MASTER

Child-centred adaptive home houses for households with young children in the suburb of the Netherlands

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Child-centred Adaptive Home

Houses for households with young children in the suburb of the Netherlands

Jiazuo Hou
August, 2013
Child-centred Adaptive Home

Houses for households with young children in the suburb of the Netherlands

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August, 2013

GRADUATION PROJECT
Smart living studio
Architecture
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With pride I present the graduation study I conducted as part of my master studies in Architecture of the faculty of Built Environment at Eindhoven University of Technology.

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Last but not least, a great amount of thanks goes out to my parents and friends for their support and inspiration.

Please, enjoy reading!

Jiazuo Hou
Eindhoven, August 2013
Abstract

Recently, because of childcare-cuts policy in the Netherlands, an increasing number of parents prefer looking after their children at home. Since young children are so fragile and dependent, guardians from parents are necessarily required. Taking care of toddlers and pre-schoolers is a job with great responsibility, and parents devote considerable efforts to try their best. However, traditional houses cannot provide the same level of professional childcare environment as a formal day-care centre does, which brings both challenges and opportunities for architects to design a smart home to meet this demand, i.e., a smart house not only could be sufficient to foster children’s developments, but also could facilitate parents’ guardians. Therefore, this thesis mainly focuses on designing an adaptive home environment with care for children under 7.
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Introduction

I. Motivation

i. Childcare cuts policy in the Netherlands

In 2010, the Netherlands government approved changes to the Dutch Childcare Act which included a reduction in the childcare allowance. This policy has led to a 12% drop in demand for pre-school and day-care places until the beginning of 2012, according to a recent research by trade union FNV (Cuts hit daycare services (update), 2012). Since numerous parents cannot afford high fees of day-care centre, they have to reduce the hours which their children used to spend in a day-care centre, or cancel the expensive formal childcare. In this case, either a parent, especially a young mother, would have to reduce working hours to look after their children at home (Fig. 1), or parents tend to seek assistance from grandparents to provide informal childcare. Even worse, this situation will continue. On September 1 in 2012, the Dutch Cabinet proposed further cuts in the childcare allowance for 2013 (Further cuts in childcare allowance for 2013 expected, 2012). Consequently, it is crucial for young children to have a quality home environment which can not only ensure their physical health and safety but also foster their mental development.

ii. Situation of Dutch households with children

Based on statistics in 2012 of the Statistics Netherlands, over half of Dutch families with child have two and more children (“Birth; age mother (on 31 December), birth order and fertility rates,” 2013) (Diagram 1). Furthermore, young children under 7 require adult’s guardians all the time, and in some states of the United America leaving young children at that age alone at home is breaking a law (“When Can You Leave a Child Home Alone?,” 2013). This means that it is essential for Dutch households with children to own a quality home environment in order to fulfil their childcare demand, because this situation may last for at least 8 years until their last child reaches his or her seven years old. In that case, parents or grandparents are required to devote tremendous efforts to supporting young children’s mental and physical developments. But sometimes adults also need some private time to release from their work and housework, for instance, parents who work from home, exhausted breadwinners after work and grandparents at a relatively high age. In this situation, a favourable home environment can possibly facilitate parents’ and grandparents’ guardians during children’s growths.

iii. Related works

Literature provides many recommendations for designing a quality physical environment for young children and discusses environmental impacts on a child development (e.g. Moore, 2009; Stankovic, 2006). With these recommendations, a pleasant childcare environment will be generated, exerting...
positive influence on developments of its inhabitants, the children. While most of them focus on quality of physical environments of day-care centre or preschool, some conduct a survey on home environments, which concentrates on parenting assessment (Caldwell, & Bradley, 2003). This research helps studies on evaluating effectiveness of a home environment on child developments. All the previous researches provide a general overview of a physical friendly environment for a young child.

Parental childcare is definitely the best choice for young children; however, day-care centre own their unique advantages, for example, professional caregivers with a diploma in Early Childhood Education (Fig.2), a wide variety of toys, games, books, and outdoor equipment, structured activities which are designed to stimulate cognitive, motor, and language development, opportunity to develop social skills and other facilities especially for children (Queen’s University Human Resources, 2005). Furthermore, parents or other caregivers at home cannot continuously focus on infants and toddlers, because sometimes they have to be absorbed in issues, e.g., preparing food for children, doing housework or working from home, or require some private time for themselves, such as taking a rest or chatting with their friends.

With rapid developments of technologies, childcare environments for children have changed a lot both in a home environment and a day-care centre. Technology and interactive media as tools serve children in early childhood programs, providing them with an alternative to develop their abilities. Thanks to these technologies, it is now possible for young children to have the same professional education at home as in the day-care centre. Literature provides guidance for educators working in early childhood education that they should make informed, intentional, and appropriate choice about technology and interactive media, and ensure any use of them serves as a way to strength adult-child relationships. (NAEYC and the Fred Orgers Center, 2012) Despite the fact that technology and interactive media should not replace other beneficial educational activities, such as creative play, outdoor experiences, and social interactions with peers and adults, these technologies, such as interactive playground (Sturm, 2008), increase interactions with children and make playing more entertaining and enlightening.

So far hardly any research has been conducted into an adaptive home environment for households with young children. Therefore, we barely know how to use adaptive technology to improve home environments for children under 7. This research may be able to start to fill in this gap. The result can be used to generate a child-centred home environment design which assists parents or grandparents with childcare and promote infants’ and toddlers’ devel-
This research will only focus on the physical home environment for children under 7, excluding other factors such as quality of parental care, adult-child interaction and quality of education programme. The reason why children in this age are selected is that demand of childcare in the age is stronger and they are more fragile and independent, requiring adults’ guardian all the times.

II. Research objects and questions

For this study, the following main research question has been formulated:

*Can a home environment in the suburb of the Netherlands be designed as an adaptive space with a diversity of activity richness for children under 7, adapting with their increasing spatial demand and facilitating parents’ guardians?*

In order to answer the main research question, the following subsidiary questions will have to be answered as well:

1. How does a physical environment meet children’s spatial requirements and offer them preferences?
2. Which kind of activities do children under 7 usually undertake, and what are their requirements of physical space?
3. How can a space fulfil the requirements of a diversity of activity richness for children under 7?
4. How can a home environment to adapt with growing spatial demand of households with young children?
5. Which kind of spatial design can facilitate parents looking after young children?

The first and second subsidiary questions will be answered in the theoretical research, which can be found in the next chapter. With regards to the last three questions, hypothesis will be formulated after research, and then will be tested.

III. Project and site

The project is in a scale of an apartment block situated in the suburb Ijburg of Amsterdam. It consist of three row houses with twenty-one houses and a gathering space with a green roof including indoor and outdoor areas.

IV. Outline of the thesis

In the chapter of research, all the theoretical research into young children the environment are presented, for example, young children environmental experiences, children’s environmental preferences and quality of childcare environments. A case study of the De Tuimelaar day-care is also in this chapter. Then three hypotheses will be formulated.

In the chapter of design progress, target group, site analysis and master plan will be first discussed. Then the rest of this chapter will be divided into two main parts: one will be concerning raw houses and the other will be about the gathering space. Both parts will elaborate on all the design aspects, including concept design sequence of space, function of rooms, spatial advantages and other important aspects.

The next chapter of final design presentation will show all the drawings with necessary explanations, involving master plan, site analytical diagram, plans, sections, facades, details and renderings. The following part will be the final conclusion and recommendations of future research. References and image sources will be at the end of this report.
Research

I. Theoretical research

i. Daily routine of children under 7

In order to design an ideal physical environment for children under 7, it is necessary to know how young children lead their daily life and their demands for childcare environments. Moreover, because of their rapid physical and mental development, their requirements and abilities change along with their age. In general, children under 7 can be classified into 3 categories, namely, infants (birth to 1.5-2.5 years old), toddlers (1.5-2.5 to 3-4 years old) and pre-schoolers (3-4 to 5-6 years). Though their situations and demands differ greatly, one common point is shared that they require their special daily routine, e.g., fixed get-up time and bedtime, stable feeding time, playing outdoor at least one hour per day and other regular activities. The goal of a daily schedule is not to overschedule children but provide stability and opportunities for learning and discovery, helping children to be independent in their familiar home environment. Meanwhile, the daily schedule should not be rigid but flexible, and it is vital to provide a healthy balance for young children, between group times and more solitary moments, quiet and noisy activities, indoor and outdoor play.

ii. Young children and the environment*

In designing physical environments for children under 7, it is important to remember that young children observe the surroundings in a quite different way, compared with adults. Their innate mode of perception is holistic, broad, and simultaneous, while the adults’ mode is focused, narrow, and goal-oriented (Olds, 2001). Moreover, children’s perceptions of and interactions with the environment change and develop as they grow older. In his work on children’s experience of places, Hart (1979) summarizes the major changes during the first six years of child’s life in the field of child development (Linden, 2004):

*This section is mainly from (Linden, 2004, p12,p13)

The first year of life:

• The infant’s first exploration of the world is visual; a new-born baby can see and discriminate patterns as the basis for forming perception (Kidd & Rivoire, 1966; Bower,1970) In the first year, the child is unable to abstract the essential qualities which characterize the identity of objects and to classify those which are similar but not identical.

• In the first months the child does not differentiate himself from the environment. In the third to seventh month there is considerable development in this: recognition that objects have permanence develops gradually and is further developed during the eighth to tenth month. (Piaget, 1967; Decarie, 1965)

The second year of life:

• The child begins to display perceptual preferences of tastes, colours and sounds. (Weiner & Elkinal, 1972)

• The process of learning to classify objects in accordance with their appearance, behaviour and use is greatly facilitated by development of speech and language.

• By the end of ‘sensoria-motor period’ (approx. 2 years of age) the child has developed from acting in a series of separate spaces to a single co-ordinated space within which all objects are interrelated. It can now move freely and confidently through a limited spatial terrain. But this is a space of ac-
— a child only gradually develops the ability to form mental representations of the larger environment. Orientation to the environment is egocentric (Piaget, 1967)

The third year of life:

• The child begins to form mental representations of the environment, e.g. can recall familiar routes, but the child cannot reverse these routes in thought (Hart & Moore, 1971).

• Perceptual discrimination develops further in all domains. In many ways, children of this age are more perceptually sensitive than older children or adults, e.g. they know all scratches and missing parts of toys and the geography of household furniture in minute detail. But they centre their perceptual attention; they tend to restrict their attention to what immediately catches their eye and only briefly look at the less obvious aspects of perceptual configuration (Weiner & Elkinal, 1972).

• Children gradually develop knowledge of the spatial properties of only those areas which they have experienced through their own locomotion. Even though they may not be able to draw a map or describe how to navigate an area, they may be able to find their way around within it. But this is still a very partial ability and their neighbourhood does not form a coordinated whole (Hart & Moore, 1971).

The fourth year of life:

• The child becomes more aware of relations as inside-outside, top-bottom, front-back, on top of, underneath etc.

• They have a strong need to expand and solidify a growing sense of spatial relations (Weiner & Elkinal, 1972) which makes them get into closets, tables, card boxes etc.

• The child still cannot perceive a unity at the same time as discriminating the separate parts of a situation.

The fifth and sixth year of life:

• During school years, perceptual organization is most thoroughly developed. The child moves away from simple discrimination and figure-ground patterning to complex organizations which the child imposes on a visual figuration.

• Perception is also much more rapid (Weiner & Elkinal, 1972).

• Only half of the children of this age master the concepts of left and right (Sandels, 1972).

So during the development from infant to preschooler, child’s perception of and interaction with the environment changes from a passive to an active exploration. As children’s capacities grow, they learn to interact with their environments (Linden, 2004). By the time children reach preschool age (3 to 5 years), their capacity to discriminate among different environmental setting characteristics and to selectively respond to those of preference is well developed (Cohen & Trostle, 1988 & 1990). These preferred characteristics will be discussed in the next section.

iii. Children’s environmental preferences

Environmental preferences can be referred to elements which make the surroundings appealing to children. According to previous studies, four environmental characteristics are verified their impact on children’s preference, namely natural elements, activities richness, colour and opportunities for both privacy and interaction (Linden, 2004). With regards to natural elements, outdoor element is frequently mentioned when children are inquired for their favourite places, for instance, rivers, lakes
and woods (Hart, 1979). It is possible because the
green area is the spots where their activities under-
take. Since playing is a significant part of young
children’s life, activities richness as a characteristic
greatly affects children’s evaluation of an environ-
ment. Because a place with a diversity of activity
richness means that it can offer children many op-
portunities to play. As to colour, children do re-
spond to colour, but they hardly show a distinct
preference. Colourfulness in general is preferred to
one particular colour (Linden, 2004). Besides, col-
ourful decorations can easily catch children’s at-
tentions, especially the decorations made by them-
seleves, e.g. self paintings and handcrafts. Some
studies show children also need some privacy time
(Hart, 1979). While they adore places which pro-
vide their opportunities to interact with their peers,
hiding places are also very highly valued by them
(Fig.3). Therefore, children prefer an environment
that provides a variety of possibilities for both so-
cial interactions and privacy, so they can make a
choice whether to engage with other children or
not. Furthermore, age and gender do not influence
their preference to those elements, according to a
research of Linden (2004).

iv. Quality of childcare environments

In designing a child-centre smart home, it is es-
sential to satisfy children’s requirements for physi-
cal environments. Traditional home environments
are based on adults’ criteria, so little literature is
regarding quality of home environment for chil-
dren. However, numerous studies were conducted
on day-care centres, where is a place specific for
kids, and these researches are more referable to my
research question, i.e. the Children’s physical en-
vironments rating scale (CPERS5) (Moore, 2009)
Some aspects related to designing home environ-
ments are listed and adjusted below.

General

Figure 3: The Little School in San Francisco, designed by Mark Hor-
tons

The exterior of the whole building is supposed to
be of a child-friendly scale and inviting to children,
e.g. pitched roofs, verandas, use of wood, brick and
stone not concrete blocks or large expanses of glass
and other components. With regards to interior, the
scale appears small and cosy, e.g., low ceilings,
low hanging lights, low windows that children can
look from, low openings between adjoining spaces
and other elements. With some appropriate decora-
tions, interior space tends to appear friendly and
natural, such as use of carpet, warm colours, soft
lighting, curtains and other interior decorations.
Besides, furniture, toilet, basins and mirrors should
be child height, and secure health and hygiene
standard are also very important.

Home base

According to functions, indoor space could be di-
vided into two categories, home base and activity
areas. A home base is the name for the space that
fulfils children’s basic needs, such as eating, sleep-
ing, toileting, diaper changing and storing personal
belongings (Moore, 2009). The activity areas are
for children’s developmentally oriented activities,
such as creative, social and physical activities in-
cluding quiet and loud, clean and messy activities (Moore, 2009). This section will elaborate quality of the home base area.

In a well-designed day-care centre, there should be a well-defined area for individual lockers or cubbies for child’s personal belongings. The eating area can be used predominantly for lunch and snacks, and also can be occupied for other activities at other times. Besides, it is vital to have a quiet sleeping area separate from children’s play areas, so it can be used for napping at any time during the day. With regards to toilets, children in different ages have their specific demands. With regards to infants and younger toddlers, a diapering area is of necessity. If toddlers are in the process of becoming toilet-trained, the toilet should be not closed or isolated but that is visually and spatially connected to other indoor children’s activity areas for caregiver’s guardian. In the case that young children are already toilet-trained, the toilet area is closed and architecturally separated from other indoor children’s activity areas (e.g. by walls, not by distance).

Activity areas

Generally, the best mode of activity area is modified open-plan space, which is flexibly planned children’s activity spaces consisting of a mixture of semi-open areas interconnected with smaller, partially enclosed spaces to accommodate children individually, in small groups, or in larger groups and to facilitate children moving freely from one activity to another (Moore, 2009). It is in contrast to totally closed-plan space where each activity is in a separate enclosed room, and to totally open-plan space where there are few or no dividers between children’s different activities. Children’s activity areas are supposed to be partially enclosed to provide protection from visual and noise distractions and easily modified to change activities from week to week. Hence the division of space should be few or no permanent walls, but partitions or furnishings are easily movable, or maybe different floor and ceiling levels.

Furthermore, the activity areas can be divided into three categories, namely quiet activity area, physical activity area and messy activity area. In the quiet activity area, some activities can be undertaken, such as reading, small toy (fine motor) and playing computer. Physical play (gross motor), music and dramatic/fantasy play could be done in the physical activity area. Children could be involved in arts and crafts, science and nature and water play in the messy activity areas. Moreover, the physical activity areas are supposed to separate from the quiet activity area, because activities in the physical area are noisy. The quiet activity area is also separated from the messy activity area, because the quite area should keep clean, and messy activities can be more flexible for children to develop their imagination and creativity. About all, indoor children’s spaces are spatially and visually connected with outdoor play areas, and with appropriate furniture and storage. Requirements for these three areas will be elaborated below.

Quiet Activity Areas

With regards to infants, a designated manipulative play area (fine motor) is necessary. As to toddlers and pre-schoolers, reading area, manipulative play area and computer area are required. The appropriate furniture is listed: e.g. couch for reading, assessable shelves for storage, flat child-height work surface for fine motor, display rack, etc.

Physical Activity area

In the physical activity area, only the physical play area (gross motor) is suitable for infants. The physical play area, music area and dramatic/fantasy play are essential for toddlers and pre-schoolers. The appropriate furniture is listed: for instance, hard surfaces for ball play, climbing equipment,
play house, stages, mirrors and display shelves.

**Messy activity areas**

The messy activity areas are just suitable for toddlers and pre-schoolers, namely, arts and crafts studio, water play area and science and nature area. In the arts and crafts studio, this furniture is required, such as easels, tables, working wall, dedicated sink with water, easily cleaned floor, open shelves (Fig.4). In the water play area, a sink with water, easily cleaned floor, tables, storage, and possibly sand are essential. With an abundance of natural light, the science and nature area is furnished with a sink with water, racks, cabinets, or shelves, provision for keeping pets and plants, display walls, small indoor garden.

**Outdoor area**

In this section, outdoor area will be discussed. The outdoor area influences children’s physical and mental developments. This outdoor play yard should be developmentally challenging, interesting, friendly and comfortable and resemble as a ‘back yard’ instead of a large open area commonly called a ‘playground’ (Moore, 2009). With functional needs, the play yards are supported to have both sunny and shady areas, and some parts are open and largely flat. Moreover, some facilities are also needed, e.g. a large accessible storage room for outdoor play equipment, a sandpit with a partial shade cover and roofed outdoor areas that protect children’s activities in most local weather conditions. With regards to developmental needs, the play yard provides enough diversity, such as a variety of surfaces for different types of play, such as grass, hard surfaces, sand and other material surface, or different scale of area including both large and small areas. There should be some space for social and fantasy play, and some facilities are necessary, e.g., quiet areas away from physical play, cubby house, outdoor playhouse and storage for dress-up props. Moreover, the play yard should be divided into different parts: some are smaller and have a friendly feeling with intimate character and natural elements, some may be safe yet challenging, and others may be secret or retreat places which exist for a child to have privacy yet within sight of adults. If there is a garden that children help to maintain or an outdoor water play area, the outdoor area will be highly evaluated.

**II. A case study of De Tuimelaar day-care centre**

i. Background information of the case study

After a couple of months of theoretical research, a general view of young children’s interactions with physical environments is held. However, more information and knowledge of children’s behaviours and activities are still urgently required for my design stage. Therefore, a case study on daily life of young children is very much necessary. Children in the De Tuimelaar day-care centre are chosen as my study subjects.

This day-care centre (Fig.5) is situated on the ground of the TU/e (Eindhoven University of Technology) campus, and has a strong historical
Figure 5: De Tuimelaar

connection with the university. So it is highly probable for me (a student from TU/e) to obtain a permission to observe my subjects (toddlers and preschoolers). In terms of the De Tuimelaar day-care centre, this institution offers day care for children aged 10 weeks up to the age of 4 years, and mainly serves for children whose parents working at the TU/e or at companies on the campus (“Info about De Tuimelaar,” n.d.). Besides, children in the De Tuimelaar are divided into eight groups, according to their age and requirements, namely, De Smurfjes en Pebbels, baby/toddler groups from 10 weeks up to the age of 24 months with a maximum of 9 children per group; De Boelies, a baby/toddler group from 10 weeks up to the age of 30 months with a maximum of 10 children; De Koekies en Stampertjes, toddler groups from 24 months up to the age of 48 months with a maximum of 14 children per group; De Freggels, Teigetjes en Knorretjes, vertical groups from 10 weeks up to the age of 48 months with a maximum of 12 children per group.

With regards to pedagogical teachers, this day-care centre has an agreement that three caregivers are necessarily allocated to each group, and at least two of them are permanent employees, because it is highly recommended that the children have as many permanent pedagogical teachers as possible in every group and meet the same teachers each day (“The groups, De Tuimelaar,” n.d.).

ii. Approach of investigation

After a visit to De Tuimelaar day-care centre, some important information was gathered for preparation, and an appointment was made on the 30th of February from 9 to 12 o’clock. The reason to fix this specific time period is that most of young children will attend day-care centre in the morning, and they are probably awake according to their daily schedule. In the afternoon, some kids will be picked up by their parents, and have a strong possibility to take a nap (“Daytime schedule, De Tuimelaar,” n.d.). So in the morning, there is a great opportunity to discover how different types of space influence on children’s behaviours. Due to regulations of the day-care and children’s privacy rights, no photos and videos are taken during my visit. Therefore, direct observation and informal interviews with teachers are the main methods. Three groups are prepared for my study, namely De Smurfjes en Pebbels group with infants from 10 weeks to 2 years; De Koekies en Stampertjes group with toddlers from 2 years to 4 years; Teigetjes en Knorretjes vertical groups from 10 weeks to 4 years.

iii. Records of investigation

The study lasted for 3.5 hours. In the first half hour, I talked to the manager of the day-care centre, and she generally introduced the building of the day-care centre. A basic idea of organization of that building is formed: each group has their own unit including sleeping areas and toilets; every unit have an access to outdoor activity area; and a big hall and a corridor connects all the units. Because babies usually take a nap and need less activity areas than toddlers, their units are smaller than other groups. In the light of observations, it is interest-
ing to discover that sometimes children tend to hide themselves in a very small space, for example, under a table, in a corner or in some shelves. Moreover, crawling is also one of their favourable movements, especially when the floor is uneven, for instance, stairs and slopes. They also love to have companions and attract their peers or teachers’ attentions, for example, following their teacher whom they are very familiar with. Additionally, after talking with caregivers, an interesting phenomenon is reflected, that children in a vertical group learn things faster than the other group, for instance, using potties or toilets, assisting their caregivers, and even taking care of younger ones when they are crying. They are eager to learn to be independent.

iv. Investigation results

Children enjoy gaining different spatial experiences to develop their abilities. From time to time, a large flat playground is preferred when they would like to have social interactions with their peers to get companion. Occasionally, a small cosy place for hiding themselves from others is preferred when they would like to be alone and need privacy. In terms of activity areas, playgrounds in different heights are more popular than even and flat ones because they need challenging but safe adventures to assist them to develop themselves.

III. Conclusion of research

In this section, three hypotheses will be formulated according to the research and the case study. The first hypothesis specifies the research question in a certain situation, forming the background of the second hypothesis. The second hypothesis analyses the certain situation, and makes the research question concentrate on one specific aspect. The third hypothesis proposes an approach to the specific research question.

i. Hypothesis 1

As it is mentioned in chapter research, a flexible and healthy daily routine is beneficial for young children’s development. Therefore, it is possible to arrange children’s daily schedules for next day, even next week by parents or professionals. Activities in a child’s daily schedule can be divided into three scenarios depending on adults’ guardian (Fig.6). The first scenario is that caregivers directly interact with children, e.g. fulfilling children’s basic requirements (feeding, diapering, toileting, etc.) and involving into their activities (teaching, playing, etc.). The second scenario is that with adults’ guardian child play with himself or with other peers. The third scenario is that without adults’ guardian child is in a sleep. So my first hypothesis is that under a smart home environment, young children in the second scenario (playing) can be without adults’ guardian as in the scenario 3 (sleeping). So the caregiver, usually mother or grandparents can also have a flexible timetable, such as working from home, doing housework or having some private time.

ii. Hypothesis 2
### Table 1: Infants and younger toddlers

<table>
<thead>
<tr>
<th>Room</th>
<th>Home base</th>
<th>Activity areas</th>
<th>Outdoor areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kid bedroom</td>
<td>Sleeping and napping area,</td>
<td>Quiet activity areas (manipulative play area)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Locker/cubby area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dining room</td>
<td>Eating area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet</td>
<td>Diaper changing area</td>
<td></td>
<td></td>
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<tr>
<td>Bathroom</td>
<td>Bathing area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td>Bottle preparation area</td>
<td></td>
<td></td>
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<tr>
<td>Living room</td>
<td></td>
<td>Physical activity areas (physical play area),</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Quiet activity areas (manipulative play area)</td>
<td></td>
</tr>
<tr>
<td>Terraces/roof gardens</td>
<td></td>
<td></td>
<td>Physical activity areas (physical play area)</td>
</tr>
</tbody>
</table>

### Table 2: Older toddlers and pre-schoolers

<table>
<thead>
<tr>
<th>Room</th>
<th>Home base</th>
<th>Activity areas</th>
<th>Outdoor areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kid bedroom</td>
<td>Sleeping and napping area,</td>
<td>Quiet activity areas (reading area,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Locker/cubby area</td>
<td>manipulative play area and computer area)</td>
<td></td>
</tr>
<tr>
<td>Dining room</td>
<td>Eating area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet</td>
<td>Children’s toilets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bathroom</td>
<td>Bathing area</td>
<td>Messy activity areas (water play area)</td>
<td></td>
</tr>
<tr>
<td>Kitchen</td>
<td>Preparation for meals and snacks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living room</td>
<td></td>
<td>Physical activity areas (physical play area,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>music area and dramatic/fantasy play)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Messy activity areas (arts and crafts studio)</td>
<td></td>
</tr>
<tr>
<td>Terraces/roof gardens</td>
<td></td>
<td></td>
<td>Physical activity areas (physical play area,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>music area and dramatic/fantasy play),</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Messy activity areas (natural/science)</td>
</tr>
</tbody>
</table>

*Tables 1 and 2 list the activity areas within various rooms for infants and younger toddlers, and older toddlers and pre-schoolers respectively.*
Therefore, the second scenario of playing activities is the key point of design, and it is vital to investigate what kind of physical environments are suitable for children’s activities. As it is mentioned in the chapter of research, day-care centre have some advantages that home environment does not possess, and owning a rich diversity of activities is one of the most important benefits. Hence my second hypothesis is that a home environment could accommodate a diversity of activity richness children’s activities with appropriate space arrangements. Two diagrams are listed below to illustrate possible location where an activity can take place in a home environment. (Tab.2&3)

iii. Hypothesis 3

Some lately technologies provide possibilities to realise an adaptive home environment, which can better fulfil the spatial requirements of young children. A smart home can be adapted with the growing needs of her inhabitants, for example, more room for a new born baby and adjustment to growing children. Therefore, my last hypothesis is smart home could adapt with increasing requirements and changing preferences of their users, especially young children.
Design progress

I. Spatial situation analysis

i. Target group

Many urbanites leave the city as soon as they have children. Although a counter movement can be discerned, family households still favour suburban residence. Suburbs in the Netherlands are not entirely comparable to suburban places elsewhere. Compared to the stereotype of large, isolated, low-density, completely mono-functional single-family housing districts, it can even be argued that there are no real Dutch suburbs. Most suburban areas in the Netherlands are relatively small, consist of row houses instead of detached houses and are close to the urban core. In the Netherlands, the suburban family community have been being remade by the middle classes which tend to exclude childless and lower-class households. Besides their neighbourhood activism involves both the reproduction of an unspoiled and orderly environment and the realisation of a suburban paradise for children (Karsten, 2012). Moreover, the new Dutch model of division of paid work within two-parent families is that men working full-time and women working part-time. Therefore, working parenthood creates a need for childcare, either formal or informal. While the employment rate of mothers in the suburbs is increasing, they are still influenced by the Dutch norms about family care, favouring a pattern of families taking care of their children by themselves. Some reduce the number of hours in paid employment or choose to work from home in order to take care of their children, others choose to organise informal childcare within their social network, e.g. exchanging care with their neighbours, or asking for grandparents’ assistance. They opt for informal arrangements that most closely resemble home care. Besides complaints about the lack of facilities for the children were still frequently heard among the residents in suburban areas. Therefore, according to the demand and situation of suburbs, households with children under 7 in suburbs of the Netherlands are chosen as my target group.

ii. Proposed site

Ijburg is the suburban site which is chosen to set my project. Explanations are listed as followed: firstly, Ijburg is a typical Dutch suburb. It is located on the lake (IJmeer) on the eastern outskirts of Amsterdam (Fig.7). It is connected to the city centre by a tramline which takes 15 minutes to reach Amsterdam city centre. Subsequently, Ijburg is still under construction, and it was to be completed in 2018 with approximately 18,000 houses, making it the second largest Vinex area in the Netherlands. Due to the economic crises, however, the construction of IJburg has been put on hold; until now, only half of the total area has been completed. Initially, row houses next to canals were first built and residents mainly consisted of single-family homes; however, several low-rise apartment buildings were under construction. Some complaints are lodged about lack of child playing facilities. Additionally, according to the first diagram (Tab.3) slightly more than half of the residents in Ijburg
comprise of families with children, including single parents (5%) and two-parent families (48%). In other words, Ijburg possesses a much higher proportion of households with child than the rest of the Netherlands (35%) whose proportion is composed of single parents (6%) and two-parent families (29%). It reflects that there will be a large group of potential users of my design. Furthermore, as the table 4 and 5 show the statistics of the division between paid work and child care within families in Ijburg, it is highly likely that households in Ijburg have working parents and tend to use kindergarten and afterschool care. In the past, traditional families are with one working partner, and the wife is usually a housewife. Nowadays, a-symmetrical model becomes new Dutch traditionalism with men working full-time and women working part-time. The symmetrical model is in which both men and women work for about the same number of hours per week. Hence the percentage of households with two working parents in Ijburg is 84%, which is exceedingly higher than the rest of Netherlands (55%). Besides, due to the high proportion of working parents, in Ijburg it is more probable for parents to send their children to kindergarten or use afterschool care, respectively kindergarten (71%) and afterschool care (32%). The percentage of the rest of the Netherlands is much lower: 28% for kindergarten and 19% for afterschool care. Consequently, the issue of childcare home environment in Ijburg tends to be more crucial and urgent to be settled, and this district is likely to be an ideal site for my project.

### iii. Current situation of Ijburg

The urban fabric of Ijburg district and the final location are shown in the Figure 8. From this figure, a general view of this district planning is faithfully reflected: most buildings on this island are in rectangular shapes and are organised like a chessboard confronting to the lake Ijmeer. Since Ijburg is selected as the proposed site for the project, an excursion was carefully arranged to explore its current situation and to choose the ideal location. During the excursion, some general urban information of Ijburg has been gathered: a tramline goes through this district from the Northwest to the Southeast, connecting to the Amsterdam central station in 20 minutes. Besides along a canal surrounding the urban core, some row houses with decks can be seen (Fig.9), and so are some lowing rising apartments mentioned in the previous section (Fig.10). Additionally, a few public parks and lawns are distributed in this area, and some are equipped with child facilities, for instance, a sand pit with wooded
climbing facilities for toddlers and goals for playing football for teenagers (Fig.11&12). After viewing all candidate locations, a proposed site is set which in my opinion will be a new children gathering area for that district. It is a sweep of lawn along the canal, and 5 minutes’ walk to the nearest tram station with the dimensions of 84 m by 77 m. The area is almost wild merely equipped with some abandoned boats, and surrounding by apartment buildings (Fig.13&14). Moreover, from my observation, in the Northwest of Ijburg, child facilities are particularly in shortage. Therefore, assumed that sufficient playgrounds and children facilities are provided in my project, it would bring more chances to transform this area into a more pleasant residential block for households with young children.

II. Master plan

The figure (Fig.15) is my final master plan. After analysing the current environment of the site, the initial idea of master plan would be an indoor child centre with a green-roof playground surrounding by row houses. With integration into the unban fabric of Ijburg, the scale of footprints of row houses are restricted by other buildings surrounding the site. Three row houses are set along the roads, and in the direction of canal there is a public outdoor activity area with seating areas and a partial shade. With regards to public flows, three openings are set as accesses with the purpose of welcoming children from neighbourhoods or other blocks to come to this site and making here an appealing space for children from this block and other district to have social interactions. The locations of the openings are defined based on potential public flows. In the centre of the site there is an indoor activity area in a round footprint, covered by a green-roof playground. Colourful glass curtain wall is used as the
Figure 9: Row houses with decks along the canal in Ijburg

Figure 10: Low rising apartment in Ijburg

Figure 11: Child facility in the southeast of Ijburg

Figure 12: Playground in the southeast of Ijburg

Figure 13: Current situations of proposed location

Figure 14: Current situations of proposed location
façade, and also three entrances to the indoor activity area are equipped for flows. From every house residents could directly access to the green roof by bridges which is connected with their first floor. Concerning people from other blocks to accessing this green roof, three stairs are situated at the three openings, leading them to the green roof.

III. Row house design

i. Concept design

The concept of the row houses in my project is inspired by traditional Dutch houses along the canals in Amsterdam (Fig.16). So the initial design is a row house with a pitched roof. With regards to spatial design, privacy of both parents and children are supposed to be taken care of. Moreover, some internal space would be a pleasant place for kids to play in safely, and facilitate adults to parent their young children. Because of the rapid growing speed of young children, houses tend to be modi-
fied to their changing spatial demand including both parents and children.

The row house design will be explained systematically as followed. Each house has three floors and a sloped roof. The entrance to the house confronts with the roads; each house has their backyard and an entry to a central community centre inside the block on the ground floor, and an access to a green roof on the first floor. In other words, every family in this block share two giant backyard gardens on the ground floor and the first floor. Besides, beneath every kid bedroom there is a corresponding playroom. These two rooms are directly connected with a slide.

ii. Types of various houses

Four different types of houses are designed for various types of households on the basis of a family size. Type A (Fig.17) is designed for families of two parents or single parent with one kid with a floor area of 135.10 m²; type B (Fig.18) is for households of two parents with 2 or 3 children with a floor area of 214.44 m²; type C (Fig.19) is for families of two parents with one or two kids with a floor area of 158.64 m²; type D (Fig.20) is for household of two parents with two or three children with a floor area of 190.44 m². According to the footprint of each house type, the capacity of the project is 21 households. On the basis of the statistics for live born children in the birth order in 2012 of the Netherlands (mentioned in the chapter introduction), households with different number of children can be classified into three categories, namely families with one child, families with two children, and families with two or more children, with a proportion of 10:23:13. Hence those houses are distributed as type A in 5, type B in 6, type C in 5 and type D in 5, according to the capacity of each house. Additionally, with an easily modified timber structure, type B, C and D can adapt with an increase in the family size of their users and growth of children. These advantages of adaptation will be explained in detail in the following section adaptations.

iii. Hierarchy of spatial aspects in one house

With regards to privacy of both children and parents, all the four types of houses share the same spatial organisation system (Fig.21): the ground floor is entirely for parents, equipped with a master bedroom and study; the first floor is for all the family members to enjoy their quality family time, equipped with a living room, a dining room, a kitchen and playroom(s); the attic is only for children, equipped with kid bedroom(s). This system can provide an opportunity for both parents and kids to choose on their will, depending on whether they want their privacy or to spend time together.

iv. Advantages

Adaptations

One of the most important advantages of the house design is adaptive. Because of child’s developments and potential new born babies, residents can probably need more rooms or change the function of...
Figure 17: Plan of house type A 1:300

Figure 18: Plan of house type B 1:300
rooms. Therefore, to fulfil their changing demand, this house design own two adaptations, namely, modified kid bedrooms and flexible playrooms. In terms of modified kid bedrooms, households may need additional kid bedroom considering a new born family member or growing kids. Due to highly prefabricated timber structure (Fig.22) of row houses, it is highly possible to modify the inner walls to enlarge the kid bedroom or divide one room into two to adapt with the enlargement of the family size and child’s developments. Concerning flexible playrooms, walls between playroom and other room are made of easily modified timber structure mentioned above. In addition, an inflatable partition (Fig.23) between playrooms and living rooms can be adjusted according to the function of playrooms. For example, if users would like to hold a party in their house and require a larger living room or dining room, the partition can be removed; if users need to do some housework and look after their children at the same time; the partition as a low fence can assist to restrict toddlers and pre-schoolers in the playroom where is a safe childcare environment, protecting them from potential injuries; the playroom can act as a study for teenagers; adults can even transform the playroom
into a game room or others for their hobbies. To sum up, these two adaptive characteristics give users many possibilities to adjust their house to their wills, providing a quality child care environment for children.

**Child-friendly aspects**

The definition of child-friendly in my design is that taking children’s requirements of physical environment as priority. There will be three main child-friendly aspects in my row house design. First, every house owns playroom(s) especially for children, so they have their own space for their toys, models and their other favourite things, and can enjoy their privacy at home. Subsequently, playrooms in the direction of the inside block have an access direct to the green-roof playground. Hence, it is not necessary for them to climb stairs for going outside to enjoy the sunshine and lawns, and they can just use the bridge. Additionally, because there is a slide from their bedroom to their playroom, it could take them probably less than one minute to go to their playroom with fun of slide, and then one minute to go outside through the bridge. In terms of windows, façades of playrooms and kid
bedrooms are all assembled with small windows in a height of child. Now they explore outside world and enjoy a scenic view without assistance of their parents.

**Parent-friendly aspects**

The definition of parent-friendly in the project is that using architectural design to reduce parents’ work load at home, for example, taking care of children, doing housework, and providing them with some private time. Three prime parent-friendly points are in this project. First, playrooms could facilitate parents to look after their young children, because with an inflatable partition children can be restricted in a relatively safe place. Moreover, through windows (Fig.23) on the inner walls between a kitchen or a living room and playrooms parents can provide guardians while they are cooking meals or working from home in the living room. Another important aspect is easy to maintain the house clean and tidy. Though young kids do not deliberately make a mess, the rooms tend to be not neat after they are playing or eating. Hence cleaning occupies a high proportion of housework in a family with young children. Playroom also can help in the cleaning aspect, because the room has a relatively small scale and easy to clean, compared with the whole house. Besides, a new material named ultra ever dry spray (Fig.24) can retain cleanliness of walls, furniture and even clothes. This nanotechnology coating is a super-hydrophobic (water) and oleo-phobic (hydrocarbons) coating that will completely repel almost any liquid. Ultra-Ever Dry uses proprietary nanotechnology to coat an object and create a barrier of air on its surface. This barrier repels water, refined oil, wet concrete, and other liquids unlike any other coating(Utra tech international Inc, 2013). It can last for a year in an outdoor condition, and can be applied to maintain cleanliness of playrooms and the dining room. Therefore, in the playroom children can do some messy activities which may be forbidden in a traditional house, for example, arts and crafts, water play and keeping pets or plants. This tends to provide children for more fun and reduce parents’ work load.

**Health and sustainability**

It is well known that people in the Netherlands are very keen on the sunshine, so sufficient day-
light is exceedingly vital for a house design. In this project, glass curtain walls adjacent to stairs and skylights are applied to ensure living room and dining room to have abundant but indirectly soft daylights (Fig. 25). Concerning components of glass curtain wall and skylights, the material of glazing is glass reinforced polyester (GRP) insulated with transparent aerogel (Fig. 26). An advantage of GRP panels is their lightness in weight, combined with being manufactured be moulding, allowing them to be made in large panel size, up to 6000mm x 1500mm. Panel thickness are usually 70 - 75 mm to provide structural stability and thermal insulation. Panels are made from two moulded GRP skins which are bonded with either side of the rigid insulation (Watts, 2007). Moreover, the void between the two skins of the panel can be filled with a translucent insulation quilt to increase thermal insulation, while still allowing a diffused light to pass through the panel. This avoids from internal space overheating by direct sunshine, and provides a soft and comfortable daylight for living space of the row houses. Besides, thermal insulation of the skylights reduces heat loss, and makes relatively large size skylights with low heat loss possible. Its lightness in weight and structural stability also makes the GRP panels a high quality skylight material. Considering the acoustic problem, triple glazing are applied to windows in the both facades, diminishing noises from traffic and the green-roof playground in case of children playing on the community playground. Also triple glazing can help with thermal issue.

Additionally, row house is using a kind of timber platform frame structure. It is a highly prefabricated and standardised building material, which means the house can be built very fast. Besides, this timber structure is produced off-site: panels are built with the external and internal sheathing attached, and are then insulated. The completed system is then transported to site and craned into position. Using this simple and rapid build technology, a typical pair of semi-detached house shells can be fully erected so they are wind and water-tight in a single working day. This system also tends to minimise impact on the environment by using up to 40% less material than traditional timber frame.

With regards to the white roof, one reason is aesthetics requirement. Another important advantage is that a white roof can substantially reduce air
conditioning loads and provide cooler living space due to its high solar reflectance. A white roof can actually reduce energy consumption by about 20 percentages in hot, sunny weather, according to the Lawrence Berkeley National Laboratory Heat Island Group in Berkeley, Calif. On the other hand, Critics have suggested white roofs do more harm than good in colder climates. But research shows that the heating benefits of a dark roof in the winter are negligible because days are shorter, skies are cloudier, the angle of the sun is low, and sometimes roofs are covered in snow. Hashem Akbari, the Heat Island Group’s lead scientist says: “The amount of heat savings you may lose in the winter would be, at the maximum, 30 percentages of the summertime savings. If you need cooling in the summer and heating in the winter, no matter where you are, a white roof will most likely save you money.” (Kimble-Evans, 2010) In my design, the surface of the roof is made by the 3mm resin-based mortar spray-painted with urethane-based water-repellent and anti-slip finish. This material is used in the white roof of Meiso no Mori Municipal Funeral Hall, Kakamigahara, Japan designed by Toyo Ito & Associates. Furthermore, the waterproof coating ultra ever dry spray which is mentioned in my thesis can be also applied on the roof. This material can be durable in an outdoor environment for at least one year.

IV. Child-centred community centre design

i. Concept design

The concept of the child-centred community centre is to create space with a diversity of activity richness for children to have social interactions with their peers which is very significant during children’s development, especially for children who stay at home with parental guardians. This area could provide an ideal place for young kids to make friends after school. This activity area can be divided into three categories according to their
different functions: the indoor activity area protects children from bad weather which occurs very frequently in the Netherlands. Its green roof system forms into a wavy playground connecting to row houses around it. This green roof playground not only provides children with a pleasant outdoor activity area, but also gives the residents a nice landscape view. Adjacent to the canal is a sunken playground with partial shade and seating area. It is for children’s collective activities, for example, playing football, dramatic play and other activities.

This area tends to be a gathering area for children from this block and neighbourhoods to make friends and play with each other. Hence all these three kinds of space can be accessed to by residents of this district and other districts. As it is mentioned before, every opening is equipped with public accesses to both the indoor activity area and the green roof playground. In terms of residents of this block, every house is connected with the green roof playground by a bridge. Those bridges create many huge voids to allow abundant daylight to go through the row houses and keep a distance between row houses and the playground to protect resident’s privacy. Additionally, there is a large patio in the centre of the green roof playground, and a big slide is equipped there to let children on the green roof quickly go to the indoor activity area.

ii. Timber structure

The timber structure (Fig.27) in this design is inspired by playhouse and tree house for children. The space of the child-centred community centre is supposed to provide with both large indoor activity areas for groups and some small for individual kids. Moreover, it should also have a wavy green roof for children to play outside. The timber structure system with a unit of hexagon forms a giant net to support the whole building by connecting all the columns with each other. The whole structural timber network works as a forest, sheltering chil-

Figure 27: Timber structure for the wavy green-roof playground
Children as Mother Nature. Columns are like trunks, the timber net is like branches and the green roof is like leaves. Every column forms a small playhouse with two storeys, providing children with some small cozy space to enjoy privacy and safety. This timber structure not only can create various types of space, but also can be equipped with skylights on the top of columns to let sufficient sunshine go through the indoor space. So the whole child-centred community centre would have sufficient daylight for children’s health. In addition, this structure forms the green roof in a wavy shape, and this give children more fun by exploring different heights and forming sand pit than flat playground.

The digital model of this organic shaped timber structure is generated by Grasshopper which is a graphical algorithm editor tightly integrated with program Rhino’s 3-D modelling tools. This is an image to show the algorithm of one column of this structure (Fig. 28). By adjusting parameters, distances of every joint moving down can be controlled. The further the joint away from the centre, the larger distance the joint move down. Hence the size of a column can be transformed, for example, some in a larger size can form a large patio or a play house for children, and other can only have a structural function.

### iii. Advantages

#### Child-friendly aspects

Due to this specific timber structure, a variety of spaces are created. Concerning indoor activity area, large scale space is divided into quiet activity area, physical activity area and messy activity area; playhouses formed by columns are distributed among these large areas, providing small and cozy space for children. The capacity of each playhouse is up to 4 children, and the rest of the indoor activity area is up to 50 children. With regards to outdoor activity area, small group of children could play on the wavy green roof; the sunken playground with audience seating areas can hold some events and competitions for a larger group of kids. As a consequence, it is highly possible to provide diverse activities for children. For example, the green roof playground can be designed as interactive playground for various open-ended games with playground props. Its wavy surface could provide
great possibilities for different games. Playhouses formed by structure can be installed with slides and ladders for children’s adventures.

The façade of the indoor activity area is consisted of colourful glass curtain wall with six different colours, so when daylight goes through the inside space will also be colourful, which matches children’s physical environmental preference mentioned in the chapter research. With some skylights and a huge central atrium, abundant sunshine can keep indoor area bright enough. These skylights are made of semi-transparent polycarbonate, which can avoid unpleasant direct sunshine and keep soft and gentle daylight. Additionally, through the main slide in the central patio children can directly go downstairs from the green roof to the indoor area, and through stairs children can easily go to the green roof from the indoor activity area.

Parent-friendly aspects

The child-centred community centre is not only for kids, but also for parents. The indoor activity area provides adult-size seats for parents to rest while keeping an eye on their children, and it even could be a nice socializing area for parents. Backyard lawn, the green roof and the sunken playground could be an ideal spot to have party, picnic, barbecue, or even just simply lay on the lawn to enjoy the nice weather. So parents could take care of children while having some fun themselves.
Final design presentation

Bird view
Ground floor plan 1:500
First floor plan 1:500
Second floor plan 1:500
Southwest facade 1:500

Perspective view of the green roof
Southeast facade 1:500

Bridges connected playrooms and green roof
Northeast facade 1:500

The sunken playground with a green-roof shelter
Northwest facade 1:500

Glass curtain wall of row houses
Colourful facade of the child-centred community centre
Perspective view of timber structure

Perspective view in the direction of the canal
Slide in the main patio

Facade with child-size windows

Column with a skylight
Detail of the timber structure

Facade with child-size windows
Detail of the row house roof with skylights 1:50
Detail of the green roof

Pictorial Meadows
Green Roof Seed Mix

Green Estate
Green Roof Substrate

Filter Layer

Drainage Layer

Protection Mat

Waterproof Membrane

Insulation

Vapour Control Layer

Plywood Deck
Final conclusion

Main research question:

Can a home environment in the suburb of the Netherlands be designed as an adaptive space with a diversity of activity richness for children under 7, adapting with their increasing spatial demand and facilitating parents’ guardians?

In order to answer my main research question, three hypotheses formulated in the preview chapter require to be testified based on the research. The three hypotheses would be demonstrated in detail as followed.

Hypothesis 1: Under a smart home environment, young children in the second scenario (playing) can be without adults’ guardian as in the scenario 3 (sleeping).

It is very possible for young children to play in the playrooms without adults’ guardian. Because of inflatable partition, children could be restricted in a small but relatively safe space, and parents just need a baby monitor to take notice of their activities. Moreover, the low height of this partition and oversee windows can help parents to keep an eye on their children while occupied in their issues, such as cooking, cleaning and working from home.

Hypothesis 2: A home environment could accommodate a diversity of activity richness children’s activities with appropriate space arrangements.

Due to the playroom, children could take more activities at home. Thanks to the new material ultra ever dry, some messy activities (such as painting, crafting, keeping plants or pets etc.) could be held at home without taking much effort to tidy up. Despite of playrooms, children in a home environment are unlikely to enjoy the diverse activities as they do in a professional day care centre, not mentioning frequent social interactions with peers in the latter case. However, a child-centre community centre could solve this problem perfectly. This space does not have so many restrictions as a home environment (such as sanitation, limited space, privacy etc.), and it is flexible to adjust to various activities through different spatial types. The child-centred community centre not only provides activity areas for children from this block, but also allow their peers from other blocks to access. This space forms a gathering place for children to enjoy social interactions.

Hypothesis 3: Smart home could adapt with increasing requirements and changing preferences of their users, especially young children.

It is highly possible for a smart home to be adaptive with modified timber walls and inflatable partitions. Some house types could be reorganized to add an extra kid bedroom for new born baby. Inflatable partitions make playrooms be easily modified for different purposes by removing, being in a low height, or forming full-size wall. So the playroom can be temporarily used as enlargement of living room or dining room; or to be as a study room for a teenager; even to be as a hobby room for parents if children no longer need it. Therefore, because of adaptations, the life span of this house will be much longer than expected, and when children are all over 7 years old, the house can still adequately fulfil users’ spatial requirements.
References and sources of images

References


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Sources of illustrations


