2.7 m wide floor panels spanning onto intermediate columns.

Two-storey terrace blocks, 11, are similar in concept to Diset with front and back aspect providing four types of flat.

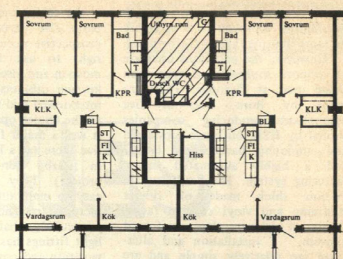
There are two types of free-standing block. Type 1, 12, has three floors of four flats in cruciform arrangement providing 70 m², 90 m² or 91 m².

Individual storage is provided on landings, and there are air raid shelters under some of the blocks.

Type 2, 13, may go up to five storeys and incorporates two smaller flats for single people, 38 m², on upper floors. In the future these flats may be absorbed into another flat adjacent. Other flats on a typical floor are two at 81 m² and two at 61 m². Storage is provided within the flats (for one-room flats in the air raid shelters).

The architects told us that the starting point for flexibility at Orminge was research into dry partitions for the Skarne 66 system, and that flexibility was not a project objective for Orminge originally.

The result is a timber framed partition with vinyl-faced plasterboard. The partition is stiffened with 'studs' of corrugated cardboard. Electric cabling and outlets are factory installed for connection on site, although the problems of electrical distribution are seen by HSB as the biggest obstacle for flexibility generally.



19 Tensta. Plan of typical blocks. Note the extra room plus facilities (shaded) which can be let separately or as part of right-hand flat.



20 Tensta. Changing the partition layout can be a family activity.

In order to find out the consequences of active tenant participation for the design and production process, about 10 families were given the opportunity of planning their flats within the framework of the production programme. 17, shows the shell of a 120 m² end flat in the two-storey terrace.

shows the architect's proposal to the ten families, and d, e, show the tenants re-planning of that proposal. There is a tendency towards a more open plan. It was found that this planning procedure need not slow down the completion rate of flats.

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Tensta 1970

Architects unknown. This is a 650 flat development near Stockholm, completed in February 1971, built using the Skarne system of construction.

Unimaginative site planning on a difficult sloping site has resulted in a very ugly and unpleasant result even on a sunny day. 18, 19.

In terms of building plan, an interesting feature is the single lettable of extra room opposite the stair and lift. This room may be let by itself or as part of a 94 m² flat. The shell has obviously not been

closely studied as to layout possibilities although it is probably no more limiting than at Gothenburg.

However, the partitions used are of a more sophisticated type than those used at Orminge. They are made by Boro, one of five component producing companies owned by HSB, but state subsidized and employing handicapped labour and a highly automated manufacturing system. The partitions are 70 mm thick made of timber subframe and vinyl covered facing sheets of 13 mm glass reinforced gypsum.

Installation and alteration are relatively simple and are advertised in Boro's literature as a family activity, 20.

The standard panel size is 600 mm, which weighs 39 kg for a 2.50 m-high panel. A range of smaller sizes permits any linear dimension to be achieved. Panels are placed over the floor finish and a 70 mm-wide batten is placed on the ceiling with grooves both sides to accept plastic 'skirting' which mask electrical installation. The batten is routed to receive the bolt head of a spring-loaded fixing device which keeps both batten and partition in place (as well as accommodating structural movement between floors). Joining is by hardboard tongues in edge grooves of the panel studs. The partitions have gained a 1/2-hour fire rating on the Swedish test and claim 30 dB acoustic insulation in a laboratory test (probably not achieved in the field).

There is no occupant participation in flat planning at Tensta and flats are completed to plan-types which are advertised in HSB literature. However, flats may be modified or re-planned by the occupant at no extra cost prior to move-in, by arrangement with the HSB management.

In common with other Swedish schemes, there is no planning module or grid, as such. Dimensions are made up using the range of panel sizes available.

Västerås 1971

In this project of 159 units, HSB have consciously marketed flexibility, using the Boro partitions, for the first time. The project is some 120 km from Stockholm and in an area of stiff competition for developers.

Flats are disposed in a single long seven-storey building, 21.

The planning affords greater variety of shell types than in previous schemes to attract a wider range of occupants. Lifts and stairs serve three or four flats per floor and communal facilities such as laundries are grouped on the ground floor.

Construction is in-situ concrete and precast floor units and the exterior is brightly clad in enamelled steel vertical siding which looks good in the rather cold Swedish light, but is more expensive than precast sandwich panels used elsewhere.

In this project, as at others, a basic flat layout is proposed to prospective occupants, who have the right to ask for changes before move-in and also to select colours of kitchen cabinets, etc. Occupants were interviewed said they were well aware of the choice open to them and that it was a major factor in choosing to live there (at a higher outgoing than in nearby non-flexible traditional project). They find the partitions easy to maintain, wallpaper, and fix pictures to. They weren't bothered particularly that wiring to central light fittings has to emerge from the partition and cross the ceiling. There were, however, complaints about noise within the unit as ventilation is by gaps in fanlights.

Figure 22 shows the suggested layouts for the 99.5 m² flats. Mrs. Nilsson a retired widow occupies one and has chosen to provide only one bedroom, 23 24. The size of flat is determined by the rent that can be afforded, rather than by the number of persons in the household. Figure 25 shows that casework, although made to a high standard (melamine faced throughout) has not been co-ordinated with the partition detailing. This does not bother occupants but would simplify site fixing.

Figure 26 shows a typical 65.5 m² flat in the version proposed and two alternatives. For such a flat the deposit would be 2100 kr (reimbursable by the subsequent occupancy) and monthly rent of 510 kr. HSB's return on investment to its members is about 6 per cent for this project. Occupants do not have to obtain permission to alter their layouts, but assistance is available from the local branch of Domus Interior, a large-scale Swedish version of Habitat which just happens to be a subsidiary of HSB, providing a complete range of home furnishings at reasonable prices, 27. This tie-up with furniture retailing is an important development, strongly advocated by Arsène-Henri in France, who sees it as a prerequisite to wide scale acceptability of flexible housing.

Kalmar 1971

This has been a turn-key project by Skanska Cement AB, designed and planned by their architects' department, and constructed using their system of L-shaped panel construction.¹³ The project forms part of the expansion of Kalmar known as Marmor and Porfyren. It is some 300 km south of Stockholm.

The planning of the project, as at Orminge, is based on pedestrian walkways between low blocks, all two-storey in this case, with perimeter parking and intermediate space given over to public open space.

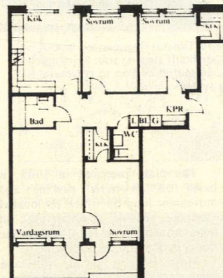
Rents are lower than for HSB projects near Stockholm because development and construction costs were about 10-15 per cent less. Plans



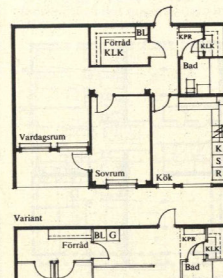
21 Västerås. External appearance.



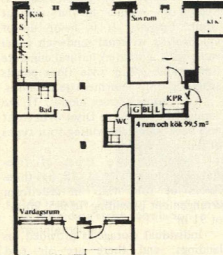
25 Västerås. Details of casework and partitions.



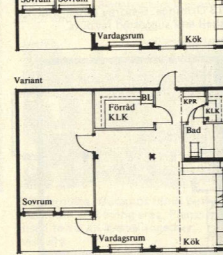
22 Västerås. 100m² flat with layout suggested by architect.



26 Västerås. 66m² flats with layouts suggested by architect. (HSB)



23 Västerås. 100m² flat occupied by Mrs Nilsson.



26 Västerås. 66m² flats with layouts suggested by architect. (HSB)



24 Västerås. Interior of Mrs Nilsson's flat.



27 Domus Interior. A subsidiary of HSB to provide furnishing at reasonable prices.

Germany

The starting point for flexible housing in Germany was the 1927 Weissenhofstiedlung exhibition at Stuttgart. The scheme was projected to enable the most advanced architects of the time to put revolutionary ideas into practice. The scheme was dominated by Mies van der Rohe's steel framed apartment house, 'in which the inner walls could be disposed according to the liking of the tenants, in whatever manner they choose'.²

Other notable projects at the exhibition were the house by Adolf Rading in which the interior was planned as one living space, which could be subdivided by means of sliding folding partitions running on tracks in the ceiling and floor, and the Double House by Le Corbusier and Jeanneper. Le Corbusier remained interested in the possibilities of flexible housing and developed projects in which the space was transformed for day and night use. In his 'Projet d'un immeuble locatif' 1928/29³ the beds are pulled out from under a raised corridor, shared with the adjoining flat. The idea of 'transformable' space is also incorporated into the 'Maisons Loucheur of 1929'.⁴

The impetus for recent development has been three government sponsored competitions. In Germany the major problems are high rents of apartments and flats, combined with high construction costs because of a lack of industrialization. The building industry alone has been unable to develop meaningful contributions to the problems outlined above. A few promising developments in the area of modularized university buildings, the 'Marburger System' for instance,

failed to reach a larger market because they lacked sufficiently large construction programmes. The amount of units sold was not large enough to lower the prices substantially. In fact prefabrication in the residential market accounts for less than 10 per cent of all built units.

So, one of the aims of the competitions was to promote industrialized construction methods in housing combined with an answer to psychological needs, like visual differentiation, functional indeterminacy, possibilities for user participation and so on.

With government support and several sites all over Germany it is anticipated that the amount of units produced will be large enough for a substantial reduction of costs. Research will be conducted during the construction and - for the first time - also during use as a basis for later decisions.

The first contest in 1971 was concerned with the changing user requirements within apartment flats and was called 'Flexible Residential Floorplans'. The task was to develop proposals and plans for a multi-storey residential housing development with flexible interior spaces.

The objectives of the competition were:

- The principle 'the user has to adapt to his apartment' has to change into 'the apartment has to adapt to the user'.
- Building structures should allow several cycles of change of inter space requirements caused by changing living habits during their life-span.
- Active involvement of apartment dwellers in the layout of rooms and

space creation.

- Visual and acoustical separation of spaces with non-bearing walls.
- Long-term and short-term variations of room functions and facilities.
- Partitions should be relocatable by occupants without damage or special equipment.

- Consideration of varying rates of obsolescence of building elements, finishes and services.
- Compatibility of modular grids for electrical installations, sanitary installations, suspended ceiling systems, etc.
- Improved identification of users with their immediate surroundings, reduction of aesthetic alienation through the variety of changeable parts.

The competition attracted 48 entrants and six prizes were awarded. Figure 1 illustrates the award-winning schemes and shows two distinct attitudes to the positioning of service spaces within the shell. In schemes a, b and c they are treated as service cores within the space; subdivision into rooms is made with the minimum amount of partitioning between the core and the exterior wall.

Schemes d, e, f, the service spaces are grouped back to back in a neutral space between two flats. This then leaves the remaining living area as one large uninterrupted space to be divided as required.

All the projects submitted are well documented by the German Ministry of Housing.⁵

The second competition in 1972, ELEMENTA, was not only concerned with the interior flexibility of buildings, but with whole residential structures and the problems of industrialization.

The objectives of this competition were:

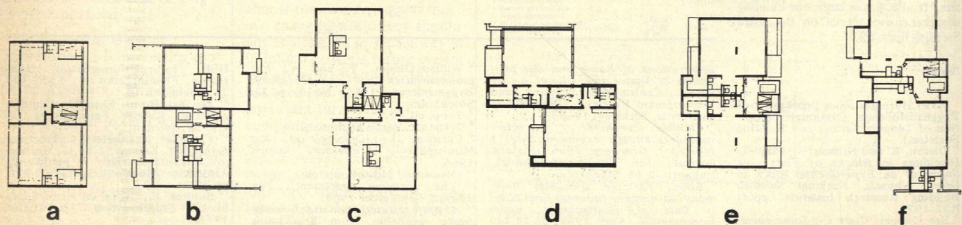
- Development of five apartment sizes to be accommodated in a variety of building types up to eight storeys by means of the same basic elements.
- Flexibility of external elements to define living space and to provide means for a strong architectural expression.
- 'Second Generation' building systems, offering not only technological and economical advantages, but with a better consideration of 'soft facts' like architectural psychology, social and human factors.
- To be compatible with low costs, rapid construction and subsequent extensions and rearrangements of internal walls.
- Co-ordinated vertical dimensions for apartments on one level, maisonettes, split-level and varying room heights.
- Costs to be within certain limits for State-supported housing.
- Reduction of structural rigidity responding to a dynamic housing market.
- Wide possibilities for combining all five apartment types.

The competition was won by the firm of Jourdan, Peterman and Professor Posenenske, 2 from 73 entrants.

'Stern' magazine who promoted the competition is to publish the results of the technical studies and user surveys that are to be continuously carried out. The first project is to be built at Bonn, and if successful, the approach will be employed on a national scale.

In 1973 the third contest,

1 'Flexible residential floorplans' competition. 1971 Plans of the six award winning schemes.



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INTEGRA, tried to find new concepts for the central-city redevelopment. The mixture of dwellings, recreation, offices, stores, parking and the like to be integrated in one building system was the goal.

The objectives of this competition were:

- The context of the current urban crisis, deteriorating cities and dissatisfaction with mono-functional central cities and their socio-psychological consequences, need to be corrected by improved laws and environmental systems.

- Modular coordination of parking, commercial and office space and housing facilities on the upper levels with approximately 50 per cent of usable space for residential housing.

- Systems for indetermined spaces, as opposed to the systems of the '50s and '60s which were mainly mono-functional dwelling systems.

- Enough privacy and isolation for urban communities with green spaces and maximum amount of site for recreation.

- Building structures where large interior areas are free of structural obstacles so that free organization of commercial and living spaces is possible and which can be refitted at later stages.

- Separation of parts and features of environmental structures that will not change, e.g. the load-bearing parts, and flexible secondary structures to be altered during the life of the building.

- Compared to other industries the building industry has had the fastest inflation (1970 to 1972 over 30 per cent) because of a lack of modular coordination and economic production methods, therefore, in-

dustrialization and standardization to make an essential contribution to the stability of building prices and labour costs.

Figure 3 shows one of the award-winning entries by Horst Enters, Ulrich Bitsch, Ingelove Ehlers and Polensky Zollner.

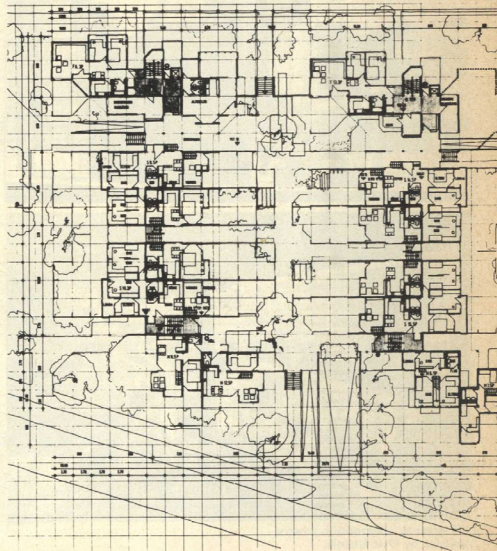
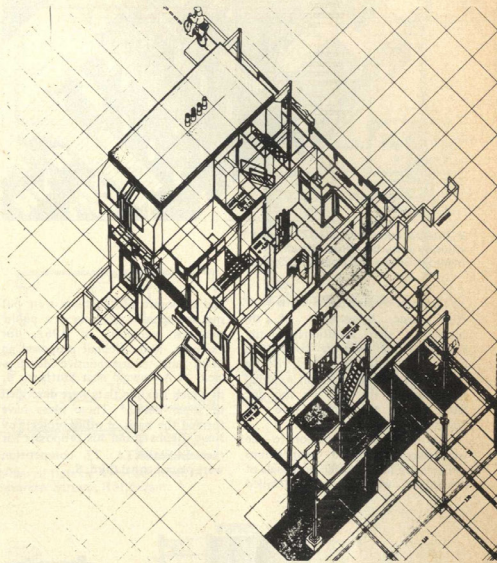
This attempt to promote R & D in the building industry with government support has had great success. The joining of general contractors, architects and financing organizations brought up new concepts and ideas with a wide spectrum of applications, and, what is important, within limits of State-supported 'social flats'.

An interesting result of these competitions has been to throw light on the development gap between highly industrialized construction methods for the structural parts and extremely uncoordinated secondary systems, meaning internal and external walls, ceiling and floor products as well as built-in furniture, kitchen and bathroom appliances. In this particular area some research and international coordination could help a lot.

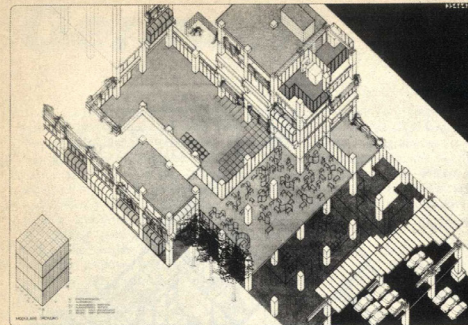
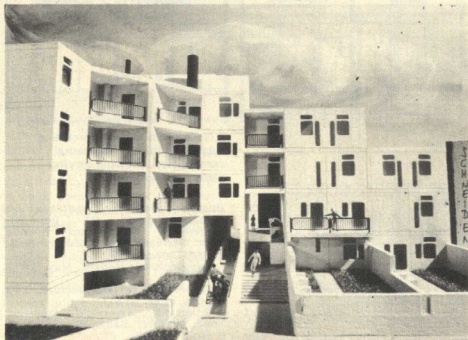
The first winning entries of 'Flexible Wohngrundrisse' and ELEMENTA are under construction; INTEGRA will most likely be started in 1974.

Research during the construction period and the investigation of user behaviour in these new types of structures will most likely be of the same interest as the results of the three competitions.

The equal third prize winner in ELEMENTA 72 was a system designed by Otto Steidle of Munich, 4, which had already been tried out



2 'Elementa' competition 1972. Winning scheme by Jourdan Peterman and Professor Posensenske.

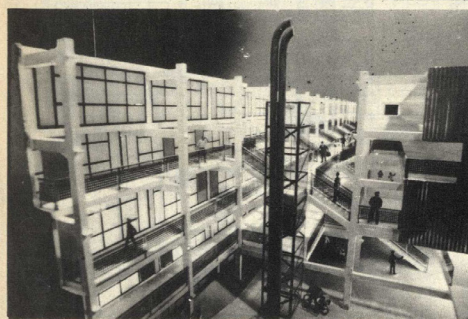
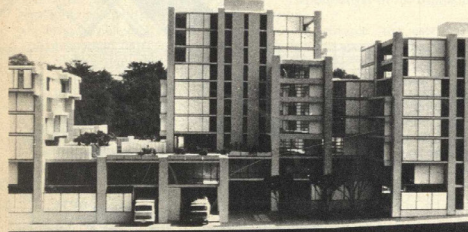


3 'Integra' competition 1973. Award winning entry by Ulrich Bitsch, Ingelove Ehlers and Polensky Zollner.

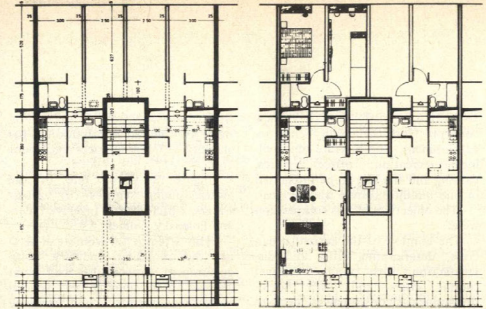
in a scheme by Ralph and Doris Thut. The basic hypothesis of the system is that traditional family structures are evolving towards a communal life-style, which is the reason for the internal and external flexibility of the unit on the one hand and the importance of communal spaces on the other.^{6,7}

An interesting precursor to the Government-sponsored competitions in Germany has been the proposals of developers, whereby quite detailed

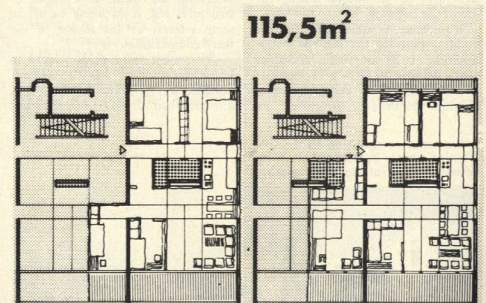
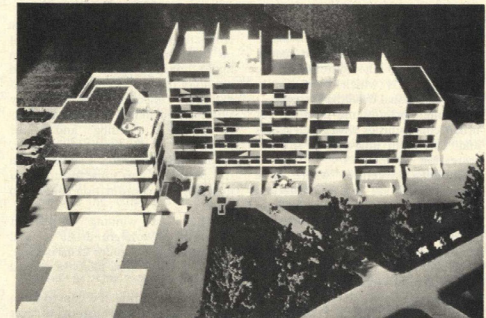
and elaborate prospectuses were put out for specific projects as a public relations exercise. In 1962, for example, Neue Heimat proposed an 1100 unit comprehensive development at Asemwald near Stuttgart, 5, in which flexible flats were described in some detail.⁸ These ideas have formed the basis of other projects by Neue Heimat, and his proposals for the ELEMENTA 72 competition were placed equal third, 6.



4 'Elementa' competition scheme designed by Otto Steidle.



5 Neue Heimat's proposals for 1100 unit comprehensive development at Asemwald in 1962.



6 Neue Heimat's system catalog submitted for the 'Elementa' competition, showing varying configurations of flats.

Notes

¹ The editors are grateful for material supplied for this section by Ulrich Bitsch of Düsseldorf.

² From a contemporary account by Giedion quoted in Giedion, S., *Space, Time and Architecture*.

³ *Le Corbusier et Pierre Jeanneret 1910-1929*, p. 184.

⁴ *Le Corbusier et Pierre Jeanneret 1910-1929*, p. 198.

⁵ 'Flexible Wohngrundrisse' from *Der*

Bundesminister für Städtebau und Wohnungswesen, 53 Bonn-Bad Godesburg, Deichmanns Avenue, West Germany. Published by Nesse Presse, Coburg, 1972.

⁶ *Architectural Design*, May 1972, p. 277.

⁷ *Techniques et Architecture*, 292, pp. 41, p. 70.

⁸ *Wohnstadt Asemwald Stuttgart*, Neue Heimat, Baden-Wurtemberg, Stuttgart, 1962.

Netherlands

In a review of flexible housing today the Netherlands is important as the home of N. J. Habraken. However, there have been some interesting precedents. Rietveld's house of 1924¹ for his collaborator Mrs. Schroedor, is designed 'to the end of achieving an individual mode of modern living'.² It consists of largely open floor plans with wet services arranged around external walls and a central staircase. Sliding partitions from the perimeter to the stairwell provide a variety of spatial possibilities. 1. Rietveld was convinced that workers' housing should be a newly conceived industrialized product, not reminiscent of bourgeois developer housing or individual houses:

*'the most the architect can do is integrate all lost or exclusively used bits of space into one single serviceable room.'*³ 2.

Holland is a densely populated country and it has been tackling a considerable housing problem by means of large, formal, geometrically laid-out suburbs. While Van den Broek, Stokla, Van der Vlugt and others have attempted to bring 'identity' to this type of housing, it is essentially what Habraken refers to as MH (mass housing).

Havander Strasse, Rotterdam

This project by Van den Broek, done in the early 1940's represents a conscious attempt to provide an adaptable flat design. Permanent features of the plan are entrance lobby and kitchen aligned on one party wall, and the bathroom and a lobby on the opposite party wall. 3.

In 1965 Dr. de Jonge, a sociologist at the Delft Technische Hogeschool Afdeling Der Boukunde surveyed the flats and found 24 different ways of organizing activities within the space. The plan form is highly ambiguous, an essential quality of adaptable housing. It invites variety of expression within it.⁴

'Kristalbouw' project, Amsterdam

In 1964, two important articles appeared in Holland.^{5, 6} Trapman describes a project in his article which he calls 'Kristalbouw' which is a 'multi-storey land' proposal. A permanent concrete frame structure (or alternately, tower supports for a tension cable framework) supports lightweight floors, timber fireproof suspended ceilings, and double party walls which are moveable. The depth of the building is 11 metres plus balconies, and it may be built up to 10 stories. Access is normally on alternate floors, by means of a

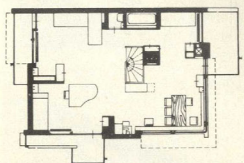
precast concrete stair and lift tower. In terms of planning, the aim is to give occupants choice of size of flat not only horizontally but also vertically. 4. The light floor construction gives freedom in locating stairs within the flat.

Although the true benefits of the scheme are doubtful (we have found all schemes which propose a trade-off of area between flats to be non-starters as they depend on mutual probabilities), it is interesting to compare it with Habraken's work which is more convincing for having a sound theoretical basis.

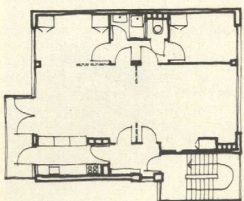
Habraken and SAR

The work of John Nicholas Habraken since 1961, when he published his thesis *De Drager en de Mensen* (Supports of the People), has quite rightly received much attention in Britain (although very little in France; at January 1973 Arsène-Henri did not know of his work). In September 1964, he formed SAR,⁶ a group sponsored by other architects, to develop his theory of housing, and to do necessary research to bring it to reality.

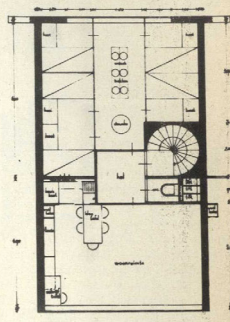
The essence of Habraken's theory is that the role of the community and



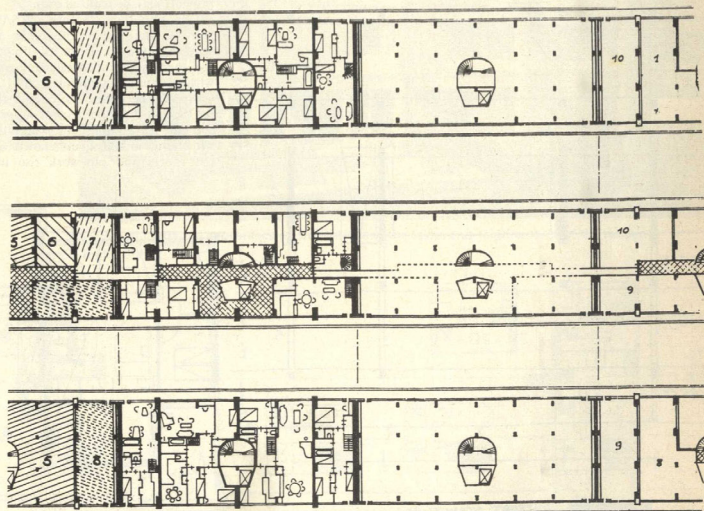
1 Schroeder House, 1924, by Gerrit Rietveld. First floor plan.



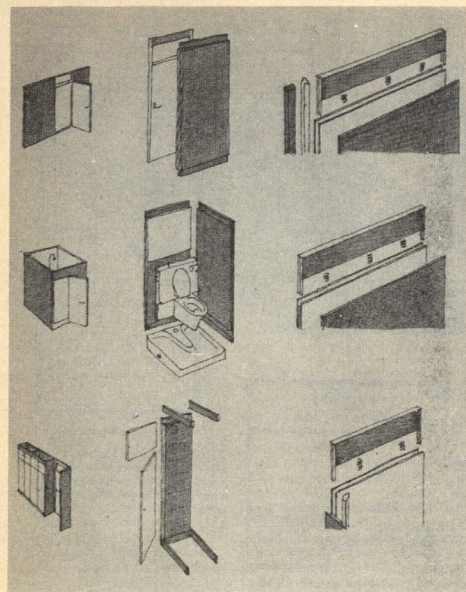
3 Plan of flats by Van den Broek at Havander Strasse, Rotterdam.



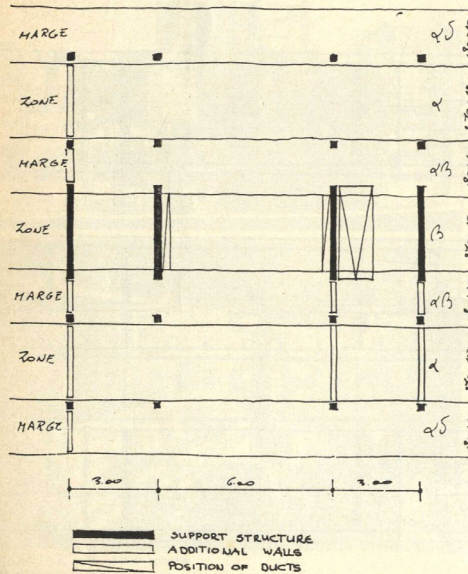
2 Rietveld houses for the working class (66m²/5 person unit). Bedrooms are very small so as to keep the living room as large as possible.



4 'Kristalbouw' project, 1952, by J Trapman. (Forum)



5 Principle of detachable units by 'Bruynzeel Ltd'. (RIBA J 11/72)



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the role of the individual in housing are distinct. If we confuse them or roll them into one, the result is the 'perfect barracks' of mass housing as presently practised. The home is the connecting point between a series of communal services and the personal enterprise of home life. The starting point for the communal services should be the convenience and fulfillment of the occupants rather than the convenience of planners and architects.

The basic expression of the theory is seen as a bipartite form of construction, in which 'supports' are permanent, long-life, multi-storey artificial land, providing utilities and communal services; Habraken often uses the word 'allotment' to describe the communities' contribution to the home. The dwellings within the supports are formed of what Habraken calls detachable units (external walls, bathrooms, kitchen, partitions, etc.), which should be available to occupants, eventually through normal marketing channels, but until then as the products of individual manufacturers (e.g. Bruynzeel Ltd.). 5.

The history of SAR has been a series of projects almost reaching fruition. In 1969, De Jong, Bax and Van Olphen won a competition for the enlargement of Maakens Broek.⁷ According to Habraken, in a talk given at the RIBA last year, several projects may be realized soon.⁸

An important feature of SAR's work is the system of 'zones and margins' used to define possibilities for the layout of detachable units within support structures. 6. It is obviously necessary to ensure that the design of the permanent supports and the detachable units permit a wide range of occupant choice, and that ducts and pipework rise in a

convenient place. However, we feel that this theory of 'zones and margins' implies a control which may be self-defeating with respect to the objective of assigning freedom of choice to the occupant.

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Notes

¹ G. Rietveld, *Architect*, Arts Council of Great Britain, Exhibition Catalogue, 1971.

² Rietveld 'De 8 en Opbouw', 1941, quoted in G. Rietveld, op. cit.

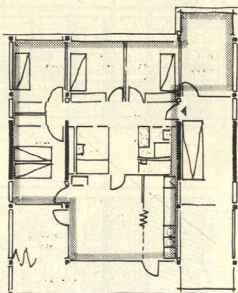
³ Worthington, J., *Holloway Scholarship Report 1964/65* (unpublished).

⁴ Habraken, N. J., 'Quality and Quantity: The Industrialization of Housing', *Forum*, Vol. XVIII, No. 2, 1964.

⁵ Trapman, J., 'Essential Possibilities of Flexibility in Housing, New Characters in the Town Planning Language', *Forum*, Vol. XVIII, No. 4, 1964.

⁶ de Stichting Architecten Research. See Pawley, M., 'Mass Housing: The desperate effort of pre-industrial thought to achieve the equivalent of machine production', *Architectural Design*, Jan. 1970, pages 32-38.

⁷ Habraken, N. J., 'Involving People in the Housing Process', *RIBA Journal*, Nov. 1972, pages 469-479.



6 J N Habraken, detachable units within support structures. (RIBA J 11/72)

Switzerland

In Switzerland construction costs are high and so are the expectations of users, especially in the private market.

It has not been so much a question of providing flexibility as an aid in the management of inadequate space. Rather, the two projects shown here illustrate flexibility as a mechanism for the fulfilment of expectations which are rising as a function of increasing standards of living.

System 4D

The system, designed by Karlsruhe architect Paschmann, has found its first application in a 12 unit building designed by Peter Kamm and Hans Kundig at Zug in Switzerland.

The central principle of the system is standardization of methods of construction rather than of construction itself. As its name implies, the idea is to incorporate the

notion of time. Decisions about plan layout, servicing and facades remain reversible throughout the life of the building, from initial conception to eventual demolition.

At Zug the structure consists of flat plate insitu construction with large bays (7.80 x 4.80). Vertical movement of services is adjacent to columns, but horizontal distribution is by means of raised access cavity floor, 1. Services are simply laid over the RC slab and are accessible from above. They belong to the owner of the flat. There is autonomous air conditioning to each flat.

The layout of flexible elements changes during the process from the initial concept to occupancy. Figure 2 shows stages in the development of Zug.

2.1) Plan of unobstructed floor area showing notional subdivision into four flats.

2.2) Plan of one floor as submitted

for construction permit.

2.3) Successive alteration during construction

a) basis of sales contract

b) first alterations by the client during construction

c) final alterations corresponding to clients definitive choice.

2.4) Flat 13, resold shortly before completion, alters from six rooms to three plus lettable office space.

2.5) Flat 14 altered on completion due to a change in family composition.

1) entrance 2) living 3) bedroom 4) utility room 5) dining 6) kitchen 7) store 8) bathroom.

Figure 3 shows the outside on completion, reflecting the individual choices of the clients.

Its creators see the inflexible structure of this project as a constraint on the potential freedoms of the occupants, like an inconvenient regulation which will

eventually be swept aside. The project has been quite well documented.^{1,2}

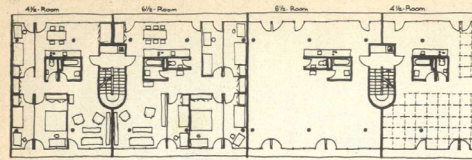
Carasso

At this small town near Bellinzona in Ticina, the architect Luigi Snozzi fulfilled his desire to install high quality moveable partitions designed for office buildings in housing, to provide a degree of flexibility. There is little else remarkable about the project, unless it is the idea of transferring a sophisticated product from one market to another.

Considerable attention has been paid to the location of service cores within the 12-flat building, 4, 5, and these are standardized for both 4½- and 6½-room flats. They related well to

the location of service cores within the 12-flat building, 4, 5, and these are standardized for both 4½- and 6½-room flats. They related well to

the entrance but because the kitchen is fixed, only a small number of layouts are possible. The Strafor-Hauserman³ partitions are steel faced with self-evident joints, and are



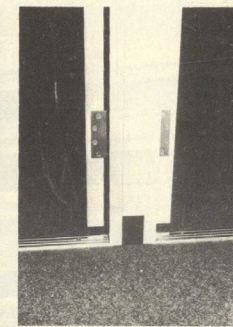
4 Carasso Plan of a typical floor divided into 4½ and 6½ room flats.



5 Carasso External appearance.



6 Carasso Internal movable steel faced partitions with magnetic picture hanging.



7 Carasso Internal doors and partitions are erected after the carpet has been laid throughout the whole flat.

Britain

There is a respectable tradition of search for forms of housing that are responsive to their occupants, but little has been achieved. The fact that much of the best architectural talent has been working in the 'mass housing' field, and has therefore been unable to think creatively about new forms of housing, has left us far behind Sweden, France, Germany and Holland.

The product of private architects and architectural propagandists falls into two categories. First, what may be called the 'popular mechanics' school (e.g., Smithsons, Rogers). These designers have tended to accept the notion of minimum space standards, because to do so focuses on the need for ingenious technical solutions to achieve illusions of greater space, multi-function of rooms, freedom to alter layout, etc. Because such ideas are tied to a notion of economies of scale in production, they do not find an immediate application in the public housing field. Instead, craft-made or ad-hoc examples get built for private clients in the best traditions of Modern Architecture.

The second school is what may be called 'new society' (e.g., Hix, PSSHAK) in which the starting point is to refute the idea of minimum space. However, in the face of cost constraints, these designers are forced to look for technologies that will break the deadlock of cost/sq. ft., thereby providing the freedoms for the occupants that they seek. Aware that to invent new technical solutions is to invite a non-acceptance of the whole idea, they borrow existing technologies that can be applied with little or no modification, e.g., greenhouses, furniture systems, office building structures. However ingenious this approach, most projects become real only for clients who can choose, because the products of the borrowed technology generally don't conform to the occupants' or to bureaucracy's view of housing or home.

Another avenue of exploration has been extendability by means of 'add-around' (e.g., Richard McCormack's Huddersfield Building Society prizewinner¹), 'add-on' (e.g., Pearlman and other winners of the 1963 Daily Mail Extendable House Competition²; Fred Pooley's Mini-Houses³, the Milton Keynes extendable house, and others), and 'add-in' (e.g. Church Hill, Harefield by Hillingdon Borough Architect in which roofspace provision is made for an additional floor⁴). For housing authorities, these approaches avoid setting a dangerous precedent of building above Parker Morris areas, i.e. providing more space, and may

therefore be politically acceptable. However, they all require the full investment today, for the eventual size of the house, in terms of land, infrastructure, party wall, or structural overdesign. When tomorrow comes, there is always another use for the money and people still have the choice of moving. Karn's analysis of the work of Stone and others shows that investment in future extendability generally represents poor value for money and a lack of concern for opportunity costs.⁵ It may well be that the only politically acceptable way of raising space standards will be by a policy of under-occupancy of units built to present standards.

Appliance house

The Smithsons projects of 1958-59 were for a house based on appliance cubicles, with connections for food preparation, sanitation, communication, storage and maintenance appliances. The shells of those cubicles are the fixed structural units in the house and they would therefore define the architectural forms.⁶ The first project was designed like a car, 1; but the second, for a house in Kent, came down to earth as a real project, 2, resembling very much Prouvé's small core houses of the 1940's (see French section). The house is 34 feet square with internal space defined by bath, kitchen, cloakroom, and utility cubicles containing sliding screens. The Smithsons describe the dilemma of the 'Poular Mechanics' school eloquently:

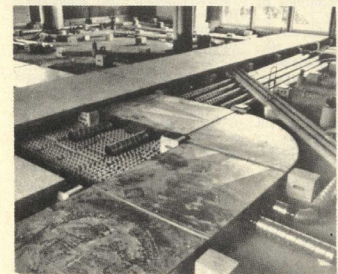
The flexibility offered by the 'stockyard-of-standard-parts' has a great intellectual appeal, but architects handling such a system appear to have had neither the self-discipline nor the 'total idea' to make anything out of the parts other than a clumsy sort of 'Meccano' toy equivalent.⁷

MHLG adaptable house

John Bartlett, under Oliver Cox, produced this design for the 1962 Ideal Home Exhibition^{8,9} to illustrate the recommendations of the Parker Morris Committee Report (1961). Aimed primarily at developers, the design showed an 'openable' ground floor as opposed to the *de rigueur* open plan, then being offered to offset tiny areas, 3.

5M flexible house MHLG

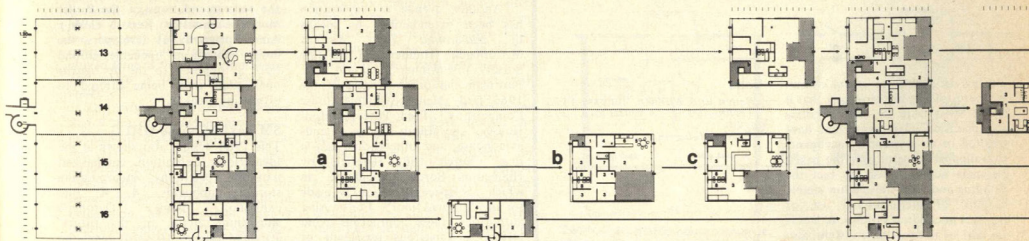
This 1964 design, also shown at the Ideal Home Exhibition, emphasized movable partitions incorporating storage cupboards, 4. At the exhibition, James Gardner's aluminium 'house of the future' attracted queues 10 yards long, the 5M house 40 yards, and the conventional bungalow 63 yards.¹⁰



1 System 4D. Services simply laid over the floor slab with a raised cavity floor which allows freedom of internal layout together with a clear legal responsibility. (*Bauen & Wohnen* 1/73)



3 System 4D. External appearance at Zug reflecting the tastes and requirements of the residents. (*B & W* 1/73)

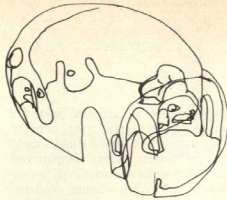


2 System 4D. Development of the plan at Zug. (*B & W* 1/73)

finished in a uniform cream colour. We were told by the company that it is the Swiss taste for crisp detailing and precision engineering that have resulted in no attempt by occupants to wallpaper or paint over the baked on matt acrylic finish. In fact the detailing and steel finish allow simple hanging of pictures and use of magnets in children's rooms. 6. Doors are part of the partition system, also steel finished, and all partitions are fixed over the floor finish. 7.

Notes

- ¹ *Bauen und Wohnen*, January 1973.
- ² *Techniques et Architecture*, 292, op. cit.
- ³ *Strafor-Hauserman Ltd.*



1, 2 The Appliance House, 1958, by A & P Smithson. (Arena 2/66)

which statistically places it neatly in the scale of aspirations.

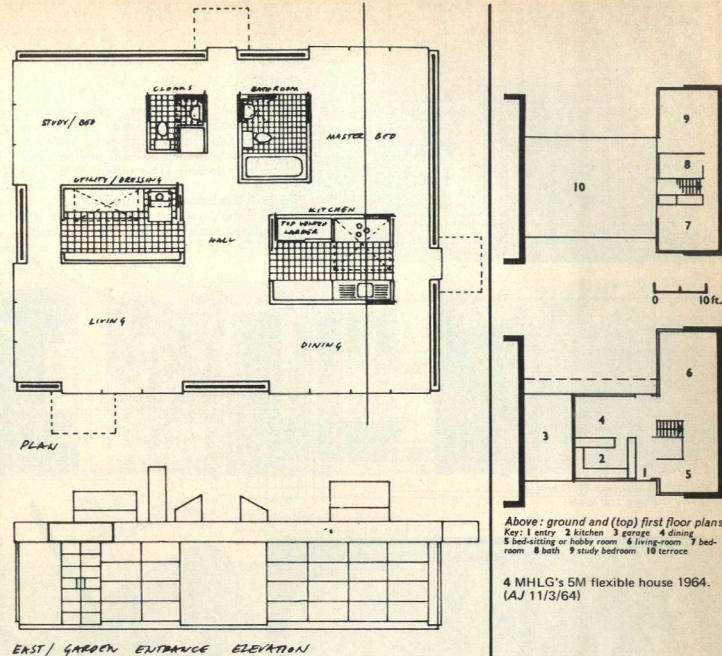
Spec housing and Alton Gardens
In 1962 Paul Ritter edited a special issue of *AD* on spec housing.¹¹ Implicit in Ritter's review was the idea that good designs and building-for-rent-or-profit are somehow incompatible. He tried to show that this need not be the case, with examples of the work of Eric Lyons, Diamond, Redfern and others – the prototypical two- and three-storey modern terrace houses. Also, Ritter saw a need for flexibility in the private sector:

*'Flexibility is one of the very best selling points. To be able to change the detail design and subdivision of houses as they are being erected without major modifications, to allow for easy extension and addition of detail within the framework of the designer's foresight, will increase the saleability of good design.'*¹²

Alton Gardens in Beckenham, built in 1966 by Galberg and Weal, answers Ritter's appeal, 5, 6. The idea of flexibility, proposed by the architects, was taken up by the developer, based on the idea of a 'home for all seasons'. There is a terrace of 13 houses, with patios giving on to communal open space. To quote from the developer's brochure:

'The living room (24 ft x 17 ft) provides space for all family activities, or may be divided by a glazed folding partition, 7. A graceful flight of stairs leads to the bedroom floor, which consists of huge spaces on either side of the two bathrooms. You have the choice of layout on this floor, so that the size and age of your family can be considered – two bedrooms large enough for four-poster beds or three or four or study and nursery. The permutations are many – even the final plan can be altered later to fit new circumstances. The space is there, the choice is yours.'

Our survey of the terrace showed that 9 out of 13 owners have made, or plan to make, modifications. In the last six years, these have included: change number of bedrooms, add library, box in stairs for more storage, rustic stone wall in living room, add shower or basin in bedroom, remove built-in wardrobes between bedrooms (width-reducing). Construction is brick crosswall with



Above: ground and (top) first floor plans
Key: 1 entry 2 kitchen 3 garage 4 dining 5 bed/sitting or lobby room 6 living-rooms 7 bedroom 8 bath 9 study bedroom 10 terrace

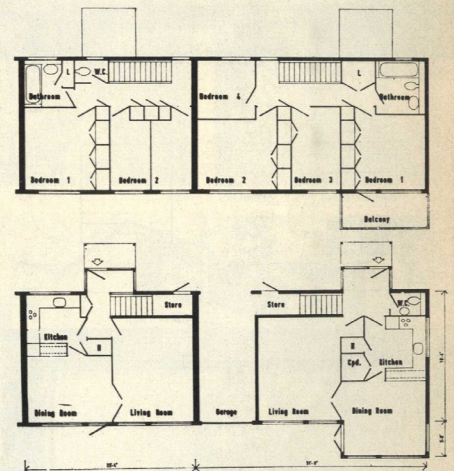
4 MHLG's 5M flexible house 1964. (AJ 11/3/64)

17 ft clearspan timber floors, single stack plumbing and plasterboard on stud partitions.

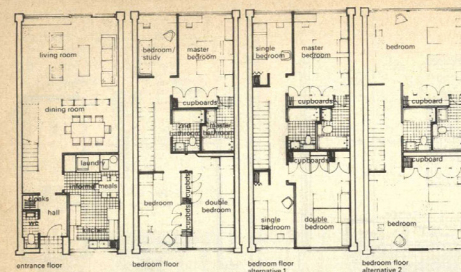
Zip-up enclosures. Spender and Rogers houses

These three projects, by Richard and Su Rogers with John Young, epitomize the 'Popular Mechanics' approach to flexibility. They are seen as prototypes for volume production aimed at an unspecified market. The zip-up house (which has not been built) is an aluminium-faced foam-sandwich tube, raised off the ground.¹³ Reminiscent of Herbert Ohl's tubular houses, the unobstructed floor plan allows alteration of the plan in a day, plumbing items over a week-end. 8. New doors and windows can be cut in with a power fretsaw. Partitions are 2 in. thick Airwall locked in place with inflatable gaskets.

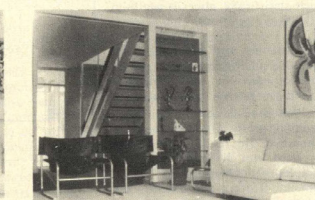
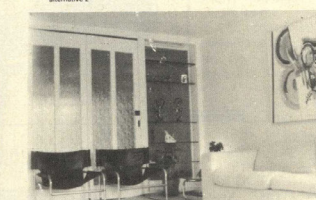
More prosaic are the Spender and Rogers houses.¹⁴ Both houses are made up of 45 ft clear span steel portal frames, to provide unobstructed space, and a tubular extendable plan form. Use of current industrial building technology and a reluctance to fall back on tried traditional detailing (e.g. cover strips, skirting, tiling, smaller windows) have led to inconveniences to the users.¹⁵



3 MHLG adaptable house shown at Ideal Home Exhibition 1962. (AD 5/62, AJ 7/3/62)



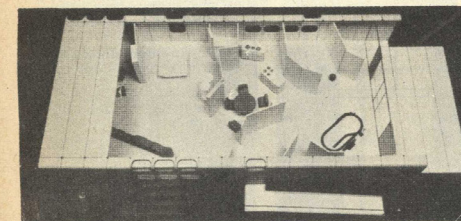
5, 6, 7 Alton Gardens, Beckenham, 1966, by Galberg and Weal.



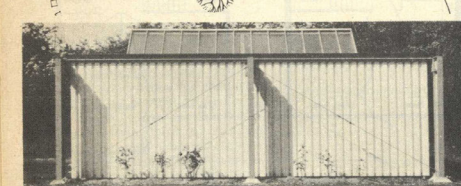
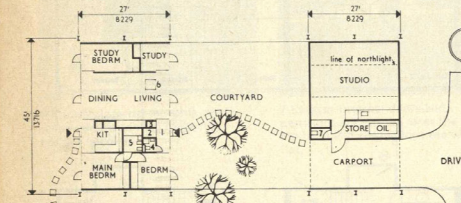
The plan forms, however, are convincingly flexible, 9, 10. As houses for private clients they are fine, but their tendentious aspirations are unlikely to be fulfilled.^{16, 17}

Maximum Space house
This development is the outcome of a live project at Cambridge University in 1969 under John Hix.¹⁸ It is a

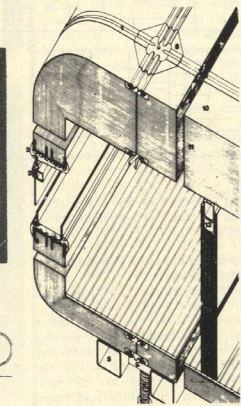
Despite obvious acoustic and fire protection difficulties, the concept was a prizewinner in the Huddersfield Building Society's ideas competition, 13. The assessors commented, 'a very thought provoking scheme, challenging in terms of finance and financing, but indicative of an approach which we think society may well have to, and should, accommodate.'²⁰ The



8 Rogers zip-up house. (AD 3/70)



9 Spender House. (AJ 6/10/71)



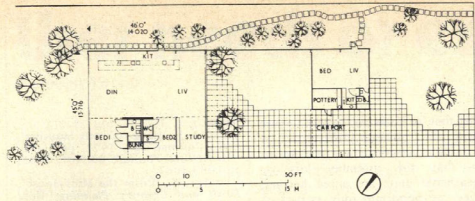
Cambridge house has been well documented, and has even made the popular press.²¹ Hix acknowledges the inspiration of a glass house prototype shown at the Copenhagen Ideal Home trade fair in 1967 by Jørgen Rasmussen,²² and the idea seems to have caught on elsewhere. Ritzen and Grundhoff have recently completed a glass house near Maastricht in Holland,²³ 13, 14.

125 Park Road

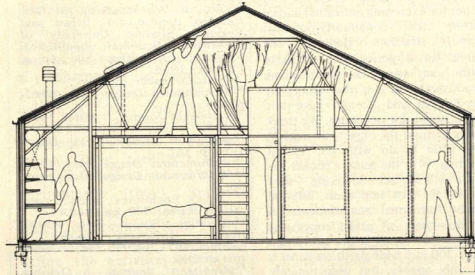
This 1970 building by Farrell and Grimshaw provides 40 co-ownership flats arranged four to a floor over 10 floors.²⁴

Flexibility of flat-mix and layout was an objective from the outset, with a concept of detachable units for service elements, storage and partitions. From the start, it was intended to use an 'office building' structural and planning concept (compare with *Système GEAI*, France), opening up the perimeter of the building as much as possible, and providing maximum floor area in each flat. Cost constraints and Housing Corporation requirements made the concept of inviting change through the use of detachable units unworkable, so the end result is an apparently conventional building which nevertheless presents a minimum of obstacles to change. This strategy has resulted in spacious flats that can be readily altered (as several have been since occupation). Equipment and finishes were basic to allow maximum area to be built, and many improvements have since been made, including communal areas (carpet in lobby, new entrance hall, etc.).

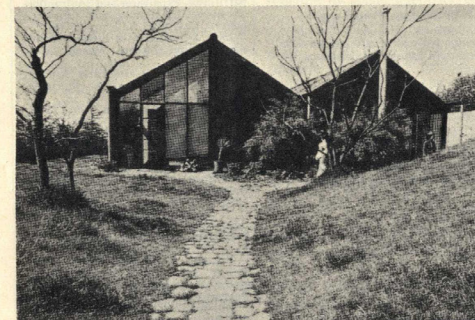
blast against minimum space standards and previous attempts at industrialization which produce what Hix calls 'industrialized cottages'.¹⁹ To achieve usable area of 2700 sq ft within prevailing cost limits applicable to conventional space standards, meant resorting to unconventional technology – a greenhouse structure, 11. Infill panels substituted insulated panels and polystyrene backed glass for plain glass, to achieve thermal control and privacy. Within the large volume, spaces are created using whatever partitioning and platform building techniques may be appropriate.



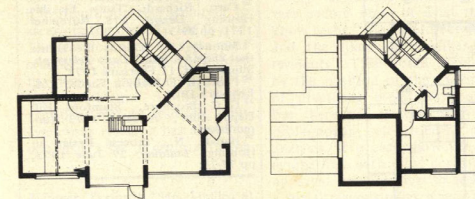
10 Rogers house. (AJ 6/10/71)



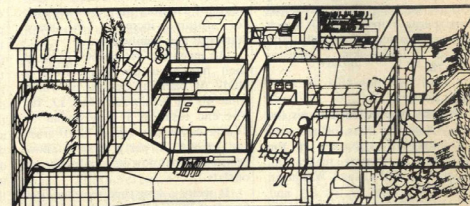
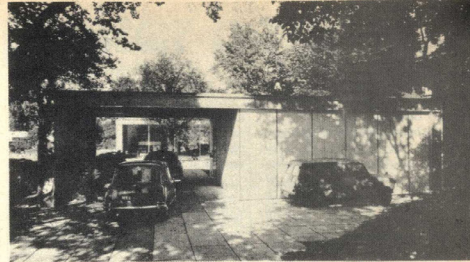
11 John Hix's maximum space house. (AAG, summer /72)



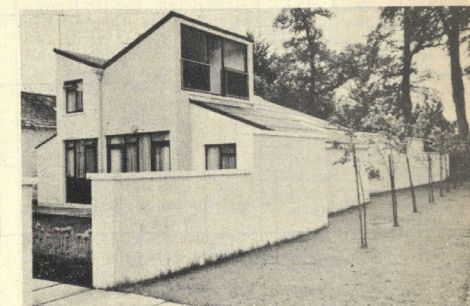
13, 14 Glass house in Holland by Ritzén and Grundhoff. (B & W 8/73)



15, 16 Low cost houses in Ireland, 1972, by Curley and Dowley. (AC70 4/73)



12 John Hix's Huddersfield competition winner. (RIBAJ 1/72)



Kilfrush, Ireland

These 1972 low-cost houses (£6500) by Curley and Dowley are very interesting in that their flexibility planning; that is, a central living area (communal) off which open other (private) activity spaces. 15. Apart from one fully enclosed upstairs bedroom, the whole house can be opened up by means of sliding partitions between living area and private spaces. Construction is 9-inch blockwork plastered internally, and insulated double-skin asbestos roof.²⁵ 16.

PSSHAK

The Primary Support Structures and Housing Assembly Kits, offspring of the thinking of Habraken in the Netherlands, is nearing realization. Originated by Hamdi and Wilkinson (see refs.²⁶⁻³⁴) while at the AA, and later taken into the GLC Architect's Department, 47 flats are finally to be

built at Stamford Hill Depot, only 12 of which will have movable partitions. Work on the project started in September 1970.

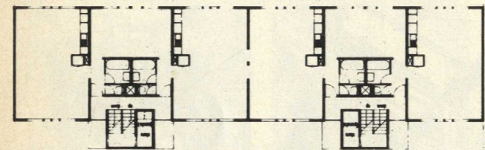
The aims of the scheme are:

1. To allow tenants to choose plan layout before moving in;
2. To allow layout to be adapted to a family's changing needs, and to subsequent tenants;
3. To provide longer term adaptation of the basic structure to different mixes of dwelling sizes thus allowing for future increases in space standards and family size.

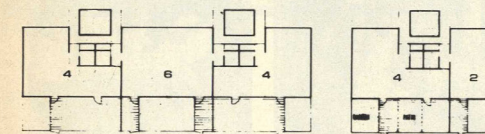
An ingenious yet simple crosswall shell has been developed from a study of planning options of which some 40 are possible in a flat. 17, 18. The end result is a plan similar to Tensta in Sweden (q.v.). 'Soft' areas are provided in party walls to allow eventual expansion or amalgamation of flats.

It seems a long time since we first heard of PSSHAK. Why should what is essentially a simple idea take such a

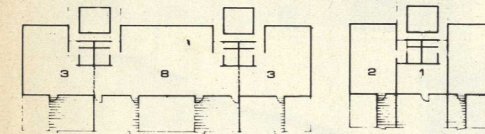
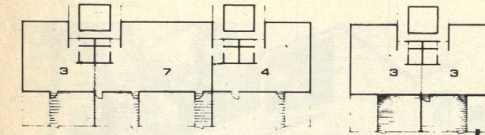
long time to come to fruition? Apart from the obvious difficulties of working in a bureaucracy, it seems to us that the assembly kits or detachable units are a red herring. They are important only as part of the 'supports' concept as a whole, as a means of providing occupants with a tool for exercising individual choice within the community-provided support structure. However, the search for a perfect kit of parts within an adaptable shell seems paradoxical, and it is interesting that the Swedes and French have not found such a kit necessary. We think this is because the objects themselves have little to do with the 'act of dwelling' - in the sense a cooker has to do with the act of cooking - they are simply not important, beyond simple functional requirements. A detailed study of grids, zones and margins may result in the conviction that a 300 mm wide partition panel is the only answer, but unfortunately wallpaper comes in 20 inch widths.



17 PSSHAK flats, Hamdi and Wilkinson and GLC. First floor plan showing basic structure and services. (Maximum capacity 4 dwellings per floor).



18 PSSHAK. Plans showing options available on dwelling size group.



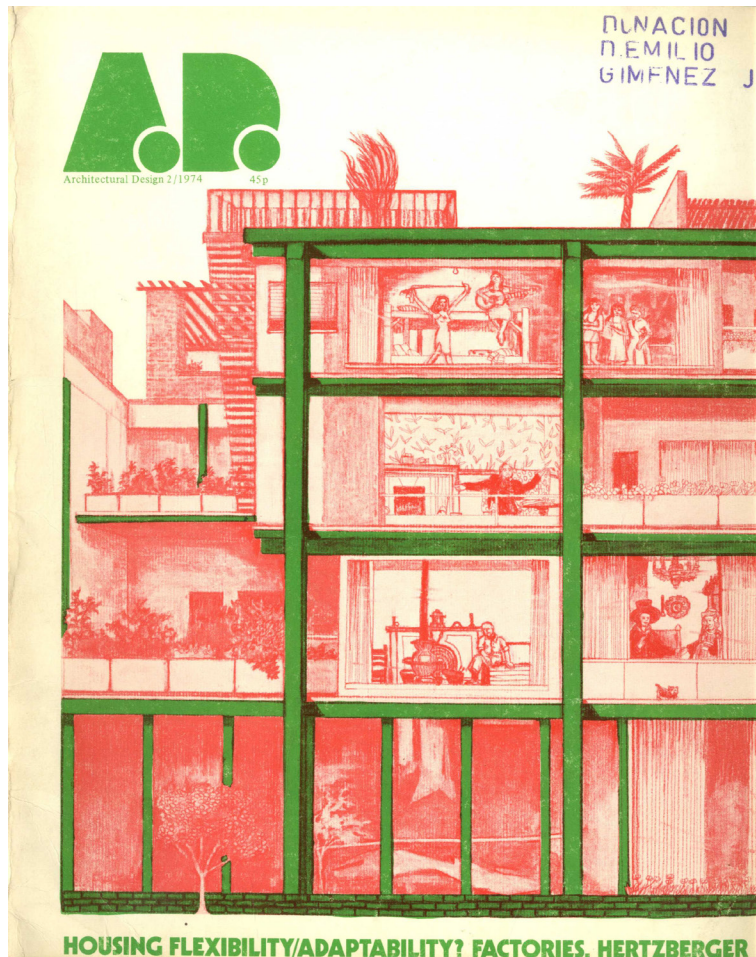
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- ¹ Byron, J., 'Happy Family Housing', *RIBA Journal*, Jan. 1972, pp 15-21.
- ² *Architects' Journal*, 20 Nov. 1963, pp 1059-1062.
- ³ Pooley, F., 'Enter the Mini-House', *Town and Country Planning*, Dec. 1970, Vol. 38, No. 11, pp 529-532.
- ⁴ *Architects' Journal*, 9 May 1973, pp 1132-1133.
- ⁵ Karn, V. A., *Standards for New Housing*, Centre for Urban and Regional Studies, University of Birmingham, first draft unpublished.
- ⁶ Baker, J., 'A Smithson File', *Arena*, February 1966.
- ⁷ Quoted in Baker, op. cit.
- ⁸ *Architectural Design*, May 1962, p. 230.
- ⁹ *Architects' Journal*, 7 March 1962, p. 498.
- ¹⁰ *Architects' Journal*, 11 March 1964, p. 562.
- ¹¹ *Architectural Design*, May 1962.
- ¹² *Architectural Design*, May 1962, op. cit.
- ¹³ 'Zip-up Enclosures', *Architectural Design*, March 1970, pp 146-147.
- ¹⁴ 'Building Stuy: Two Private Houses', *Architects' Journal*, 6 October 1971, pp 753-766, includes cost analysis.
- ¹⁵ *Architects' Journal*, 6 October 1971, op. cit.
- ¹⁶ Per una Edilizia Industrializzata', *Domus*, March 1971, pp 11-14.
- ¹⁷ Rogers, R. & S., 'Demountable partitions: expansion and contraction of house by adding and removing panels', *Casabella*, 352, pp 32-36.
- ¹⁸ Hix, J., 'Maximum Space House', *Architectural Design*, March 1970, pp 148-149.
- ¹⁹ Hix, J., 'People and Glass Houses', *Architectural Association Quarterly*, July/Sept. 1972, pp 44-50.
- ²⁰ Byron, *RIBA Journal*, Jan. 1972, op. cit.
- ²¹ 'People in Glass Houses', *Ideal Home*, November 1970, pp 49-53.
- ²² *Architectural Association Quarterly*, July/Sept. 1972, op. cit.
- ²³ Muhlestein, E., 'Im Glashaush wohnen', *Bauen & Wohnen*, August 1973, pp 310-311.
- ²⁴ '125 Park Road', *Architectural Design*, Oct. 1970.
- ²⁵ *International Asbestos-Cement Review*, AC70, April 1973, pp 16-17.
- ²⁶ Hamdi, N. and Wilkinson, N., 'Public and Private Possibilities in Housing', *Architectural Association Quarterly*, July 1970.
- ²⁷ Worthington, J., 'Breakthrough in Flexible Housing', *OAP*, August 1971, pp 595-597.
- ²⁸ Morris, A. E. J., 'A PSSHAK of One's Own', *Building*, 10 September 1971, pp 75-82.
- ²⁹ Hamdi, N., Wilkinson, N. and Evans, J., 'PSSHAK', *RIBA Journal*, October 1971, pp 434-445.
- ³⁰ Carr, Richard, 'Truly Flexible Housing', *Design*, 275, November 1971, pp 29-31.
- ³¹ Mooney, B., 'This is the House that PSSHAK Built', *Daily Telegraph*, Supplement, 11 February 1972.
- ³² PSSHAK, Exhibition Guide, ICA, February 1972.
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5. ANEJOS

5.3 Anejo 3

"Housing Flexibility Adaptability?" en Architectural design, 44, p. 76-90.



C. DE ING. ARQUITECTONICA
E.T.S.A.V.

HOUSING

flexibility/adaptability?

Andrew Rabeneck
David Sheppard
Peter Town



1 The family changing the partition layout (Tensta, Sweden).

Variety of problem statement
Architects are not necessarily the instigators of flexibility in a given project. The problem varies according to who is defining it and with local conditions. In Sweden the problems were initially shortage of skilled site labour and a saturated housing market in which the giant housing associations such as HSB needed to make an effort to attract new members. The use of moveable partitions cut down site labour and gave a marketing bonus to the developers simultaneously.

In France and Germany, on the other hand, government concern about the effect of 'tight-fit functional' planning on the rate of obsolescence of new housing has led to architectural competitions and subsidy programmes for innovative design. The solutions offered so far all take flexibility of plan layout as their basis.

Again, in the Netherlands the problem is stated differently by Habraken whose design proposals serve as illustrations to an analysis of the inadequacies of present mass housing processes. To some individual architects and social researchers the problem is seen as one of permitting personalization of the home, the guarantee of a private domain in which personal choice may be exercised. At Montereau, in France, doctors were interested in the problem of housing design to suit the varying requirements of handicapped individuals who could be cared for at home with their families for half of the cost of institutional care, if only the home could meet their special needs.

Extendable houses, the initial increment of which would be within the financial reach of first-time purchasers, has been suggested frequently in England, where rapid inflation and wide income differential put ownership beyond the reach of most.

Variety of solution statements
A general observation about the solutions being offered to the variety of problems outlined is that they all represent a form of insurance against predicted undesirable events. All entail a degree of overprovision of some feature or performance attribute of the housing, above what might be considered a 'normal' base (e.g. additional area, moveable parti-

tions). The true value derived from the investment in a particular form of overprovision must be related to the original problem statement and the aims of the person or organization making it. What is important are the opportunity costs of the investment in overprovision. For example, in extendable houses initial investment in infrastructure, bathrooms, kitchens, heating etc. is worthwhile only if the house is eventually extended. A slight easing in the housing market may well make moving a more attractive proposition than extending. Of even more doubtful value (as investment) is 'spare space' to be traded off between adjacent occupancies, as is being tried in the PSSIAK project. The probability of the conditions obtaining for transferring the use of the space from one occupant to another is infinitesimal.

Universal in the projects we have seen are moveable partitions and central heating. All other factors are variable in terms of degree of choice for the occupant and intentions of the designers. For example, in some Swedish examples the design of the shell and external wall are entirely conventional, while in some French examples these have been closely studied to provide maximum possible choice of layout. Or again, in some cases the freedom of internal layout is treated in a casual ad hoc manner, while in others elaborate sets of rules and partition systems have been developed by designers. We can assess the relative merits of these approaches only with respect to discussions with occupants of flexible homes about what they think is important.

User reactions
In the first part of this article we quoted the main conclusions of Olsson and Nilsson's study of the 1964 project at Diset, Uppsala by Axel Grape. The results of this study support the assumption that the potential adaptability provided by moveable walls and fixtures is not popular with the tenants and that the mere knowledge that the layout of the dwelling can be altered, if so desired, has a positive effect on residents' satisfaction with their accommodation.

Perianez' sociological study of Arsène-Henri's Montereau project near Paris reached similar conclusions, although he emphasizes the

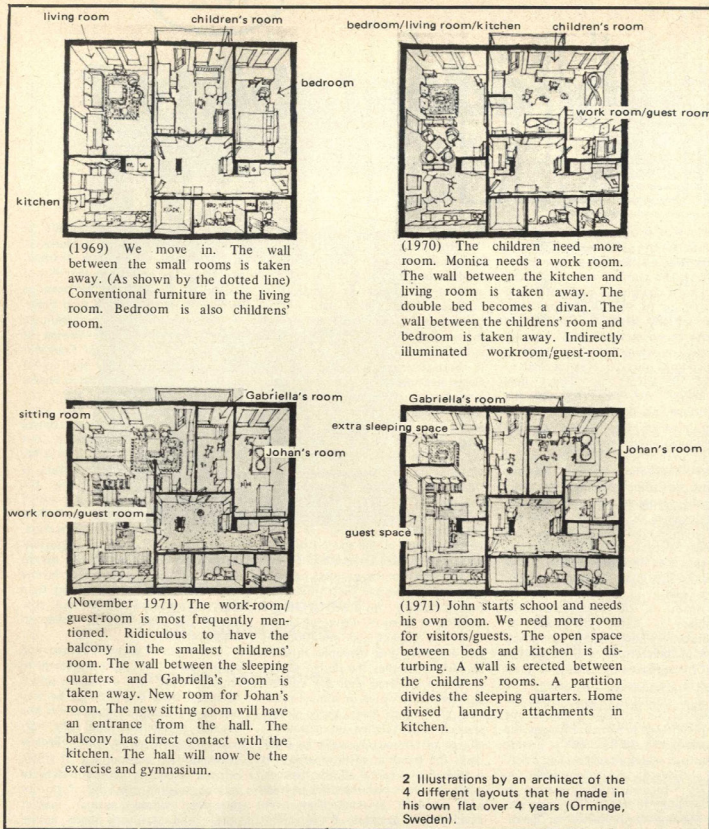
evident satisfaction of tenants at being able to satisfy aspirations, often at the expense of 'correct' planning. He points out that few of the plans chosen can be seen as variations on well known plan types.

The overwhelming impression we gained from casual interviewing of occupants in Sweden and France is that it is the knowledge that layout decisions are reversible that is important. People value most highly the opportunity to choose their own layout. Very few of them foresee altering their layout frequently, but the knowledge that this is possible with a minimum of disruption is reassuring when confronting the planning task. If a particular aspect of layout later proves inconvenient there is no penalty for modification. That this is the most important factor is borne out by the fact that in all the projects we visited several tenants were paying more rent than they could really afford but considered self-determination cheap at the price.

The sense of personal domain and privacy seem to us more important to renters than to owner-occupiers. Although their tenancy may be very secure, for example, as members of a housing association, and they may receive a dividend on their collective ownership (6 per cent p.a. at HSB), being a tenant is not equivalent to owning capital in the form of property, where normal market choice and statutory rights ensure freedoms not available to tenants.

This opinion is supported by the recent marketing history of the 'Anticonformes' flats built for sale in Paris and designed by Arsène-Henri. L'Espresso (18.11.73) reports that the developers, OCEFI, using a sales pitch based on the purchase of a shell inside which clients can plan their own flats, have sold only 9 out of 235 flats in a year. This is after thousands have visited the mock-up flat demonstrating the possibilities.

This is not to say that the freedoms of flexible layout are not worth anything to the purchaser. But his central concern is to gain the security and rights of an owner. Freedom of layout is secondary. To the renter, on the other hand, flexible layout can be important as an extension of the very limited franchise he currently holds on rented property. Through the ability to create his own environment within



(1969) We move in. The wall between the small rooms is taken away. (As shown by the dotted line) Conventional furniture in the living room. Bedroom is also children's room.

(1970) The children need more room. Monica needs a work room. The wall between the kitchen and living room is taken away. The double bed becomes a divan. The wall between the children's room and bedroom is taken away. Indirectly illuminated workroom/guest-room.

(November 1971) The work-room/guest-room is most frequently mentioned. Ridiculous to have the balcony in the smallest children's room. The wall between the sleeping quarters and Gabriella's room is taken away. New room for Johan's room. The new sitting room will have an entrance from the hall. The balcony has direct contact with the kitchen. The hall will now be the exercise and gymnasium.

(1971) John starts school and needs his own room. We need more room for visitors/guests. The open space between beds and kitchen is disturbing. A wall is erected between the children's rooms. A partition divides the sleeping quarters. Home divided laundry attachments in kitchen.

2 Illustrations by an architect of the 4 different layouts that he made in his own flat over 4 years (Orminge, Sweden).

core chipboard fixed with coverstrips). We will be taking a look at the cost implications of flexibility in a UK context later on in this article.

Role of technology

There was a startling disparity between projects planned and those already achieved. Those still on the drawing board such as the German competition entries and the work of SAR in the Netherlands tend to be pre-occupied with the technical means of providing flexibility, both in terms of planning disciplines (e.g. grids, service ducts) and of design (e.g. partition systems, storage units). In contrast, the projects already constructed display a comparative lack of concern about technology, although their designers have generally carefully considered the general design of the shell for flexibility. They tend to use whatever partitioning and storage units are readily available at appropriate prices.

This disparity reflects an important difference between pragmatic and utopian flexible housing. The pragmatists seem to argue that the basic freedoms sought by occupants can be satisfied by the present market for hardware, and that individual ingenuity and creativity will bridge the technology gap. In time as housing without fixed walls becomes the norm, the product market will respond to the particular needs of occupants. The architects involved support their argument by pointing to the growth of do-it-yourself and changes in the furniture and equipment industries towards modularity and extendable storage systems.

The utopians on the other hand seem to be concerned with perceiving the range of possibilities within the dwelling. These are generally expressed in terms of layout alternation multi-use of space, systems of storage furniture, and location of services. The range of possibilities offered generally results from opinions held about changes in family structure, 'alternative life-styles', and such like. These views generally reflect the architects' own aspirations or his desire to make a particular point, rather than being based on a fresh understanding of user expectations and aspirations.

Administration and management

Problems of management are entirely context dependent, and are generally relevant only to a renting situation. They vary according to the way units are let, and the way they are managed on a day to day basis. In Sweden, for example, tenants could generally ask for a complete re-arrangement on moving into a previously occupied unit. There was generally little or no individual architectural advice given and the actual work would be carried out by the building maintenance staff, or by the occupants themselves. Maintenance

staff usually kept a stock of spare partition panels and parts.

In France there was generally some individual architectural advice given, and any alteration work would be carried out by maintenance staff.

Overall, no one we talked to thought there was any difficulty over storing partitions and doing alteration work. All projects visited were sufficiently large to employ at least one full time maintenance (1 porter) staff.

The critical problem of administration is whether occupants should be allowed to arrange their homes in a way that could contravene building regulations, safety or health codes, etc. Who will check? Who is responsible when other tenants in the same building might be put at risk? What is a 'habitable' room?

From looking at situations where there is little control over these matters, we would say that people generally don't do silly things. Since regulations generally legislate for minima, people tend to exceed them when the choice is theirs. (Planning grids can help in this respect; for example, at Montereau the 900 mm grid relating to the external wall made up of structural mullions would not permit the creation of a room less than 1800 wide which is considered sufficient for a child's bedroom or small study.) The greatest potential dangers relate to internal rooms and circulation areas in terms of providing adequate ventilation. In Sweden, room-to-room ventilation is obligatory and is most economically achieved by leaving a 50 mm gap at the top of fanlight panels, at the expense of total loss of acoustic separation. By and large, all these problems can be overcome by straightforward advice to occupants by the housing manager.

The problem of initial occupancy is more difficult. In fact, the GLC drew attention to it at their recent housing exhibition pointing out that in the case of PSSIAK the management would have to know in advance who the occupants will be. The organizational problems of individually planning, say 100 units, and supervising the second-fixing sub-contracts on site are obviously considerable. That is to say they are considerable in terms of the effort we currently expect to make. Perhaps more effort should be made?

Time can be saved up to completion of the unsubdivided shell and be put to good use in the planning of its internal layouts. At Kalmar, in Sweden, partitions and doors take two man/days to install (1 day elapsed time). The problem is one of good management and being prepared to make an effort to help prospective occupants.

An obvious approach is to propose or even construct a variety of standard layouts among which people can choose. However, this approach can only partially speed up the total



3 The essential flexibility I: the contractor moves out leaving a single volume with independent services (Montereau, France).

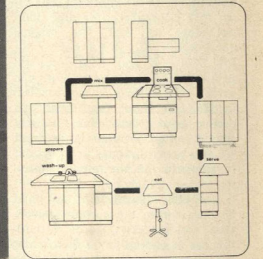


4 The essential flexibility II: the occupier now makes his choice of layout (GEA system, France).

construction period. It would be better to accept that fitting out units and moving people in takes time and to concentrate on time saving in the earlier stages of the contract, if early occupancy is a priority. In Sweden, where the short summer construction season is a factor in the choice of dry non-loadbearing partitions, a general acceleration of the contract is claimed for flexible units. A typical contract gets on site in May, is enclosed by October and finished out for letting by the following March, with landscaping completed by May.

Historical context of projects reviewed

Where do these projects fit in the development of architecture? As in the evolution of non-residential buildings, the ability to divorce the primary structure from space division is the main factor. The fact that a whole living unit can be constructed economically as a single volume obviously has a great architectural potential (2a, 2b). The other vitally important factor, that allows this potential to be realized in flexible schemes, is central heating. Within a single heated volume the disposition of spaces can become a function of personal preference subject only to the constraints imposed by the



5 An 'efficient' layout of cooking and eating.

positioning of wet services.

These freedoms are recognized up to a point in conventional housing design. For example, internal bathrooms and kitchens are now accepted thanks to mechanical ventilation. However, for the most part the planning devices made possible by such technical advances have not been used to serve a re-interpretation of the act of dwelling as a private activity. On the contrary, they have been used to help architects arrive at more 'efficient' homes (3), just as the technical possibility of deep plan offices has been used to support arguments about 'efficient' organization of business (despite the fact that no empirical evidence is offered). So technical advance in housing design presently serves to boost density, reduce frontage, minimize infrastructure costs, and so on, rather than to offer new possibilities for the occupants.

a rented area, the renter can achieve in a different way some of the freedoms normally associated with ownership.

Types of changes made

Changes made after move-in are relatively few except for those who adopt the possibility of change as a hobby (1). Apart from changes of moveable equipment and furniture, most alterations of layout are of a remedial nature; for example, altering the swing of a door or putting a folding door between kitchen and dining areas to reduce smells.

A distinguishing feature of the projects designed to be flexible is that their designers consciously anticipate change and plan for it. To do so within normal costs and other constraints further implies anticipation of limits to the order of change

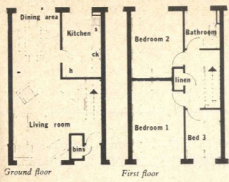
possible. This design approach is something new. Georgian and Victorian architecture, admired by architects for its adaptability, did not anticipate change, it just happens to accommodate it.

The more the response to anticipated changes is pre-engineered (intricate planning grids, kits of detachable units, crafty partition details), the more the unconventional aspects of the dwelling are apparent to the occupant. The flexibility makes itself felt, often to the point of intruding on the occupants' desires (e.g. partition cover strips interrupting wallpaper). In our opinion, the most successful projects were those in which there was no external sign that the units were unconventional in any way, where the least fuss is made about expressing flexibility.

Costs

As we mentioned above, any approach to flexibility represents an investment in overprovision of some feature or performance attribute of the home. The value of the investment depends on the objectives of the instigator, and on the opportunity costs of not achieving them.

It is remarkable that the projects visited in Sweden and France were all constructed within local yardsticks for housing association and public housing. The distribution of costs, however, was generally unconventional. In Sweden moveable partitions were installed at the expense of poor finishes and sloppy electrical distribution. In France on the other hand, the investment was generally in longer spans and high performance party walls, the partitions being the cheapest available (veneered hollow



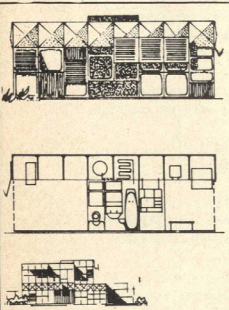
Ground floor

First floor



New houses built for sale by local authority at Bromley

2 Bromley Council houses designed to sub-Parker Morris standards, 1973.



Project of Architect Georg Emmerich, Paris.

It is based on a U shaped element, two of which are joined back to back. Between the two elements is room for conduits. By making the two cells into one, a very firm core is obtained, in which are the wet cells - kitchen, bathroom.

The floors are made of series of ± 1.40 m high elements of folded steel-plate, according to the method explained earlier in the chapter about construction. In this way a free cantilevering plane of 3½ or 4 m, total area about 65 m²·8 x 5 modules, is obtained around the firm core. There are different ways in which this space can be made into rooms to live in.

3 A crafty example of the 'popular mechanics' approach to housing design.

The most intensive use that can be made of it is worked out by Emmerich. His design strongly suggests the Japanese way of living. The day and night functions are realised in the same space by switching all the furniture. To this purpose the space in the construction-frame is made into a kind of attic which stores or supplies all the required furniture by means of some mechanical device.

The stairs are constructed outside the block or in-between several blocks. By joining these building blocks in series, very interesting terraced buildings can be obtained. The total weight of the construction is very low. Forum 4/64

Design priorities

We are looking for approaches to housing design that can cope with both *social obsolescence* and *technological obsolescence*.¹

Social obsolescence is very difficult to predict: social political and economic change will create a situation in which an object is no longer valued as most appropriate for its particular function. The most we can do is to imagine the range of things people might wish to do within the living unit.

Technological obsolescence, as well as relating to the inability of individual objects or subsystems to provide the desired performance, relates to the degree of interdependence between subsystems, the extent to which obsolescence can be 'contagious' (e.g. coal fires with chimneys built into structure, conduit inside walls, built in furniture of all types).

The physical changes people might wish to make to their homes are, for practical purposes, finite. They are circumscribed by social and cultural convention, housing technology and by the marketing efforts of the furnishing and home improvements industries. The reasons for

initiating change, on the other hand, are personal. It is dangerous to generalize about these reasons or to suggest a causal relationship between them and their actual physical result.

However, at a particular point in time, there may be a wide variety of possible reasons why a household feels the desire to perform some physical alteration to its home. The nature of these desires or their frequency of occurrence for a given section of the population are not known to us; we can only guess, although they could probably be revealed through social research.

This list of desires can be added to, and changes they entail can be elaborated, but as it stands the list covers the majority of contingencies. Taking this list and our study of both traditional and modern forms of housing that are "flexible" or "adaptable" (whether by "accident" or by design), we propose the following basic design requirements for housing. These requirements are made without reference to any particular form of housing (individual house, flats) or to any particular technical solution (demountable partitions).

Desire: to accommodate or to signify a change in family make up or family activities

- Changes:**
- increase or decrease number of bedrooms
 - set aside for study, home business, hobbies
 - accommodate possessions related to family change accumulated over time (e.g. high chairs, prams, files, granny's furniture)

Desire: to improve the quality of the home with respect to social or market criteria

- Changes:**
- replacement and/or addition to kitchen and bathroom fittings and furniture (e.g. bidets, coloured suites, fitted kitchens)
 - provision for new equipment such as freezers, washing machines, washing-up machines, dryers. Creation of utility room
 - add more bathrooms or lavatories
 - provision of additional clothes, books, equipment storage. Creation of box room
 - add garage, carport, conservatory
 - add central heating, air conditioning, insulation

Desire: rearrangement of subdivision

- Changes:**
- alter relationships between kitchen, dining and living spaces by closing off or opening up
 - create separate children's living room
 - alter partitions to gain advantage of orientation

- alter relationships between kitchen, dining and living spaces by closing off or opening up
- create separate children's living room
- alter partitions to gain advantage of orientation

Desire: re-zone the home on a basis of formal/informal, children/adult, day/night, noisy/quiet, etc.

- Changes:**
- re-allocate functions within existing spaces
 - alter partition layout
 - modify properties of existing subdivision (e.g. solid core doors, double partitions)

Desire: to be different, to conform, to keep up with Jones

- Changes:**
- re-allocate functions to spaces
 - alter partition layout
 - up-grade fixtures, fittings, decoration
 - up-grade services
 - accommodate new equipment
 - modify openings between spaces, enlarge, reduce
 - add more floor space by add-on or add-in
 - add non-living functions, e.g. garage, external storage, green-houses.

Housing unit design requirements

1. Rooms and spaces within the unit should as far as possible, avoid extremes of size.
2. Rooms should be 'neutral' in terms of form (i.e. simple volumes).
3. Doors and windows should be placed as far as possible to allow a variety of uses to be made of the room.
4. Avoid central lights and other space-making constraints.
5. Avoid expression of room functions in external walling, such as extreme variations of window size, balconies to 'living' room only.
6. Plan form should allow many different allocations of functions to rooms, and variety of zoning possibilities.
7. Either a utility room should be provided or kitchens and bathrooms should be large enough to house domestic equipment and appliances.
8. Service systems should be integrated from the basic building fabric as far as possible and should be readily accessible.
9. No equipment, storage or furniture should be built into the fabric of the building although they may be supplied as part of the building contract.
10. Plan form should allow a variety of possible interconnections between rooms.
11. The circulation space within the unit should be treated as far as possible as a room between rooms and not as an access link only.
12. A 'spare' room should be provided if at all possible, for use as second living room, guest room, study, hobbies, office, nursery, etc.
13. Form of construction should emphasize minimum alteration costs.
14. A wide range of alternative uses of space must be possible at a minimum cost.

These requirements can be satisfied, to a greater or lesser extent, in a number of different ways. We are not too concerned about how they are satisfied, but we think they should be if a resilient housing stock, which is resistant to technological and social obsolescence, is to be created in the future.

Obviously different costs will attach to different design solutions. On the next page we are showing the relative costs of the five solution types which are currently popular and which the flexible solutions discussed in the last article form two of the types, and a table showing the alternative uses to which the money invested in them might be put. The other types discussed are add-on, add-in and 'adaptable' solutions, after the following brief discussion on costs.

Cost choices

It is dangerous to advocate a particular distribution of costs in isolation at a point in time. The best use of money in a particular context depends on many factors, some outside the architects' control. To illustrate the sort of trade-offs to be made we have hypothesized five fairly distinct paradigms for meeting the objectives set out above. The costs attaching to the features of each approach are given as percentages of total initial construction cost. The percentages represent overcosts on average percentage element costs analysed for 25 housing projects built between 1968-1971, both public and private, reflecting the national mix of housing types constructed.

We then analyse the distribution of percentage overcosts necessary to achieve each of the five different models.

As a comparison we include a list of additional facilities which could be provided for an additional expenditure of about 5 per cent on a low cost dwelling as prepared by P. Stone in 1964.²

We conclude that most of the design requirements listed above could be satisfied by the add-on, add-in and adaptable solutions for a lower capital cost than that of the flexible solutions. Add-on and add-in solutions are appealing but their application is relatively limited due to their requirement for additional finance at a later date. Also the occupant receives no direct benefit for the additional capital outlay until the extensions are made.

In terms of 'value for money', adaptable solutions with increased space standards are the only real safeguard for the future housing stock. Trade-offs between space standards and technological gadgets seem to us a dangerous approach. Whilst the reduction in area may be tolerable in the short term, its effects become more pronounced as the occupants' standard of living and aspirations increase over the years.

Additional Facilities for a Low Cost Dwelling which could be Provided for Additional Expenditure of About 5% Each.
P. Stone (1964)

Size and Type

- 1) Additional floor space of 6 to 7 per cent
- 2) Semi-detached instead of terrace
- 3) Detached instead of semi-detached
- 4) Spacious balcony or small sun room

Services

- 5) Whole-house instead of partial heating
- 6) Additional toilet room with WC and basin
- 7) Shower Closet
- 8) Central vacuum cleaning
- 9) Water borne waste disposal

Insulation

- 10) High standard of thermal insulation
- 11) Improved standard of sound insulation

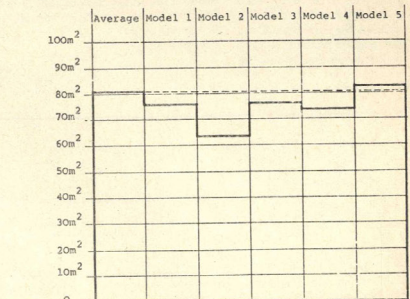
Internal Fittings

- 12) Oak instead of deal internal and external doors
- 13) Oak instead of deal staircase
- 14) Polished hardwood floors instead of thermoplastic tile and deal
- 15) Generous use of wall tiling, plastic or hardwood panels
- 16) Large amount of built-in cupboards
- *17) Demountable partitions instead of blockwork

External Features

- 18) Good quality facing bricks instead of flettons on external walls or high class dry finish
- 19) Screen walls around garden instead of chain link fencing

*Item added by Authors

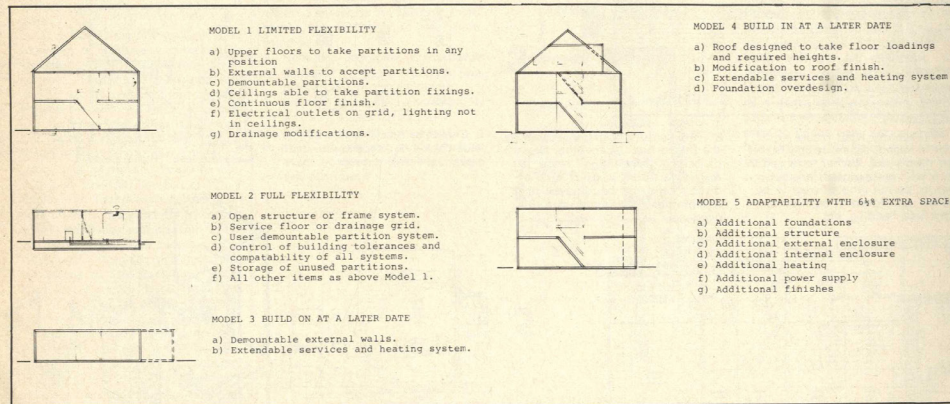


Area possible for a given capital cost facing page (5-person Parker Morris flat) for each of the five models shown on

¹ Categories suggested by John Turner in 'Planning for Obsolescence', *Architects Journal* 18th October 1967.

² P. Stone, *Urban Development in Britain. Standards, Costs and Resources, 1964-2004*, NIESR, Cambridge University Press 1970.

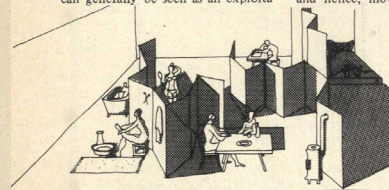
	COMPONENT COSTS	SITE COSTS	Average	Model 1	Model 2	Model 3	Model 4	Model 5
			%	%	%	%	%	
BELOW GRD FLOOR STRUCTURE	9.33						+1.00%	+ .65%
Frame	28.18							+1.60%
Upper Floors	5.00			+3.00%				
Roof	6.00		+2.00%	+2.00%				
Ext. Walls	6.00					+6.00%		
Int. Walls	8.00		+1.00%	+1.00%				
Stairs	1.21				+3.00%			
1.87								
EXT. ENCLOSURE	7.23							+ .70%
Non Bearing Walls	1.08							
Windows	4.59				+ .50%			
Doors	1.14							
Rooflights	.42							
INT. ENCLOSURE	5.12							+ .50%
Partitions	2.94		+4.00%	+8.00%				
Doors	2.18							
WET SERVICES	6.49							
Waste, Soil								
Cold Water	3.93			+3.00%				
Hot Water								
Drainage	2.57		+1.00%	+1.00%				
HEATING & VENTILATION	5.89							
Heating	5.56				+ .50%	+ .50%	+ .35%	
Ventilation	.33							
POWER	4.43							
Electricity	4.22		+ .50%	+ .50%	+ .50%	+ .50%	+ .25%	
Gas	.21							
FINISHES	11.50							+ .75%
Wall	3.26							
Floor	3.35		+ .50%	+ .50%				
Ceiling	1.67		+1.00%	+2.00%				
Decoration	3.32							
FITTINGS	7.32							
Ironmongery	.76							
Sanitary	2.06							
Carpentry	4.50							
2.73								
2.73			+5.00%					
OTHER	10.68							
Special Items	1.08							
PRELIM. & INS.								
CONTINGENCES								
			100.00%	110.00%	126.00%	104.50%	108.00%	105.00%



Flexible

This method of avoiding or delaying obsolescence is based on principles of construction and services distribution, rather than on planning and layout. It is the approach used in most of the projects reviewed in the last article.

Since the beginning of this century, proposals for flexible housing can generally be seen as an exploita-



1. Candilis' cartoon of a flexible home.

tion of a rapidly proliferating construction technology. Beyond technologies developed especially for building, architects have been fascinated by those of ships, aeroplanes, pullman sleeping cars, and latterly space flight, seeing in them metaphors for a machine age which they have sought to express in building terms.

Unfortunately, the machinery admired is of the steam age rather than the space age - it must move - and the preoccupation of architects has been with what Giedion calls "convertibility" - of one object into another - by mechanical means. We think it has been this interest that has

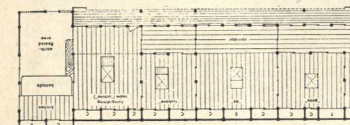
led architects to propose "moving the walls about" as an appropriate response to rapid social change. This in turn has led to the invention of partition systems, megastructures, heart units and other devices, many of which share the quaintness and instant obsolescence of 19th Century patent furniture.

More serious is the way in which the preoccupation with "flexible" dwelling is treated as a substitute for thinking about what home life might become. Also, minimum space standards are seldom challenged by flexible schemes, since lack of space emphasizes the need for "flexibility" and hence, moveable partitions etc.

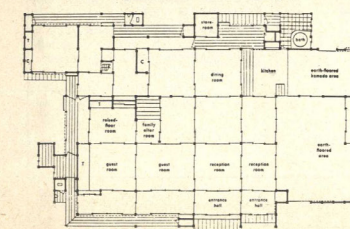
The basic components of flexible schemes are:

- non-loadbearing internal subdivision;
- central heating;
- "long"-span structure of shell;
- pre-planned relationship between basic space and services, wet and electrical;
- choice (sometimes) of external wall infill.

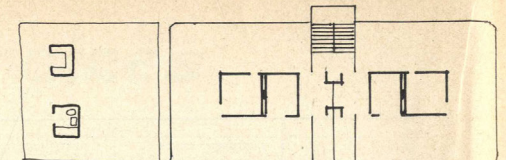
Of course, for each of these components different approaches can be used. Partitions, for example, could range from about £1.00/m² for Stramit to £15.00/m² for steel-faced office type, with blockwork or Paramount falling somewhere in between.



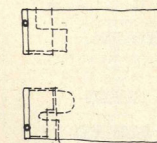
7. 19th century Nasu House on Kyushu Island, Japan. It consists of four rooms plus kitchen arranged in a row with sliding partitions between to permit whole house to be opened up. Closets at back of each room hold bedding, etc.



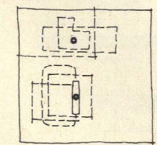
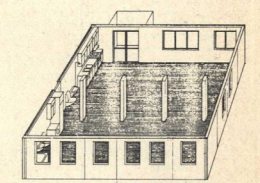
8. 19th century Nagatomi House by the Inland Sea, Japan. Note absence of internal "circulation" space. All fusuma partitions in guest suite of three rooms may be removed to accommodate parties of up to 30 people.



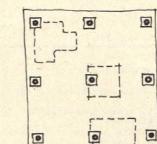
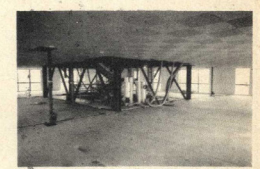
2. Core type: alteration of kitchen and bathroom is difficult and access predetermined.



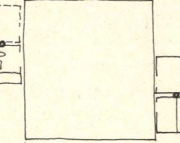
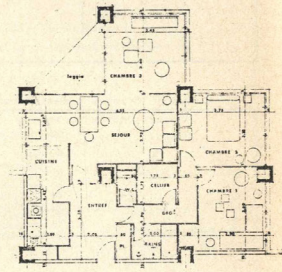
3. Fixed Wet Wall: offers wider choice of kitchen and bathroom design and relationships to adjacent spaces.



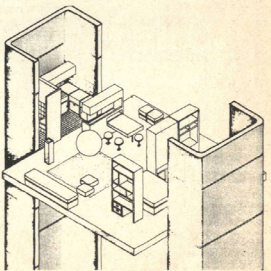
4. Fixed Stack: wide choice of kitchen and bathroom layout.



5. Choice of Stack: offers very wide choice but depends on duplicating expensive services.



6. External Core Type: characteristics combine those of 5 and 6 above but access is limited.



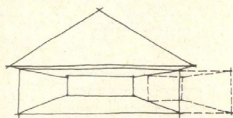
Each approach will have an effect on life costs, and the best buy will depend on frequency of change anticipated and many other factors besides.

The success of flexible projects in forestalling technical and social obsolescence is, we suggest, largely a matter of chance. The traditional design task consists of reducing uncertainty to calculable risk, while the architect of a flexible scheme is consciously admitting permanent uncertainty about some aspects of design, allowing for change and variety of use. At the same time, he must choose the hardware today for tomorrow and convince his client of the choice. Often this choice, which cannot be more than a guess, involves higher investment in a particular subsystem (e.g. structure, external wall, partitions) that he would ordinarily make. Because of this we propose that, as a general rule, subsystem choices should be as technically simple as possible, based on the long term availability of commodity materials rather than on sophisticated manufactured products. Based on a minimum regret criterion, we are saying go for long-term "kleenex" subsystems where possible, for example, a low cost monobloc partition that can be cut up, decorated and modified at will but which is as independent of other subsystems (fixings, electrical distribution) as possible.

The same principle of choice applies, we think, to the use of grids, zones, margins, and other planning rules which might inhibit future choices of hardware. These may be legitimate as design aids for developing a shell or helping a tenant plan his apartment, but they should not become permanent in the end result, for example, as a datum for electrical distribution built into permanent walls.

It is interesting that we don't find examples of traditional or vernacular flexible housing in the western architectural tradition. This is probably due in part to technical and climatic reasons but also, we think, to culturally preferred plan forms which have not needed flexibility (see "Adaptability"). In Japan, however, there are many plan types that could be described as flexible. The Nasu house 1 on Kyushu Island for example, consists of three multi-functional rooms, plus living/dining and kitchen, which can be interconnected in a variety of ways both internally and externally, by means of fusuma sliding doors providing openings of between 2.0m and 3.0m. The key to the flexibility of these houses is that there is no "circulation" space as we understand it; connections are made between rooms, each room is an antechamber to another and names can be given to rooms based on the uses to which they are put at a given time of day. The effect is heightened by the generally similar treatment of each room in terms of display and concealment of possessions.

Add on

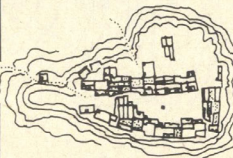


Add-on has always existed as an expedient approach to making more space available without having to move. To a certain extent, it is the mechanism that has created our townscape. In the past it was normally possible to add-on or extend a building as requirements dictated, because of a greater availability of land, lack of development controls and regulations, and universally accepted and understood forms of construction.

Now that we are strapped in by constraints and confused by construction, add-on has assumed a somewhat different form. In a tight-money situation, it is seen as a device for making home-ownership accessible to those of limited means. Essentially land, infrastructure, kitchens, bathrooms and basic services are paid for in the first increment of an extendable house, making it relatively expensive in cost/area terms. The value of the initial investment is realized only when the house is extended.

The fundamental problem is that, while an extendable house promises additional space as a family expands, and a young couple may be able to afford a mortgage on the first increment, they are likely to want more space when:

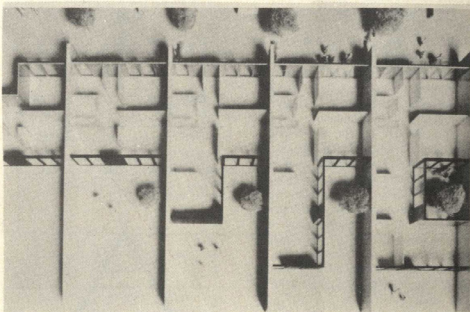
1. there is a maximum of alternative demands on their resources (e.g. feeding and clothing children);
2. interest rates have increased or lending policies have altered;
3. building costs have escalated;
4. they are already committed to other borrowings (first mortgage, car, furniture).



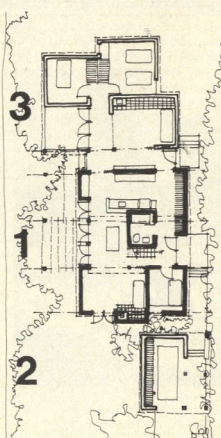
2. Shupolovi Hopi village, Arizona: add-on as a means of creating symbolic and practical townscape.



3. Typical commercial home extension by Blacknall 2000: similar projects could be simply planned to allow for rights of adjoining owners.



4. Milton Keynes project for extendable houses at Simpson: initial over-provision in party wall and demountable external infill wall. Floor/wall ratio stays the same as house grows.

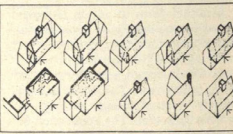


5. Three stage low-cost private house for young family by David Sheppard: building periods 1965, 1967, 1969. Add-on continues to be a real possibility for the individual owner/builder.

The combination of any of these factors may put extension out of reach, and the family would be left with too little space or needing to move.

The extension of the single-storey terrace house has been a popular idea recently. But in terms of construction costs, it entails such over-provision as cavity brickwork garden party walls and even demountable external walls. It is salutary that at Milton Keynes' Tinker's Bridge project, the brick garden walls that were to allow extension were cut out on cost grounds and replaced with softwood fencing.

The uncertainty about future extension (although new forms of mortgage could easily be designed to ensure it) suggests that mini-homes are probably a bad buy in the long-term and respond only to present financial and market conditions which may change. We would suggest, therefore, that single storey add-on potential is best achieved through limited constructional over-provision; for example, a long steel boot-lintel could be built into the back wall of an otherwise conventional house and additional ground slab area could be laid for use as a patio until extension. Beyond such simple measures, add-on would seem to be too risky a strategy for all but Housing Societies and custom-built homes, which have long term control over their housing.



6. The "right" way to do add-on without offending existing buildings, according to *Conservation in Essex No.4—Historic Buildings*, see "Let Me Hold Your Hand" in *Built Environment*, Dec 1973.

Add in

By 'add-in' we mean the gain of useable floor space without actually increasing the ground area occupied by the house.

This approach has some advantages over add-on. Most important is that the infrastructure and land costs are written down within the initial investment, and the 'envelope' of the house is built to suit the eventual density of the area.

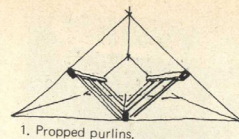
The most usual form of add-in is loft conversion. The feasibility depends on a degree of redundancy of both space and structure within the roofspace, as is commonly found in traditional house forms up until 1945 (which have made up the market of the loft conversion industry).

The advent of the close-spaced TDA roof truss and the effects of cost yardsticks have tended to eliminate such redundancy in more modern housing. Where steep-pitch roof forms are adopted that would admit extension, it is often because roof construction tends to be cheaper than exterior wall construction, or because steep roof or all-roof houses give a lower external surface area to floor area ratio than vertical wall houses. Cresswell has recently studied the economic benefits of all-roof houses, and discusses an example near Paris in which the upper level is treated as "spare space".¹ Hillingdon Borough Architects' Department's scheme for Churchill, Harefield is the only consciously planned add-in scheme we know. Because extension in the roof space is considered "permitted development", the density of the scheme can legitimately be boosted from 176 beds/hectare (73 beds/acre) to 207 beds/hectare (84 beds/acre). Constructional over-provision takes the form of a large roof of about 40° pitch with oversized ceiling joists and pre-trimmed staircase, dormer and roof-light openings.

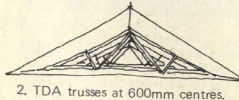
In Holland where roofspace extension is popular, Stramit have responded with a specially designed rafterless roofspace for use between crosswalls.

It may well be that the current "cottage architecture" movement will make add-in an increasingly accepted form of redundancy, even within present constraints.

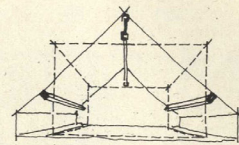
Another form of add-in is represented by the maximum space house. The search for cheap enclosure of space has led to lightweight structures which cannot generally support other subsystems. The home is built entirely free-standing within a weathertight shell. The application of this form of add-in is limited since it depends on the borrowed technology of glass houses, but it could become an important housing alternative if an appropriate purpose-designed structural envelope were developed.



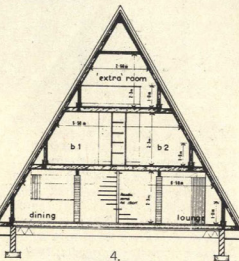
1. Propped purlins.



2. TDA trusses at 600mm centres.



3. Dutch solution aims to recapture lost roof space in a steep pitch by means of long-span Stramit insulation.

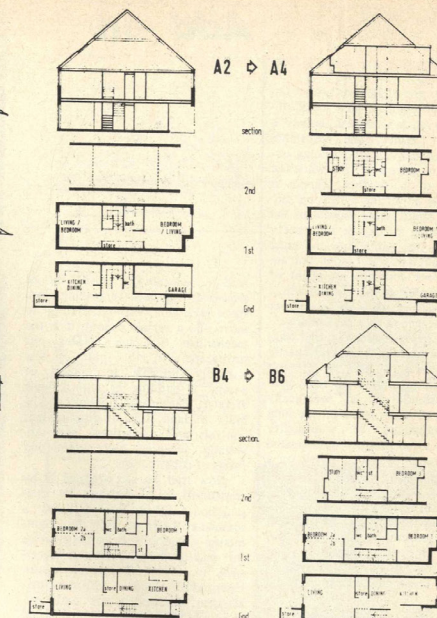


4.



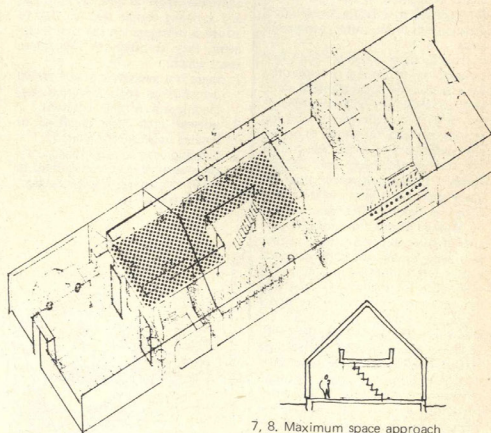
5. Conventional hard to use space may well suit some life styles: Michael Wolff's one room flat.

¹ Cresswell P: "Churchill Housing Cost Study", *Building*, 19 Oct. 1973.



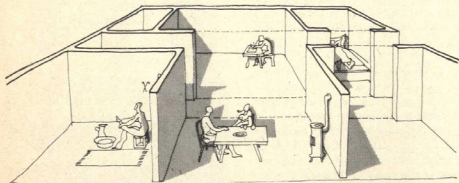
6. Low external surface/floor area ratio permits extra space at outset at the cost of unconventional form:

Alan Burden's Huddersfield Building Society Competition entry.



7. Maximum space approach entails free-standing add-in that is not dependent on envelope.

Adaptable



The adaptable approach, in contrast to the flexible, emphasizes planning and layout rather than constructional technique and services distribution. It is based on carefully considered variations in room sizes, relationship between rooms, slightly generous useable floor area, generous openings between spaces and little overt expression of room function.

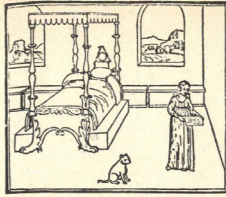
The adaptable approach is our own proposal in response to the projects we have been studying, our convictions about the shortcomings of the housing currently being built, and the objectives we have listed. Our main contention is that the "functionalist", or "management science" approach to house design is both insufficient and unnecessarily constraining. It is an approach that proceeds by the definition of need and the subsequent definition of sufficient solutions in terms of current technology and marketing. Examples of this thinking are *Space in the Home*, the more recent DoE guide to the design of kitchens and bathrooms, and other Design Bulletins. Living spaces are defined *faute de mieux* by the space required to lay out popular and currently available furniture, and the results are what has been characterized as 'tight-fit functional' design. The shortcomings of this type of design have been pointed out by many people with different axes to grind. We think, however, an important fact is generally ignored: our relatively recently acquired fluency in a wide variety of housebuilding technologies has effectively released us from many design habits derived from a building vernacular which developed over a long period of time to cope with exogenous variables of culture, con-

vention, climate, topography, etc. In building terms the responses to these variables used to be conventionalized as "the way things are done", to the extent that the contract documents for a speculative Victorian terrace house could consist of two pages of specification, sketches of typical plan, section and elevation, giving key dimensions only. The results of this process have survived well: the houses are still practical and sound. They can generally accommodate widely differing "functions", and may be economically adapted.

Because many of the exogenous design variables no longer need be treated according to tradition, many of the design habits to which they gave rise have vanished. Functionalist design is an attempt to create new design habits based on an artificial 'understanding' of occupants' behaviour acquired through social science. Whatever forms of housing emerge from this process can be built because, thanks to an over-rich choice of building technologies, we are able to ignore those variables that until recently governed man's relationship to his dwelling.

Zealous functionalists used to say, "For centuries man has had to adapt to his dwellings. We are going to change all that. From now on dwellings will adapt to man because we have the technical means to make it so." We are challenging the interpretations of this contention, that have led to 'flexibility', 'responsive environments', 'minimum livingry', although many of our own tenets resemble those underlying these ideas.

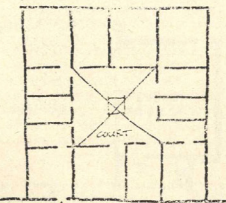
We have arrived at our particular view by trying to decide what traditional ideas about housing design



2. Two woodcuts from Francesco Colonna: "Hypertomachia", Venice 1493. "The main furniture consists of standard chests set end to end along the walls. The atmosphere is monastic in its simplicity. The pur-



pose of each room is apparent in its furniture—the bed with its platform-like chests; the table near the wall with a portable desk on which Polyphilo writes." (Giedion)

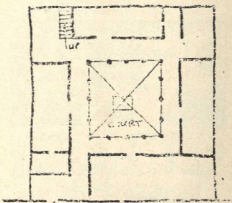


3. Egyptian courtyard house. (Rapoport)

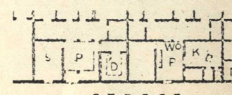
have been unjustifiably abandoned and what modern ideas are really valid. Our architectural philosophy has evolved in a true spirit of eclecticism, an approach advocated by Peter Collins.

Our eclectic concept of an adaptable home is one in which there is a conscious avoidance of a stereotype of the occupants, whether it be that of a speculative builder or a social psychologist. Our slogan for the design of adaptable homes is *occupant choice through ambiguity*. Basically, the unit is designed in such a way that there is a minimum pre-determination of the patterns of use to which it will be put. Layout is designed to allow as wide a range of interpretations as possible. There is a minimum of design features that would inhibit particular choices of use. The decisions rest with the occupant. In short, adaptable homes satisfy the design requirements set out earlier. Many forms are appropriate for what we understand as adaptable housing. The historical forms that serve as models for our concept of adaptability are:

- The Mediterranean and Mesopotamian hot-climate courtyard houses, in which the open courtyard serves as a general living/circulation area surrounded by rooms reached from it.
- The northern counterpart of the courtyard house based on a large enclosed hall surrounded by small rooms, originally within the massive thickness of the walls.
- The meeting of North and South in the sublime villas of Palladio with their domed halls and clear



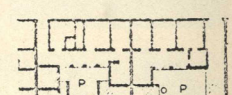
4. Moroccan house ground floor. (Rapoport) In Morocco two and three floor houses often have roofed courtyards.



7. Comlongen Castle Dumfriesshire: classic northern "courtyard" home with massive walls countering thrust of hall roof.



8. Palladio's Villa Capra: marriage of northern and southern prototypes. Note clear hierarchy of space sizes.



9. Behrens' summer villa of 1904 is at the apotheosis of ingle-nook planning.



11. Loos' Kuhner Villa of 1931 expresses all the lessons of Baillie-Scott, with secondary living rooms

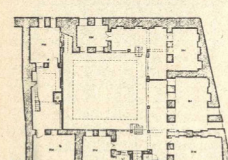


14. Ursula and George Bowyer: 2 houses at Blackheath in conventional modern idiom. Sliding doors flanking stairs provides ambiguity and choice in patterns of use.



15. BBPR Via Alcuno Milan 1947-50. Rooms are generously sized and of similar proportions. Functions could be chosen to suit by tenants.

- The English speculative housing of the 18th and 19th centuries.
- Some of the work of late 19th and early 20th century architects, particularly Behrens, Loos, and Baillie-Scott.
- Housing where "the user is in control", as in South American *Barriadas* and even in the *Bidonvilles* of Nanterre, where choices are made unself-consciously and which embody many of the features we advocate for adaptable housing.



6. Iraq: classic Mesopotamian single storey courtyard house. Court is sunken half a level.



10. White Cottage, Harrow. Baillie-Scott, 1908.



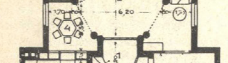
off 2-storey hall with fireplace, and gallery access above to bedrooms.



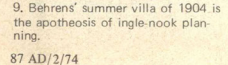
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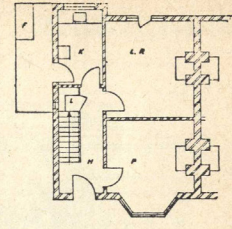


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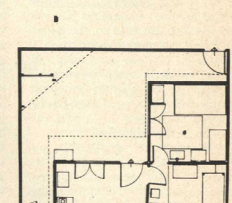
hierarchy of surrounding spaces. defined by the presence of particular items of, moveable furniture, plus storage units of one kind or another³. We consider this an intrinsic feature of adaptability. Function should not be pre-determined by built-in furniture.

In practical terms, we believe that adaptable housing could be built very nearly within existing area standards, although a 10% increase in net area (i.e. about 6% cost increase) would provide the additional 'slack' we believe to be necessary to accommodate real variety of use. In terms of costs, adaptable units should be relatively economical, because of their simple plan forms, regular structure and external walling. They

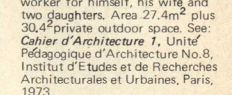
are very much what Venturi calls "decorated sheds" as, incidentally, have been most past forms of housing now admired. It is instructive to compare the "interesting" formalism of Darbourne and Dark's Lillington Street housing (particularly phase 1) with the decorated shed facades of the 19th Century stucco speculative housing over the road. Of all the concepts of housing design we have been discussing, we think the adaptable house as we have defined it holds out the greatest hope for the creation of a resilient housing stock in the future. Illustrations of our interpretations of the concept are found at the end of this article.



12. The universal plan built by speculative builders from the end of the last century onwards.



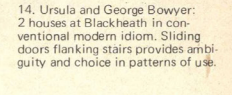
13. House 349 in Bidonville de la Rue des Pres, Nanterre. Built 1964-5 by an Algerian construction worker for himself, his wife and two daughters. Area 27.4m² plus 30.4m² private outdoor space. See: Cahier d'Architecture 1, Unite Pédagogique d'Architecture No.8, Institut d'Etudes et de Recherches Architecturales et Urbaines, Paris, 1973.



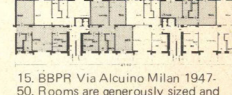
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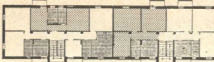
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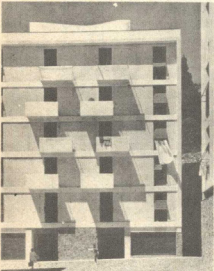
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16. Giulio Zappa housing in Genoa 1950; planning owes more to vernacular antecedents than to Modern Movement.



17. Genoa housing; exterior showing basic lack of expression of function and balconies used as decoration.



18. Typical Swedish bathroom. Note disintegrated appliances and gap between bath and wall. Bath drains into floor gulley. Single swivel h & c between bath and basin.

Furniture

The choice of furnishings, decorations and equipment is the way in which a household transforms a housing unit into a home.

We refer to it here not as an alternative to or substitute for the other approaches to housing design discussed, but as an essential factor to be considered in housing design generally.

Architects interested in flexible housing often take it upon themselves to invent systems of furniture or "detachable units" tailored to their conception of flexibility. Because these systems are necessary to the concept and don't exist on the market, the projects tend not to get built. Practical difficulties aside, their main weakness is to pre-structure the choices of occupants and thereby effectively restrict choice.

Long-term availability and variety of choice are obviously important to the purchaser and these are best provided for large markets. Architects interested in housing would do well to review some of the more recent developments in the mass furnishing market which have responded to an increasing interest in "homemaking" and change within the home. A few of these are listed here to indicate how far the industry has gone towards both creating and satisfying a desire for personalization of the home.

Furniture

- death of the 3-piece suite in favour of modular seating units;
- big cushions;
- modular bedroom systems;
- unitized storage walls;
- modular storage boxes and bins.

Equipment

- agreed (almost) dimensions for kitchen units;
- separate hot-plates and ovens;
- portable TV;
- unitized hi-fi.

Decorations

- washable and removable wall-papers;
- re-invention of the roller blind;
- whole-wall photographic and graphic murals;
- carpet tiles with integral underlay.

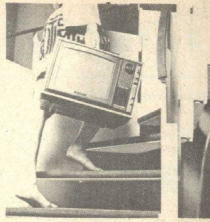
The furniture and equipment items represent possessions and they have to be paid for. Through hire purchase, £1,000 worth of stuff will cost about £11.25 per week over three years, while financed as part of a mortgage they would cost about £2.40 per week over 25 years.

The hire purchase option generally forces people to buy well below their aspirations in order to keep interest charges within reason. This

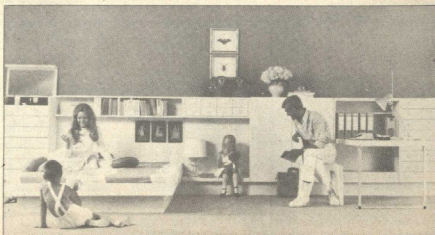
suits manufacturers because it means people will need to replace furniture and equipment relatively frequently.

It is not impossible to devise a financing mechanism for furniture and equipment on the basis of long term lending similar to a mortgage and available to owners and renters alike. This would encourage people to demand better quality furniture and would allow them to exercise discretion in terms of proportions of storage, equipment, furnishings chosen. The goods would remain their property if they moved, and such a system could take the heat out of the mass furniture market, which has reached scandalous proportions in some countries (notably the USA).

The important thing to remember is that for most people, their experience of their immediate surroundings is primarily a function of their symbolically important choices of furniture, decorations and equipment; more so than the decisions made by an anonymous architect about the fabric of the building housing them and their possessions.

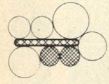


ART TEMPO LTD. PRESENTS THE GREAT NEW WALL COVERING: photo-luxil 12" x 9" THE SENSATIONAL NOVELTY IN DECORATION FROM "SCANDICOR"

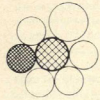


Towards adaptability: an illustration

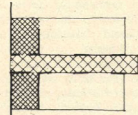
1. Organisation of the unit



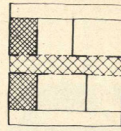
1a Conventional layout: hall used as link only and spaces sized to functions.



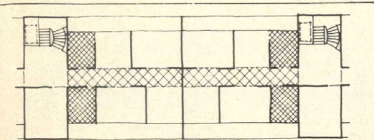
1b Ambiguous spaces grouped around central hall.



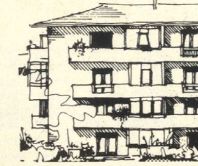
1c Generic relationships between living spaces and serviced rooms.



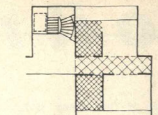
1d Constructional development of basic 4-room unit.



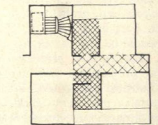
1e Typical grouping of 4-room units with common access.



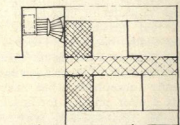
8. Notional external view.



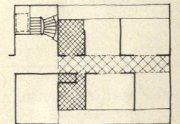
2. Development of Unit Sizes
2a 2-room - 1-2 persons.



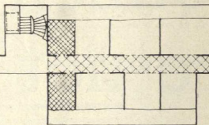
2b 3-room - 3-4 persons.



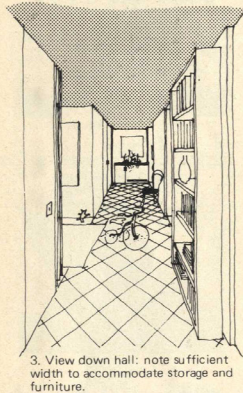
2c 4-room - 3-4 persons.



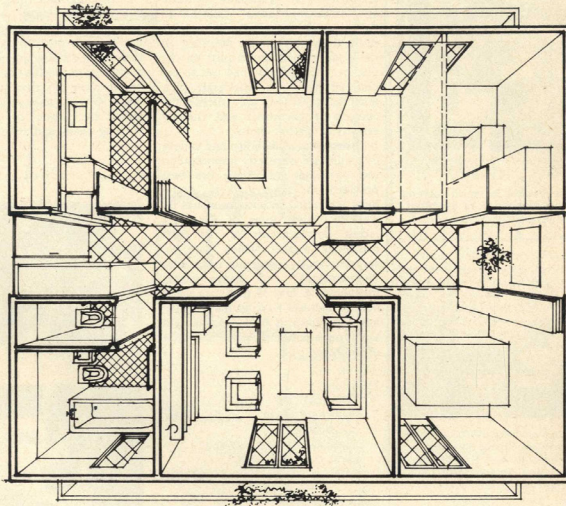
2d 5-room - 4-6 persons.



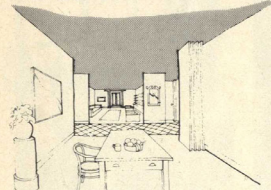
2e 6-room - 5-6 persons.



3. View down hall: note sufficient width to accommodate storage and furniture.

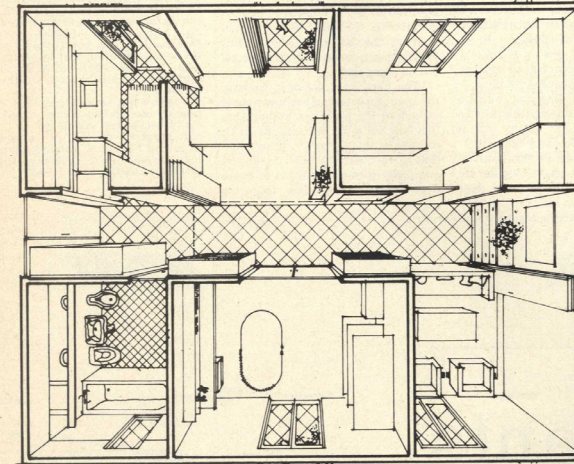


4. 4-room unit: layout chosen by mature family with subdivision of one space to form 2 single bedrooms. Through living room.



6. View across hall showing effect of hall space on through living.

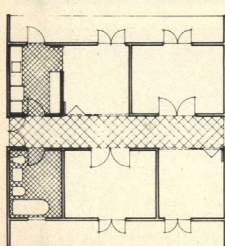
5. 4-room unit: layout chosen by young family to provide parent/children zoning.



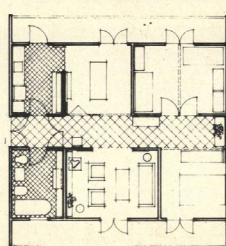
These plans show one interpretation of our concept of adaptability. They can be seen as illustrative tests of one form of generic layout. Important features of this layout are a generous hall space for display, shared family storage, and services spaces large enough to house extra domestic appliances and/or second bathrooms.

We found that the basic choice between space and gadgetry (eg moveable walls), as developed in these articles, cannot be avoided. At Parker Morris space standards, gadgetry becomes essential in order to provide any degree of choice to occupants - coupled with maximum use of space. At Parker Morris

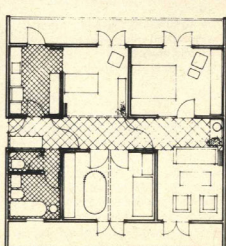
+ 10% (about 7% up on cost), considerable choice is possible using only conventional gadgetry (eg folding doors). At Parker Morris + 20% (about 14% up on cost), maximum choice can be achieved without resorting to purpose-made components. Space remains the best buy in the long term.



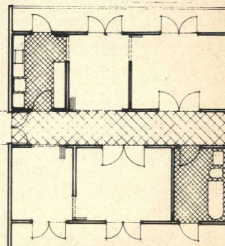
7a 4-room unit is Parker Morris plus 10% area.



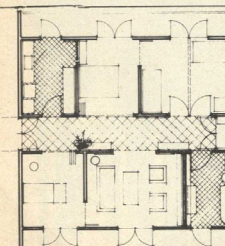
7b Plan of layout chosen by mature family.



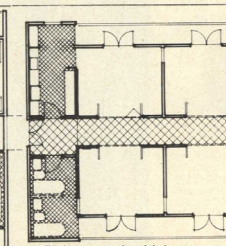
7c Plan of layout chosen by young family.



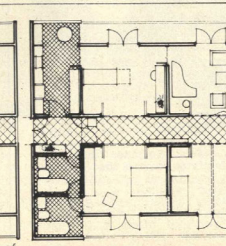
7d 4-room unit with serviced rooms diagonally opposite.



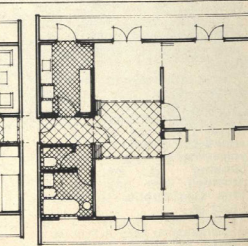
7e Mature family layout in diagonally serviced unit.



7f 4-room unit with larger rooms of equal size for up to 5 persons (Parker Morris + 20% area).



7g Large room plan chosen by four-person, music loving family.



7h 4-room unit at Parker Morris + 10% adapted from basic unit.