Pre-education and meeting: Pedagogical and architectural drivers of the emergence of Basisschool typology through case study: Basisschool Airborne

AR2A011 Architectural History Thesis

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Abstract

In 1980, the Primary Education Act was revised. One of the most important decisions was to combine kindergarten and primary school into a new type of pre and primary education institution: basisschool. In the existing literature, there were few clues about the backgrounds, drivers, and consequences. Was the new type of educational institution beneficial for the growth and development of the children? In addition, the structuralism movement in the architectural field happened simultaneously with the development of kindergarten. It initially aimed at solving the housing crisis but also deeply influenced school building typology. Were the new demands for space brought by school reformation satisfied in structuralism school buildings? The thesis would focus on these two fundamental questions. Through the project Basisschool Airborne designed by structuralist Jan Verhoeven, the thesis would study the logic in structuralism design and the intersections between pedagogical and structuralism theories. During the post-war period, there were resemblances in multiple academic fields. In the research of basisschool, apart from a more comprehensive understanding of developments in both architecture and pedagogy, people can also discover the possibilities for further interdisciplinary researches.

Keywords: *Jan Verhoeven, Basisschool, Pre-education, Montessori, Jenaplan*

Content

1 Introduction

In 1980, a new version of the Primary Education Act was revised. One of the most important decisions was to combine kindergarten and primary school into a new type of pre and primary educational institution: Basisschool[1]. The decision indicated the elimination of independent kindergarten in the Netherlands, which was a unique educational system in the world. Looking back on the history of pre-education development, the Primary Education Act of 1920 claimed the establishment of kindergarten while during the next 35 years, due to the theory struggle and lack of supervision, a stable development was not guaranteed. Kindergarten was not regulated until the introduction of the Kindergarten Education Act of 1955[2].

In the existing literature, there were few explanations of the reasons and consequent influences of the combination. There were also few clues to define if it was beneficial for the academic and social development of the kids. In addition, apart from this research gap, it was also crucial to consider "basisschool" as a new architecture typology. There was an influential movement in the architectural field simultaneously during the 35 years of tough development of kindergarten, namely the structuralism movement. Although the initial mission of the structuralism movement was to solve the housing crisis and criticize the planning principles raised by CIAM[3], the ideas deeply affected the spatial form of schools and many of the famous structuralism projects were school buildings. However, few researchers were trying to parallelly compare the developments in pedagogy and architecture about the commonalities and mutual impacts.

Therefore, the main research question of the thesis is: What were the drivers for the emergence of "Basisschool" in social, pedagogical, and architectural aspects? To understand the historical period in more detailed content, the first part of the thesis aims at investigating the development of kindergarten under the instructions of the Act of 1920 and 1955. What were the direct drivers for the combination decision? Then, it would also introduce the origin and development of the structuralism movement with typical school building cases. How did the parallel developments in pedagogy and architecture fields happen? Secondly, in the literature review, pedagogical and structuralism theories that had wide influences at the time would be introduced. What were the similarities between them? Furthermore, a case study would be carried out to specifically study the interdisciplinary performances: Basisschool Airborne in Renkum designed by structuralist Jan Verhoeven in 1976-1980. It was one of the earliest attempts of basisschool before the official victory in 1985, which showed typical structuralism principles in school building design but was less discussed. How did the pedagogical theory instruct the architectural design and how did the spaces have impacts on children's growth? In the study, structuralism graphics would be analyzed to read the narrative, including the color code and special technique in plan drawings. By understanding the concept sketches and plan experiments in the archival fond from Het Nieuwe Instituut, the concerns and intentions of the architect would be explored. Finally, after getting more familiar with the history through the case study, the general typology transformation during the post-war period in school buildings would be studied to question: Was architecture also a driver for the combination that the basisschool architecture was not only to serve the changing condition in the society but also had inevitability within its own

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[1] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987): 240.
[2] Ibid., 240.
[3] Van Heuvel, Wim and Loughlin, Michael O'. *Structuralism in Dutch architecture*. (Rotterdam: Uitgeverij010, 1992), 10.

development process?

In general, the research attempts to define the essence of the combination of pre and primary education and evaluate the drivers and consequences. By studying pedagogical theories, it focuses on how architectural design impacts children's social behavior and the role that basisschool typology played in the history of school building development.

Kindergarten, as an independent typology, was abandoned in 1980. However, its emergence and elimination both had historical value when people tried to figure out what was important in a specific period and to see how the answer changed over time. People know its role played in the history of school building typology and gain experiences from the history that may still be applicable nowadays. The research on the development of kindergarten typology worked as an extension and supplement of that of school building typology. It provided a more comprehensive view of both architectural and pedagogical fields, which was also an interdisciplinary experiment in architectural historical research.

1.1 General History of Kindergarten in the Netherlands

The transformations of kindergarten development at its early stages were based on people's cognitions of its nature. In Middle Ages, cloisters took the charge of children's education, establishing "play school", in the Netherlands, "Begijnenscholen"[4] . They believed that pre-educational children (3-6 years old) should play freely so that the instructors were able to notice their characters and future career tendencies. Through games, children would learn to follow the order and rules[5]. After the Reformation, working parents who cannot take care of their kids normally sent them to the "Matressenscholen" where an "instructor" would look after a couple of kids[6]. However, it did not work as expected because of the poor physical condition and the terrible punishments of the "instructor" to the kids. In the 1860s, "Storage school" was established to improve the poor condition which had a similar architectural form, layout, and schedule as primary school to guide and protect the children[7]. An important turning point occurred in the late 18th century when the term "kindergarten" was raised by German educator Friedrich Fröbel. He believed that the goal of kindergarten was neither "storage" to relieve the pressure of parents nor "preparation" for primary school. Instead, children should be loved and nourished as plants[8]. Since then, the focus of pre-education gradually moved from external factors to the children themselves.

1.1.1 From the 1920s to 1950s

In 1920, Education Minister De Visser raised a bill for pre-education in the Primary Education Act of 1920. However, it was withdrawn due to the failure to reach universal approbation[9]. Actually, in the first half of the 20th century, kindergartens had been lacking management and supervision. There were various problems with the kindergarten operation. Firstly, most

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[4] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 9.
[5] Ibid., 9.
[6] Ibid., 9.
[7] Ibid., 10.
[8] Ibid., 10.
[9] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987), 240.

kindergartens did not have a specific pedagogical theory for the instruction of the children[10]. Different educators had raised various kinds of theories, but none of them was carried out broadly. Secondly, most of the kindergartens were established by enterprisers that the maintenance and operation depended on the tuition fee[11]. According to the Act of 1920, public and private schools should be equally financed and supervised. However, the allowance from the government always fluctuated due to the economic turbulence that led to instability in the development and expansion of kindergartens, especially public kindergartens. Thirdly, there were few neutral-denominational schools. Half of the kindergartens were Catholic kindergartens where education was tied up in ideology struggles[12]. Finally, kindergartens varied greatly in quality due to the lack of supervision. There was no examination of preparatory education certification until 1940[13]. In summary, pre-education tended to become diversified private education based on religious principles, which resulted from unstable economic development and the lack of clear regulations[14]. The complex composition of kindergartens lacked unity which ultimately led to more binary opposition, such as public versus private and Christian versus Catholic, trapping the development of kindergarten in a vicious circle.

1.1.2 Since the 1950s

After WWII, pre-education gradually stepped onto the right track because of the economic recovery and the increasing number of participants involved in the educational system. The introduction of the Kindergarten Education Act of 1955 put an end to all the debates. More public kindergartens under the control of the government were built whose number had doubled in eight years with financial support that was also exponentially increased. In 1954, the contribution to kindergartens was 30 million (NLG) and it reached 175 million (NLG) in 1963[15].

In 1953, the Association of Dutch Municipalities set up a committee to discuss the future developments of pre and primary education. The essential material needs became one of the focal points including the requirements for the architecture. In the statistics of 1958, 60% of four-year-old kids and 81% of five-year-old kids attended kindergarten without obligation[16], which means that there was huge social demand for pre-education. The main reasons for the demand included that the special care for children during the life period cannot be completely fulfilled by family; children needed to be divided into groups according to different growth stages they were in; and some necessary facilities and spaces could only be provided by a public institution[17].

In committee regulations, there were detailed requirements for instructors, equipment, sanitary, and environment. Circulation, room size, and layout both inside and outside of the building should be arranged appropriately so that kids would not disturb others or be disturbed. The best

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[10] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987), 241.
[11] Ibid., 242.
[12] Ibid., 242.
[13] Ibid., 242.
[14] Ibid., 244.
[15] Ibid., 243.
[16] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 13.
[17] Ibid., 13.

way for pre-educational children to develop was to play and work in small groups[18]. Therefore, architectural spaces should have mobility and flexibility, providing the possibility for the children to find their place in the small "society" where they have interactions with each other. In addition, the human scale in kindergarten should be different from spaces built for adults[19].

However, due to the lasting influences of the war, the tendency of diversified private education based on religious principles could not be easily improved. Furthermore, there was a shrink in the educational budget which restricted the expansion of public education. Public kindergartens remained almost in constant amount when the number of private ones stably increased. Hence, at the end of the 1960s, people called for a reformation to realize a more equal development in the educational system and better treatment for both teachers and students[20]. The Act of 1980, as a revised version of the Act of 1920, attempted to address some of these problems. The decision of combining kindergarten and primary school was announced at that time. Economically, it saved money for operation because the two types of institutions were normally located next to each other near the community which was convenient for students to commute. When combining them in the same building, fewer maintenance, staff, and official procedures were needed. In terms of education, there were many repeat students from kindergarten to the first grade of primary school. The Dutch Teacher's Association proposed a more coherent teaching process between the two stages[21]. Besides, more foreign pedagogical theories were introduced to the Netherlands, such as the Dalton school by American educator Helen Parkhurst, the Montessori school by Italian physician Maria Montessori, and the Jenaplan school by German educator Peter Peterson[22]. In those theories, the mixed-age group substituted the traditional academic-oriented class that supported the combination decision from a pedagogical perspective.

1.2 The Movement of Structuralism

During the period that kindergarten was operated as an independent school building typology from 1955 to 1980, the most influential architectural movement was the structuralism movement which flourished in the 1960s and gradually faded in the 1980s. Apart from dwelling, school was another appropriate typology to carry out structuralism experiments. Crucial experiments included the orphanage building designed by Aldo van Eyck, Apollo school by Herman Hertzberger and the Montessori school of Leusden by Jan Verhoeven. These architects interpreted and organized spaces from a human scale, providing an innovative environment for students of different ages. A new chapter of Dutch education had started.

1.2.1 General History of the Structuralism Movement

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[18] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 22.
[19] Ibid., 28.
[20] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987), 249.
[21] McKenney, Susan. Letschert, and Jos. Kloprogge, Jo. "Early childhood education in the Netherlands: the first steps. The education of the 4 to 8 years olds: re-designing the school entrance phase". Belgium : CIDREE/DVO, 2007: 53.
[22] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987), 253.

The shortage of social housing and construction materials became non-negligible after WWII. The key idea of CIAM in the prewar period was to build enough affordable housing for low-income families in communities with low levels and high densities to maximize the commercial value of the lands. However, the solution was hard to keep in the 1950s. Some young Dutch architects thought that it was a simple and incomplete solution that only built temporary dwellings, unhabitable in a long term[23]. In 1959, CIAM ended up in failure and Aldo van Eyck and Jaap Bakema established Team X, opposing the functionalism ideas in Chapter of Athens set by CIAM IV that separated four functions in city planning: dwelling, working, entertainment, and traffic[24]. In the same year, Aldo van Eyck took in the charge of the magazine Forum which became another battleground for the critique on functionalism. They hoped to advocate more flexibility and multifunction in architectural spaces. Therefore, they invented a decentralized form of spatial layout with repetitive units, roofs in special shapes to introduce more natural light, and threshold spaces between interior and exterior, to achieve the coordination of both continuity and diversity. At the end of the 1980s, with the emergence of various kinds of postmodern styles, the structuralism movement gradually lost its power on the global scale[25].

1.2.2 Structuralism School Buildings

One of the most famous structuralism school buildings was Apollo School designed by Herman Hertzberger in 1974 (Figure 1). Structuralism features could be found in this building: flexibility, adaptability, openness, and people-orientation. Instead of space functioning as repetitive elements, Hertzberger used 1.2 x 2.4m pre-fabricated concrete panels. By combining them in different sets, various educational spaces could be customized. To ensure the free movement of the kids, sufficient supervision was essential. Visual penetration could be found everywhere which provided possibilities for the kids to have more interaction and observation. Simultaneously, the visibility strengthened the safety concern.

Another significant example of the structuralism school building was the former Faculty of Architecture and the Built Environment (Faculteit Bouwkunde) in TU Delft, built in 1966 by Van den Broek and Jaap Bakema (Figure 2). The building consisted of a series of interconnected blocks which were taken as the repetitive modules for later expansion and modification. The blocks were arranged in a six-meter grid surrounding the central courtyard. Similar to Apollo School, different approaches of combining blocks created flexibility and adaptation in functions that reflected the structuralism ideas to meet the changeable conditions in future use. The features of the building were raw concrete façade and geometric shapes of windows and blocks, as a typical style of modern at that time. While the interior spaces had a complex network of corridors and staircases connecting different zones. The central courtyard was a focal point when people walk inside, which created a humanism sense of community for the student and staff.

In these two cases, it can be seen that repetitive form was not the core of structuralism ideas. Taking the repetitive rhythm as the tool, structuralists would like to realize the flexibility in functional spaces and the freedom for expansion and transformation in long-term use.

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[23] Van Heuvel, Wim and Loughlin, Michael O'. *Structuralism in Dutch architecture*. (Rotterdam: Uitgeverij010, 1992), 10.
[24] Ibid., 10.
[25] Valena, Tomas. Avermaete, Tom. And Vrachliotis, Georg. *Structuralism reloaded: rule-based design in architecture and urbanism*. (Stuttgart: Menges, 2011), 14-15.

Figure 1: Ger van der Vlugt, Johan van der Keuken, Ronald Roozen, and Kinold Klaus, Bird-eye view exterior photo of Apollo School, 1983 (AHH)

Figure 2: Broekbakema, exterior photo of Faculty of architecture and the Built environment in TU Delft, 1970 (Broekbakema)

2 Literature review

2.1 Pedagogical Theory about Pre-education

2.1.1 Montessori Philosophy

There were various kinds of pedagogical theories at that time, among which there were a few theories weighed more in the Dutch educational system. The first was the Montessori theory raised by Italian physician Maria Montessori. She became a doctor in pediatric psychiatry in 1896 and in the early 20th century, she turned her attention to the field of pedagogy. In 1909, she published "Montessori method", which aimed at scientific methods of pre-education for kids during 2-6 years old[26]. The first Montessori school was built in 1907 in Rome and the educational system had increasing influences globally. However, without a standardized regulation to supervise, the understanding and application of the theory gradually gained locality and fragmentation[27].

Despite the local differences, there were still some universal principles. Montessori philosophy advocated "children-directed learning"[28] that children develop motivation for learning based on their own interests and take uninterrupted learning activities within multi-age classes. Teachers would be trained to observe the kids and respect their autonomy. Different from the traditional reward-punishment regulation, Montessori philosophy encouraged trial-error tasks[29]. The atmosphere of education was expected to be optimistic, productive, and peaceful, where children can develop in moral, mental, and emotional dimensions[30].

2.1.2 Psychiatry and Psychology Base of Montessori

The Montessori philosophy, with Maria's medical background, was supported by psychiatry and psychology bases. She introduced the term "sensitive period" from animal biology to define a specific period during infancy when nature stimulated the kids to find their own interests in a specific field and repetitively practice until mastered[31]. Once they developed the initial skill, the period would ultimately fade away. Here, the importance of pre-education revealed that the unique period for the children to find their real interests needed to be properly guided, carefully protected, and fully utilized.

Maria further developed the sensitive period in three dimensions: movement, social life, and order[32]. Firstly, children tended to repeat certain movements, which makes them delightful. This biological tendency could assist children to strengthen their learning memory through repetitive actions. It was proven significant to build the plasticity of the nervous system during childhood[33]. Secondly, children tended to be curious about social interactions among adults. It is a good

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[26] Phillips, Bernadette. "The Montessori Method and the Neurosequential Model in Education (NME): A comparative study". *Journal of Montessori Research* 8(2) (Fall 2022): 33.
[27] Debs, Mira, Jaap de Brouwer, Angela K. Murray, Lynne Lawrence, Megan Tyne, and Candice von der Wehl. "Global Diffusion of Montessori Schools: A Report From the 2022 Global Montessori Census". *Journal of Montessori Research* 8 (2) (Fall 2022): 2.
[28] Ibid., 3.
[29] Ibid., 3.
[30] Kocabas, Hatice Uslu, and Bünyamin Bavli. "The Montessori Educational Method: Communication and Collaboration of Teachers with the Child." *Participatory Educational Research* 9, no. 1 (2022): 445.
[31] Phillips, Bernadette. "The Montessori Method and the Neurosequential Model in Education (NME): A comparative study". *Journal of Montessori Research* 8(2) (Fall 2022): 37.
[32] Ibid., 38-40.
[33] Ibid., 38.

timing to instruct them how to treat people politely, kindly, and respectfully such as closing the door lightly, giving way to others, and doing a favor in daily life. Repeating these actions help build procedural memory. Different from oral preaching, active action is more effective and harder to change that almost form the characteristic for the whole lifetime[34]. Finally, Maria believed that children have "an intrinsic sensibility to order" that helps them to construct the notion of the world and train sequential memory[35]. In this sense, a prepared, stable, and predictable environment for the study is crucial where patterns, routines, and sequences in daily affairs should be regular to prevent chaos from posing negative effects on children's coding process of the mind. As Canadian Journalist Susanne Craig put it, "A child's successful completion of many academic tasks depends on the ability to 'bring linear order to the chaos of daily experience'"[36].

2.1.3 Jenaplan Philosophy

Another important pedagogical theory was Jenaplan theory raised by German educator Peter Peterson[37], named after the University of Jena. The Jenaplan philosophy emphasized the sense of community that combines humanism, joy, and cooperation. The working pattern in Jenaplan schools, similar to Montessori schools, was based on family mode where kids were grouped of different ages. Therefore, the study was not the main theme in the school. Instead, there were four basic activities: communication, play, work, and celebration[38]. By encouraging interactions between kids and adults, Jenaplan education promoted autonomy and responsibility in children's growth. Both Montessori and Jenaplan philosophies focused on the family-like and productive atmosphere in the educational environment, the individual differences of the kids, the mixed-age mode of working, and the comprehensive development in mental, social, and academic dimensions.

2.2 Structuralism Theory

2.2.1 Diversity in Structuralism Theory

Structuralists took built structures as "the counter-form of social structures"[39] where the spatial arrangement was composed of modular, repetitive, and recognizable elements creating a coordinating relationship that answered the demand for a more democratic social structure. Apart from the general consensus on the ideal, structuralists had their own interpretations and focus to treat such as the visibility of structure, thermal strategies, various materials, and representation of spatial continuity. Generally, there were two tributary categories in structuralism: "aesthetics of number" and "structure and infill"[40].

The former was developed by Aldo van Eyck and his students, emphasizing humanistic orientation, symmetrical beauty, and continuity in the space order. Piet Blom promoted multiple

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[34] Phillips, Bernadette. "The Montessori Method and the Neurosequential Model in Education (NME): A comparative study". *Journal of Montessori Research* 8(2) (Fall 2022): 39.
[35] Ibid., 40.
[36] Ibid., 40.
[37] Azevedo, Sissi. and Fernando Ilídio Ferreira "Participation and Learning in a Jenaplan School in the Netherlands: An Ethnographic Research with Children", *Procedia - Social and Behavioral Sciences* 82 (3 July 2013): 601.
[38] Ibid., 601.
[39] Zahle, Mette. Segaar-Höweler, Dorothee C and Andrea, Prins. *Jan Verhoeven. Exponent Van Het Structuralisme, 1926-1994*. (Rotterdam: Stichting Bonas, 2012), 24-25.
[40] Valena, Tomas. Avermaete, Tom. And Vrachliotis, Georg. *Structuralism reloaded: rule-based design in architecture and urbanism*. (Stuttgart: Menges, 2011), 10.

land use on the urban scale, intending to create a more interactive urban fabric[41] as a response to the functional planning ideas by CIAM. His impressive drawings applying a hexagon-structured color code and complex techniques in perspectives were used in his designs to test different spatial relations, which would be further explained in the case study.

"Structure and infill" theory was raised by John Habraken and developed by Herman Hertzberger[42], which was defined as "a structure with a long-life cycle and infills with shorter life cycles"[43]. Arnulf Lüchinger further explained that "it is a complete set of relationships, in which the elements can change…The whole is independent of its relationship to the elements. The relationships between the elements are more important than the elements themselves. The elements are interchangeable, but not the relationships[44]." In addition, Jaap Bakema emphasized a concept of "core"[45] which are "moments in our life when the distance between people and things is removed…perceiving connections whose existence we had not been yet aware of".

2.2.2 Compliments and Critiques

The discussion on the structuralism movement had never ceased. British Philosopher Simon Blackburn held the belief that "phenomena of human life are not intelligible except through their interrelations… behind local variations in the surface phenomena there are constant laws of abstract culture[46]". In 1990, Joseph Buch[47] placed Structuralism on a par with Amsterdam School that also developed a vernacular architectural style although not on purpose. There were critiques as well regarding the multifunction. In 1980, Rem Koolhaas raised questions about the repetitive forms that would lead to unreadable layouts[48]. In addition, as Karl Friedrich put it: "Lack of hierarchy and resulting orientation difficulties, the dearth of individuality in view of its serial monotony, and the dominance and determinism of the primary structure…" may lead to a problematic situation in spatial order[49].

Overall, the structuralism movement was an influential and meaningful experiment in new typologies that responded to the ongoing social crisis. With various interpretations of humanism, structuralists envisioned an ideal sense of community during the post-war period, grabbing the concern of modernity back to the human scale.

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[41] Van den Heuvel, Dirk. "De huiselijke superstructurenvan Piet Blom, Piet Blom's Domesticated Superstructures", DASH#05 The Urban Enclave: 58. Rotterdam: Delft Architectural Studies on Housing, 2011.
[42] Valena, Tomas. Avermaete, Tom. And Vrachliotis, Georg. *Structuralism reloaded: rule-based design in architecture and urbanism*. (Stuttgart: Menges, 2011), 88.
[43] Lüchinger, Arnulf. "Structuralism in Architecture and Urban Planning. Developments in the Netherlands. Introduction to the term" in *Structuralism in Architecture and Urban Planning*. (Stuttgart: Krämerverlag, 1980), 56.
[44] Ibid., 16.
[45] Van Heuvel, Wim and Loughlin, Michael O'. *Structuralism in Dutch architecture*. (Rotterdam: Uitgeverij010, 1992), 12.
[46] Structuralism (architecture), "Wikipedia", last edited: 12 April 2023.
[47] van Heuvel, Wim and Loughlin, Michael O'. *Structuralism in Dutch architecture*. (Rotterdam: Uitgeverij010, 1992), 44.
[48] Ibid., 46.
[49] Valena, Tomas. Avermaete, Tom. And Vrachliotis, Georg. *Structuralism reloaded: rule-based design in architecture and urbanism*. (Stuttgart: Menges, 2011), 15.

3 Case study: Basisschool Airborne, 1976-1980

3.1 Architect Jan Verhoeven

Jan Verhoeven was born in 1926 in Amersfoort. In his childhood neighborhood, there were many polygonal squares, low-rise houses, winding streets, and canals. The form and hierarchy were rooted in his mind that can be reflected in his later projects[50]. In 1956, he entered the Academy of Architecture in Amsterdam (Academie van Bouwkunst). In 1960, under the instruction of Aldo van Eyck, he designed an aquarium as his final year project that in the same year was published on *Forum*[51].

As his tutor, Aldo van Eyck had a great influence on Verhoeven. Right during his study, Aldo van Eyck finished the orphanage building in Amsterdam, which was a milestone in the structuralism movement. Repetitive modular units were used to construct a large single-store complex where each unit was 3.36 x 3.36 meters[52]. The corridors were twisted instead of straight and dark, enhancing the perspective of exterior scenery and spatial cohesion. This was defined as "configurative geometry" which can be found in Verhoeven's projects as well: clear layout, small modular unit, and perceiving the space from the human scale. Another influential idea that supported the core of Verhoeven's design was an insight raised by Carola Giedion[53] that emphasized the dual opposites such as "unity-plurality, matter-mind, subject-object...universal-individual and rest-movement". Human was the main focus for structuralists. The complemented relationship between individual and community was what Verhoeven was mainly concerned about. Finally, Verhoeven also found inspiration from Italian architect Andrea Palladio's symmetry ideas. Palladio regarded proportion as "a correspondence among the measures of the members of an entire work and of the whole a certain part selected as standard[54]". In Verhoeven's projects, polygon used as an essential unit was multiplied to compose a large organism. By rotating the units around the polar point in the center, the building was shaped in a "bilateral and radial symmetry" that is "inseparably linked with hierarchy"[55].

Since the 1970s, Verhoeven had built eleven schools for primary education based on his working experiences in dwellings. Eight of them shared some universal principles: polygonal classrooms surrounding the central hall that provided skylights (Figure 3). Different groups of children of different ages would meet in the public hall which carried a sense of togetherness and dynamism[56]. A small block was linked but isolated from the main symmetrical complex for different use. Verhoeven tended to indicate the vernacular tradition and culture in his design[57]. He normally used wood, brick, and tile as the main materials instead of a large area of concrete as modernists always did.

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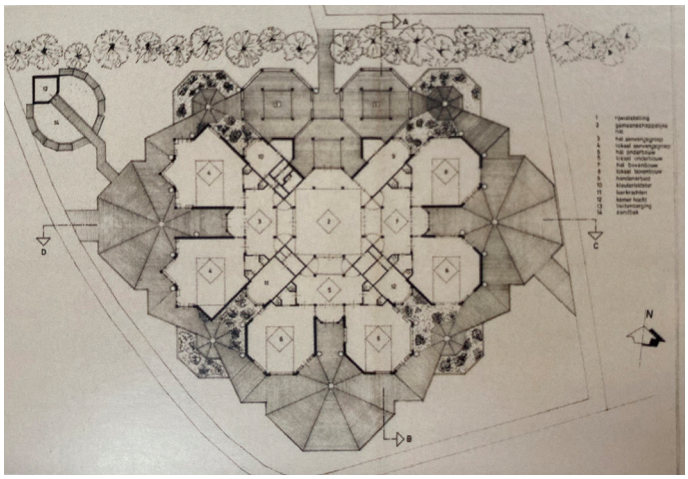
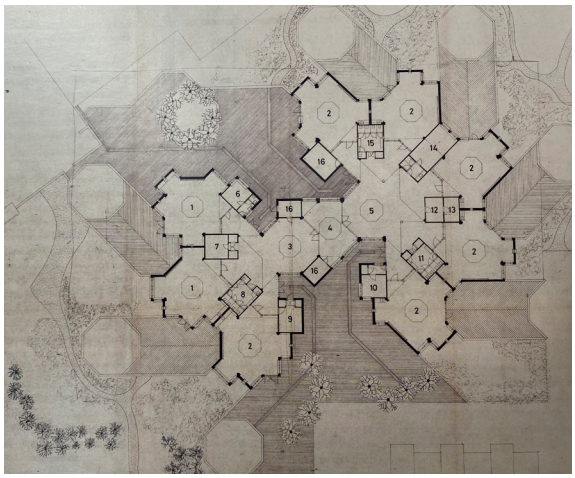
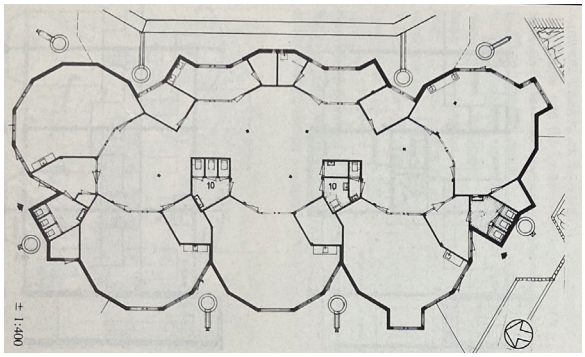
[50] Zahle, Mette. Segaar-Höweler, Dorothee C and Andrea, Prins. *Jan Verhoeven. Exponent Van Het Structuralisme, 1926-1994*. (Rotterdam: Stichting Bonas, 2012), 16.
[51] Ibid., 16.
[52] Ibid., 22.
[53] Ibid., 23.
[54] Verhoeven, Jan. *Daidalos: Architektur Kunst Kultur [1981-2000]* 15 (March 1985): 25.
[55] Ibid., 25.
[56] Zahle, Mette. Segaar-Höweler, Dorothee C and Andrea, Prins. *Jan Verhoeven. Exponent Van Het Structuralisme, 1926-1994*. (Rotterdam: Stichting Bonas, 2012), 63.
[57] Verhoeven, Jan. *Daidalos: Architektur Kunst Kultur [1981-2000]* 15 (March 1985): 25.



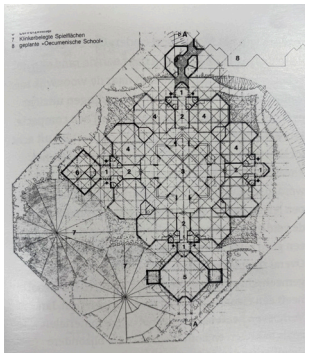
Basisschool Rozenhaal, 1971-1873



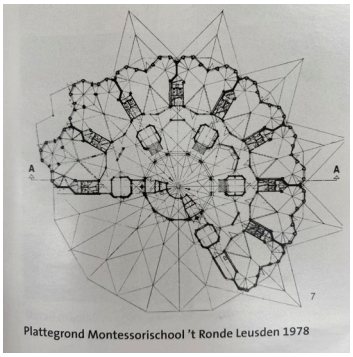
School Cuijjk, 1974



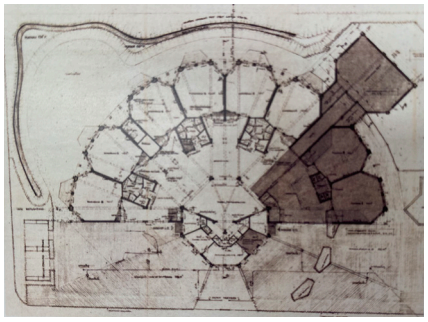
Basisschool Renkum Heelsum Airborne, 1976-1980



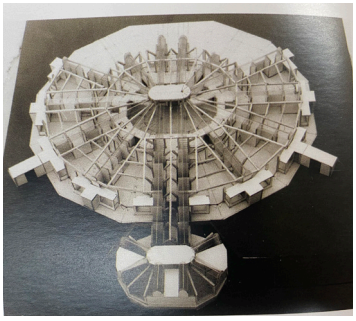
School Heumen, 1978



School Leusden, 1978



School Renkum Heelsum De Springplank, 1978-1982



School Rotterdam, 1982-1984

School Bemmel, 1982

Figure 3: Jan Verhoeven, Eight school projects with universal principles (Zahle, Mette. 2012)

3.2 Introduction of Basisschool Airborne

3.2.1 Grid and Layout

In the planning, the whole building consisted of twelve dodecagon clusters. Nine of them were classrooms where three clusters were arranged on three sides in central symmetry. Every two adjacent clusters split a few spaces which, together with the rest three clusters, composed the central hall for public use. In an individual cluster, there were six squares and twelve triangles (Figure 4). As can be seen in the hand script, Verhoeven reckoned the volume of the whole building by calculating the area of each shape (square and triangle) and summed them in total (Figure 5). He tested various possibilities with minor deviations. It embodied the humanism idea in structuralism principles that the estimation and understanding of the whole building were based on the smallest scale in which users could perceive the space.

In the primary sketches, Jan Verhoeven considered the layout of the building through a 9-classroom organization while only the lower part was finally built, that is the 5-classroom part. In the existing literature, there were no clues about the reason behind. However, in one of the massing diagrams, the architect gave the hint that the 4-classroom part was an expansion that can be added in the second phase if necessary (Figure 6). In the first phase, only the 5-classroom part would be constructed. Although it was not as flexible as promoted in the structuralism theory, it still enabled potential development in the future.

3.2.2 Function

In the built block, there were five classrooms where four of which were for the primary-educational group and one for the pre-educational group. The circular shape of the space made sure that students would gather centripetally and not interrupt each other. Apart from the classrooms, smaller rooms in the clusters served auxiliary use, functioning as canteen, game room, office, administration, storage, bathroom, changing room, lobby, and facility room. There were two entrances arranged symmetrically on two sides of the building. On both sides, there were exterior spaces for children to play and rest. Compared with other school buildings built in the late 1970s, Basisschool Airborne was less polyvalent. Taking Het Karregat as an example, it was a community complex located in Eindhoven designed by Frank van Klingeren. Apart from primary school and kindergarten, there were also theatre, library, shops, and gym.

However, there was richness in the concern of designing these functional spaces. For instance, a) the lobby areas were separated from the interior spaces by a partition wall. As requested in the governmental documents in 1953, the kids needed a space to change their shoes and put off their coat[58]. It made the lobby not only a spatial threshold that reminded the kids to make preparation for different activities but also a physical threshold that blocked dirt and virus from the outside. Additionally, by changing their outfits, kids coming from the outside would consciously not disseminate dirt, water, and smells and not disturb those studying inside. It was necessary for younger kids to gradually grasped the cognition of sanitary and self-protection. b) The playfields for pre and primary educational groups were separated (Figure 7). That for kindergarten was right outside the interior classroom/playroom cluster for pre-education. It ensured the bi-directional visibility and supervision through the window. Open layout only worked when there were enough measures to guarantee safety. This sense of humanism care could be found also in Apollo School and the orphanage building as a typical structuralism concern.

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[58] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 19.

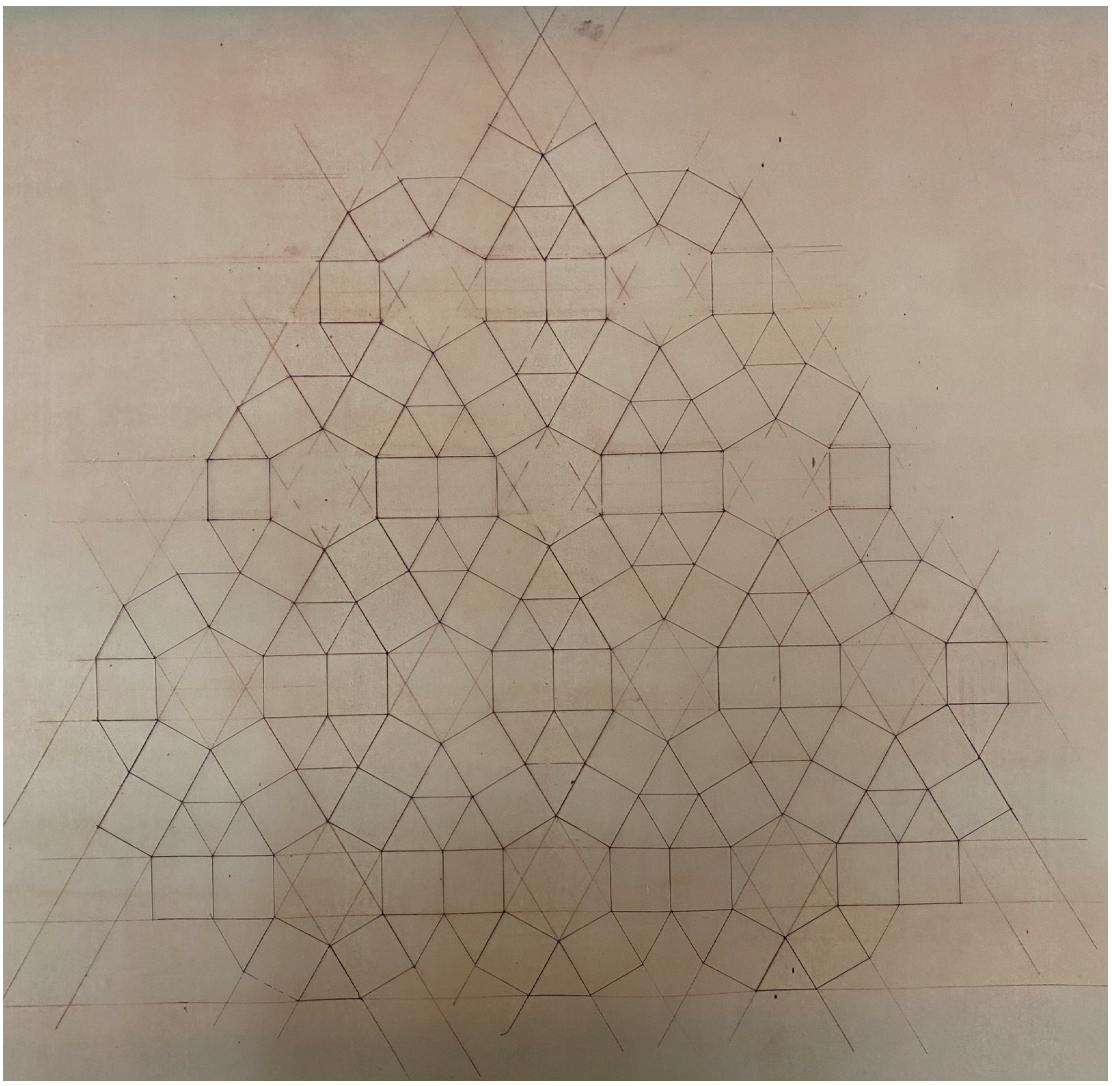


Figure 4: Jan Verhoeven, Grid of layout of Basisschool Airborne by Jan Verhoeven (HNI)

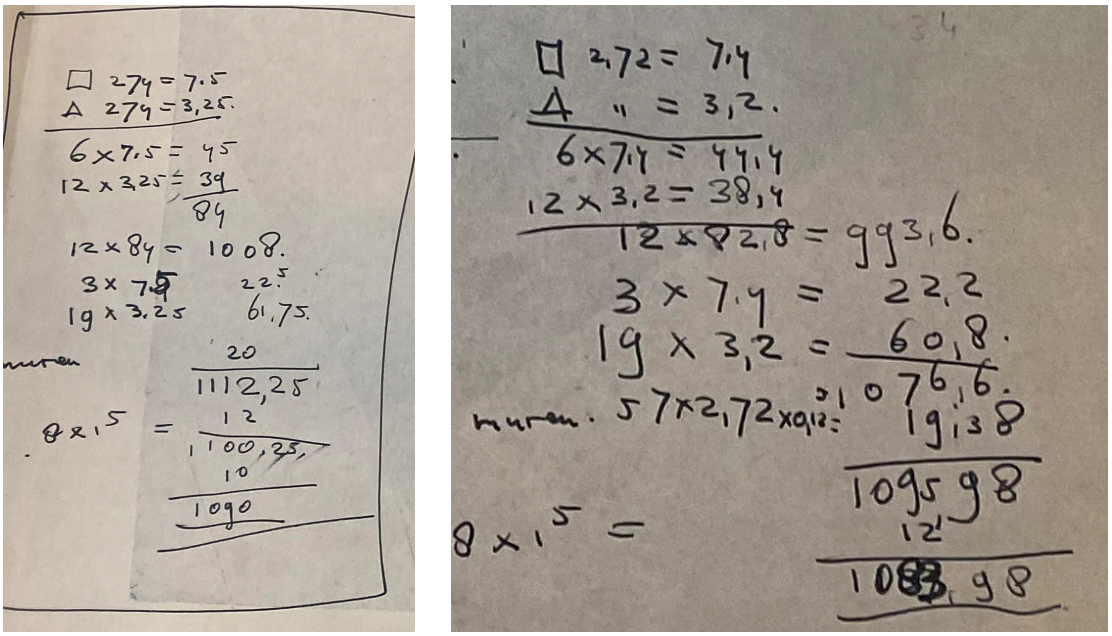


Figure 5: Jan Verhoeven, Two tests of calculation based on squares and triangles by Jan Verhoeven (HNI), six squares and twelve triangles in each cluster and twelve clusters in total. (HNI)

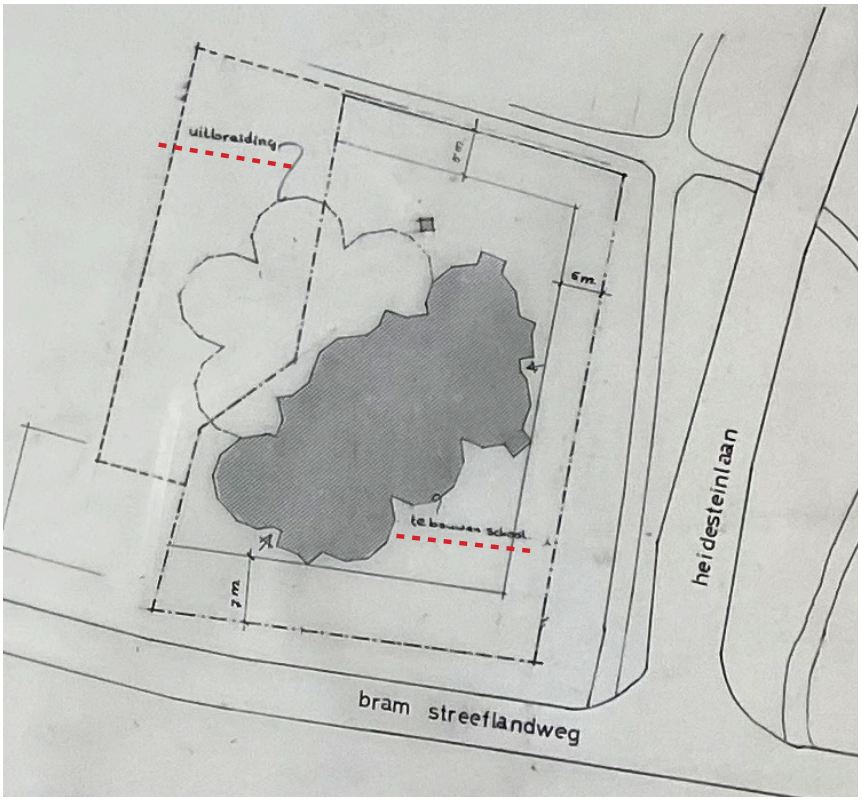


Figure 6: Jan Verhoeven, Diagram claiming the composition of the building ("uitbreiding(expansion)" and "te bouwen school (school to be built)") (HNI)

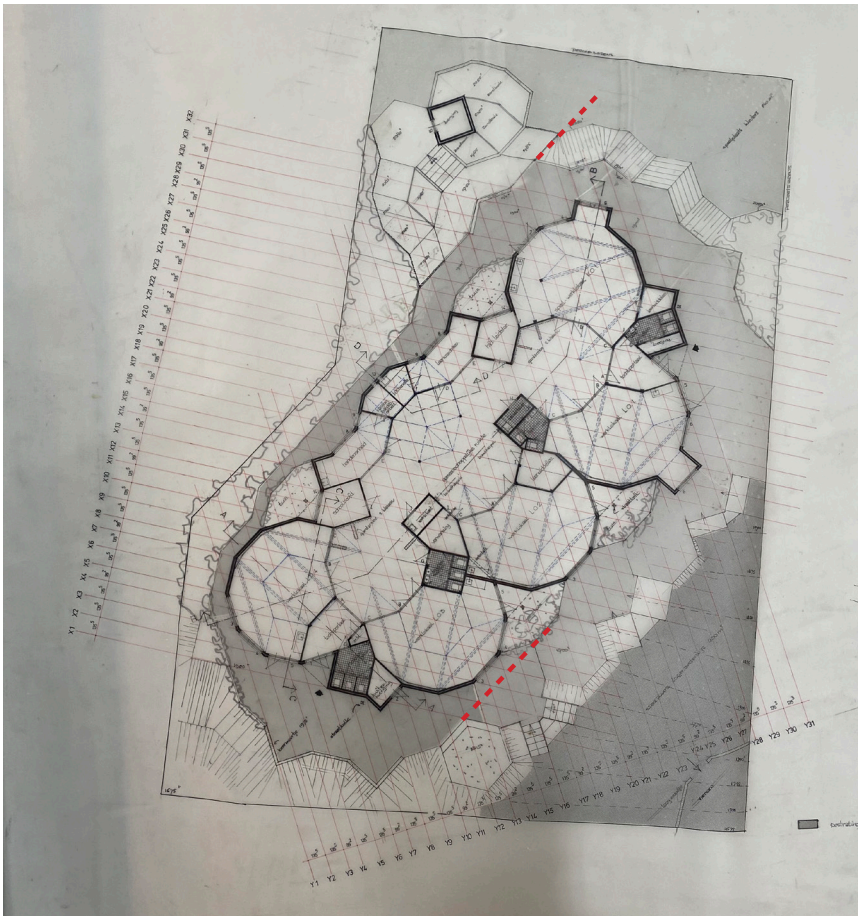
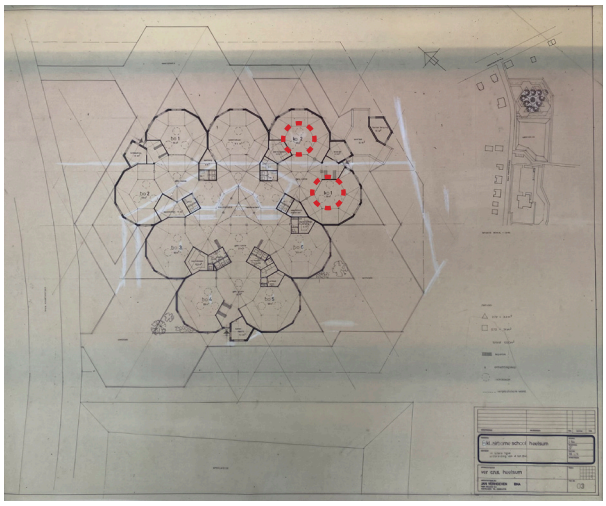
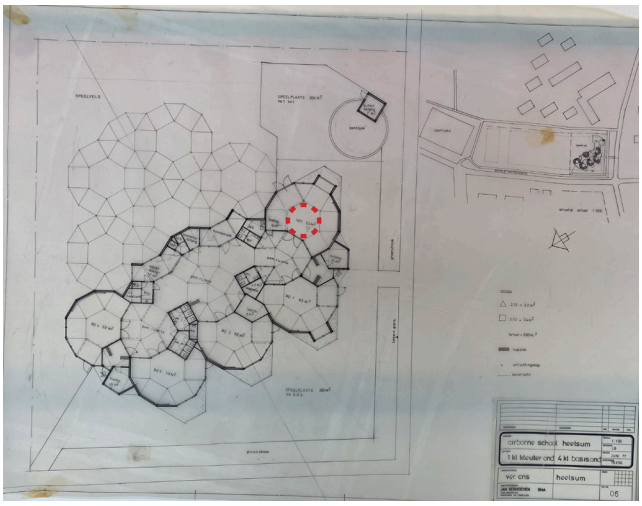


Figure 7: Jan Verhoeven, Playground for pre and primary education (top right and bottom right areas) (HNI)

c) In primary sketches, the number of classrooms allocated to primary education and pre-education had been changing and not confirmed (Figure 8). The extension part was always four classrooms for primary education. However, for the built part, in 1976 plans, there were two classrooms and one playroom for pre-education. In the 1977 plans, only one room was allocated to pre-education. Since 1978, the room became a work-play multifunctional room. In some no-date sketches, there were more pre-educational rooms. There were no critical differences between the design for spaces of pre-educational and primary educational groups. It can be speculated that the allocation was less important in this structuralism building because of the uncertain condition during future operation, all the classrooms could be reallocated for different groups and different use.

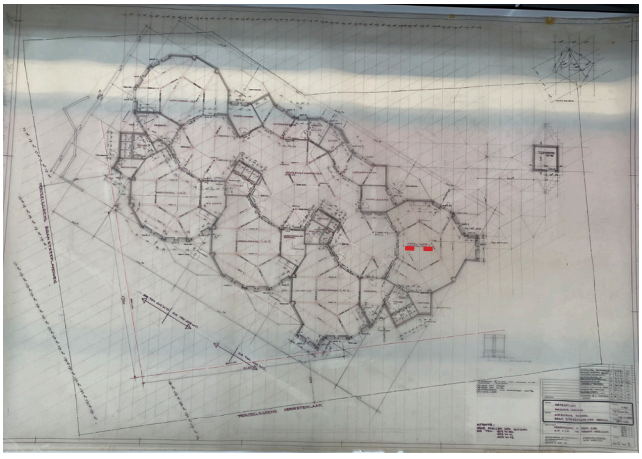


1976



1977

1978



1980

Figure 8: Jan Verhoeven, Number of rooms allocated to pre-education from 1976 to 1980 (HNI)

3.2.3 Material and Structure

The materials for external façades were red brick and stained wood and that for interior facades was concrete. The roof was made of wooden beams, timber and concrete panels, and small tiles. Unlike the massive use of concrete in other modernists' projects, Verhoeven tended to use more natural and vernacular materials. In this way, the architecture reflected the locality and engendered a harmonious sense with the surrounding context. The vernacular concern was also reflected in the form. For instance, the shape of the roof took the local sheepfolds as a reference[59]. The form and material provided an atmosphere of the family that ensured the gradual transition for the kids to adapt to society and reduce their dependence on family[60].

In his projects, color and light were the most important elements. The rhythm, where the alternation of the size and light effect created the diversity and richness of the space. For Verhoeven, the technique was the tool to realize the rhythm of the space. He used timber trusses as the main structure, with medium-sized side windows and skylights to introduce light into the interior (figure 9)[61]. The lights cast on timber ceilings provided an environment where children can feel close to nature and release their imaginations. The skylights in each cluster symbolized the aura of the children in the school that indicated the equal importance of students in the educational system[62].

Figure 9: Jan Verhoeven, Timber structure in Basisschool Airborne (Zahle, Mette. 2012)

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[59] Verhoeven, Jan. "VERH.110371969 Basisschool Airborne aan de Bram Streeflandweg te Renkum-Heelsum in opdracht van de Vereniging voor Protestants-Christelijk Kleuter- en Lageronderwijs, 1976-1980", Verhoeven, Jan fonds, Het Nieuwe instituut, Rotterdam, Netherlands, inventory number VERH0014, d83.

[60] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 13.

[61] Roos, Jeanne. "Jan Verhoeven, omdat hij bouwen een van a tot z menselijk proces vindt". *Het Parool*, May 13, 1976.

[62] Leusder Krant, "Jan Verhoeven, architect van de Montessorischool: 'Met architectuur kun je inspiratie geven aan mensen en er uit halen wat er in zit'". *Leusder Krant*, September 27, 1979.

3.3 Typical Structuralism Graphics

Structuralism architects tried to interpret their ideas in a new visual expression to draw a demarcation line with the former functionalism design concepts and stimulate new imagination in artistic creation[63]. Famous examples included the Het Speelhuis project designed by Piet Blom in 1977 who used colorful textures to overlap different floor plans in one drawing and geographic shapes in isometric perspective to test the relationship between building and exterior space (Figure 10 and 11). Through this, structuralists invented a complex, obscure, yet charming representational language.

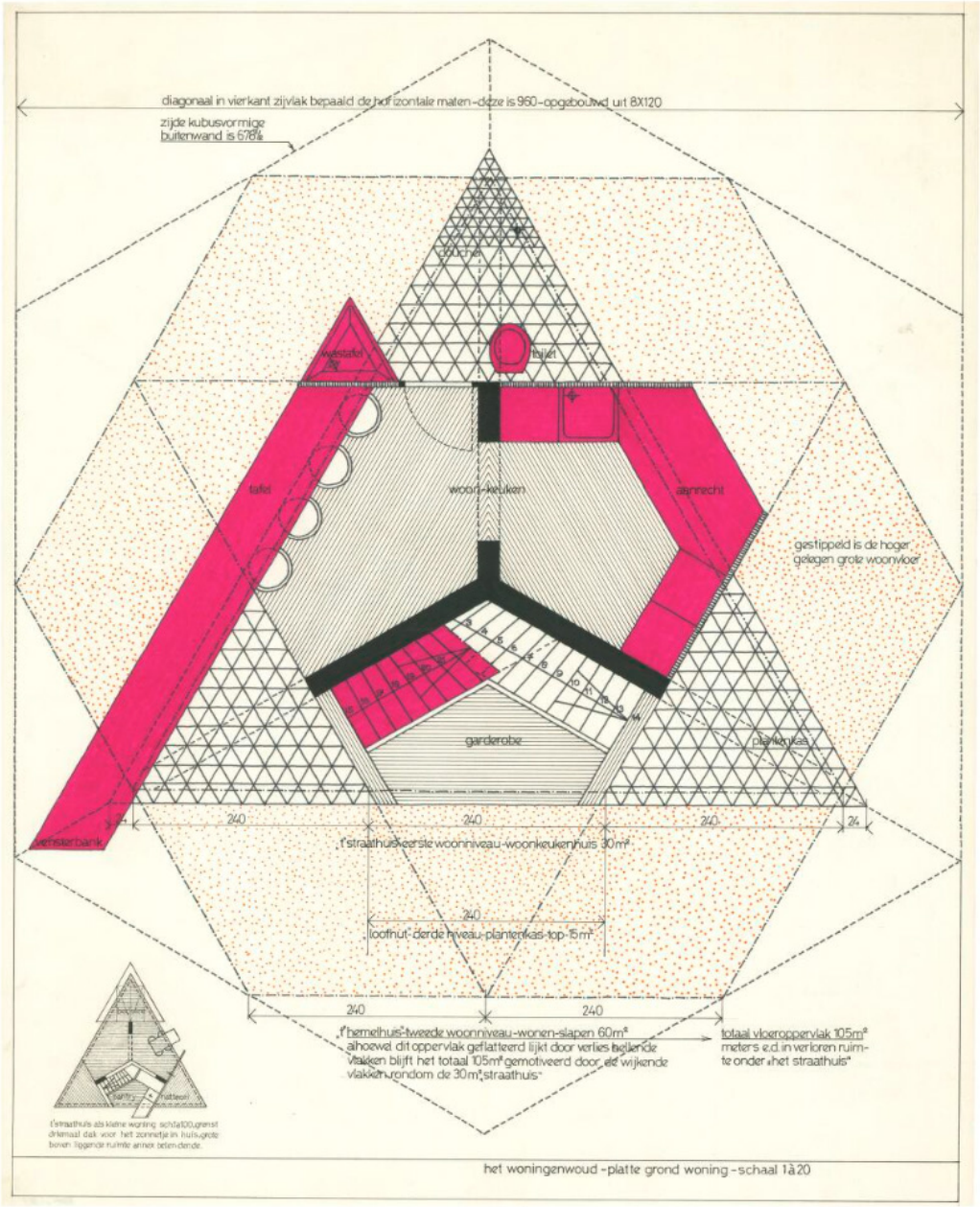


Figure 10: Piet, Blom, Overlapping plans of first, second, and third floors (HNI)

[63] Smit, Ellen. "Het verhaal van een andere tekenwijze. De structuralistische architectuurtekening in Het Speelhuis van Piet Blom", *Bulletin KNOB*, 2018, 117(2):85.

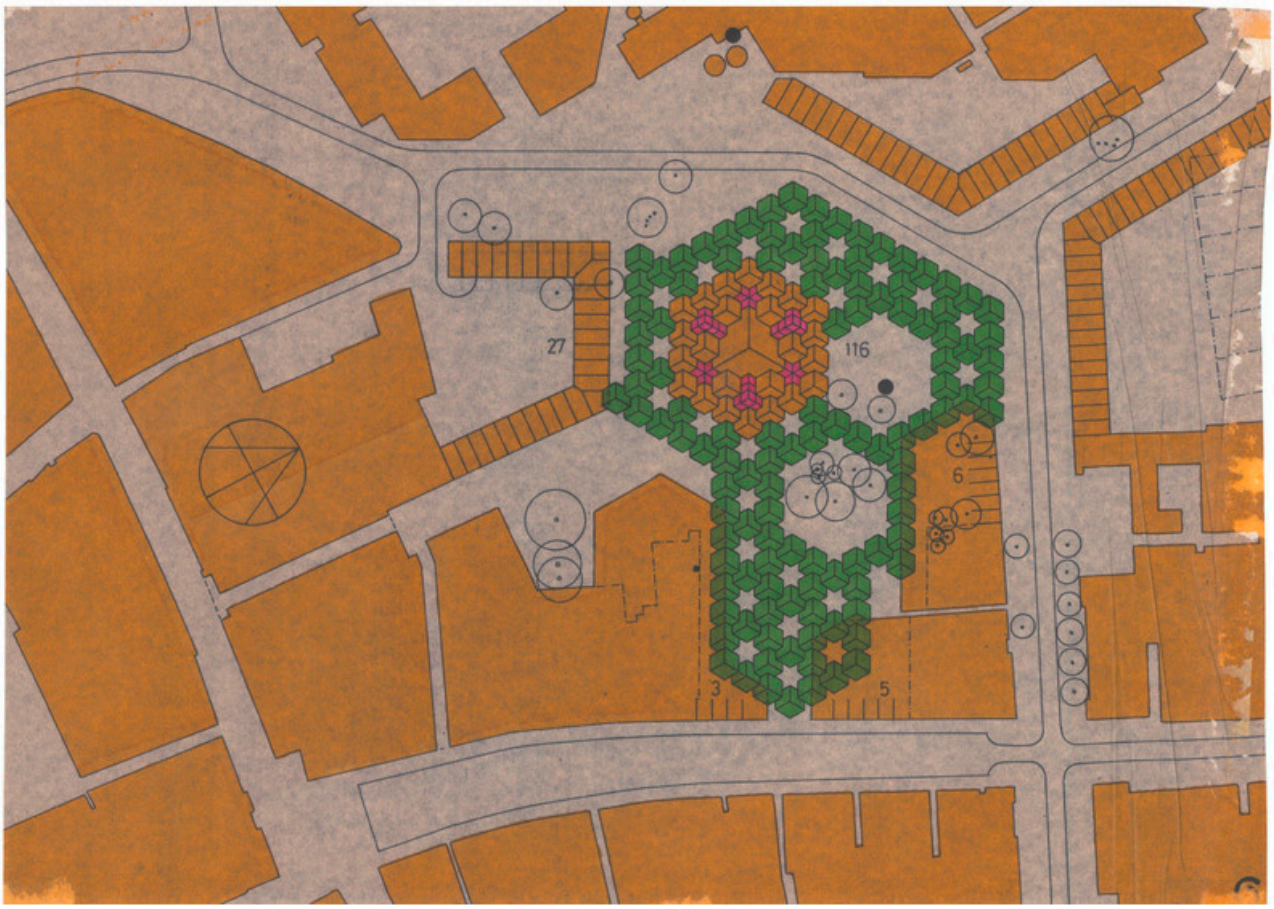


Figure 11: Piet Blom, Zoning plan of Het Speelhuis (163 dwellings) (HNI)

In the primary scripts of Basisschool Airborne, Verhoeven also used the systematic color code raised by German artist Paul Klee as a research tool. It includes six colors: red, yellow, and blue as the primary colors, and orange, green, and violet as the component colors[64].

a) In Figure 12, Verhoeven mainly focused on the functional layout where red was used to define classroom and educational areas while green meant the auxiliary functions for adult staff. Through the outline of the twelve clusters, it was clear to see the positioning of different spaces in the building.
b) In Figure 13, Verhoeven further tested the accessibility among different functional spaces. He used green to indicate the spatial scale in the classroom, blue to clarify the threshold spaces between nine classrooms and the central hall, and red to mark the three main entrances and two minor paths from the outside. Additionally, the light pencil traces of triangles extended from each cluster may indicate the plant areas which were enlarged in later plans. Blue pen traces annotated “hoog” and “laag”, which indicated the 10-centimeter height differences in the classrooms. The small steps in the building enriched the experiences.

[64] Smit, Ellen. “Het verhaal van een andere tekenwijze. De structuralistische architectuurtekening in Het Speelhuis van Piet Blom”, *Bulletin KNOB*, 2018, 117(2): 85.

Figure 12: Jan Verhoeven, Spatial layout analysis (HNI)

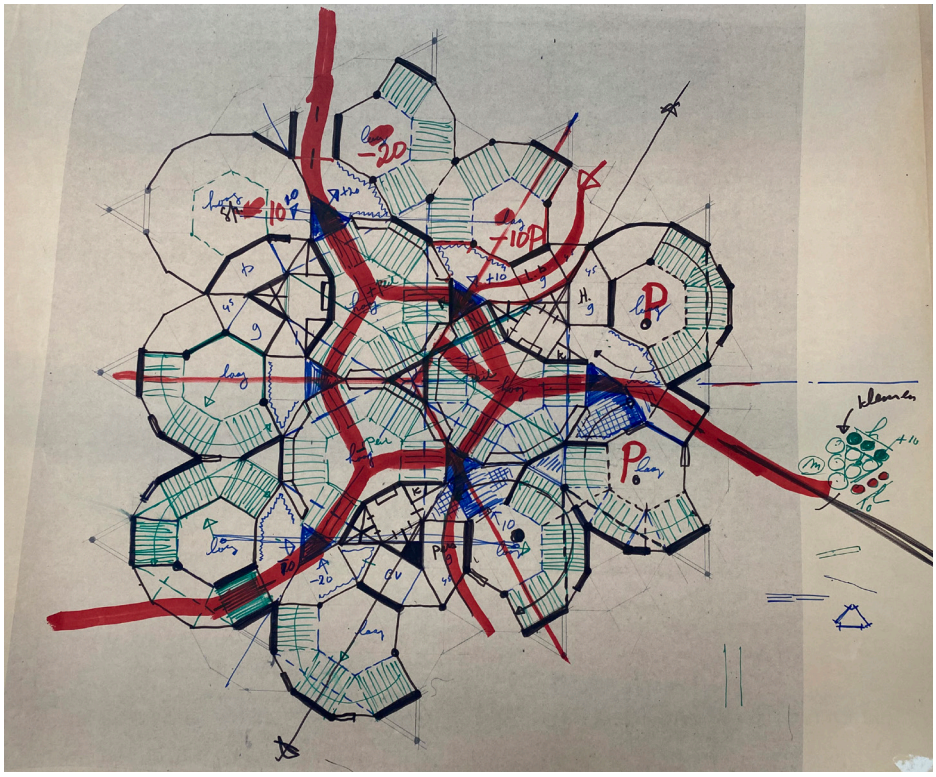


Figure 13: Jan Verhoeven, Accessibility analysis (HNI)

c) In Figure 14, there was more hierarchy in the texture coding where Verhoeven used different kinds of lines and shapes to include more information. Solid lines in black highlighted the load-bearing structural elements and red dash lines showed the division of squares and triangles in one cluster that, as have been mentioned above, were the smallest units of calculation for him to reckon the whole area of the building. Purple dash lines that had different patterns than red ones seem to be the guidelines for him to position the smaller rooms for auxiliary functions. Green circles may indicate the center of each cluster which in the structure were the light domes for the skylight (figure 15). Different from the normal dodecagon-cluster layout in other sketches, there were six nonagon clusters in another layer derived from the subtracted space from each dodecagon classroom that became a part of the public spaces. In the center of the nonagon cluster, there was one green circle and in the dodecagon cluster, there were three. Through this sketch, the readers can have a glimpse of the infinite possibilities of the aesthetic of geometry in structuralism design.

During school time, Blom and Verhoeven learned to understand the organization and logic of the structure. The academy always took Paul Klee's publications as precedents where the dynamic tendency in nature such as the light-dark duality, veins of leaves, and force potential was taken as the fundamental base of his visualization representation[65]. The wide use of different types of polygons in Verhoeven's projects may also reflect the natural structures such as honeycombs and crystalloids.

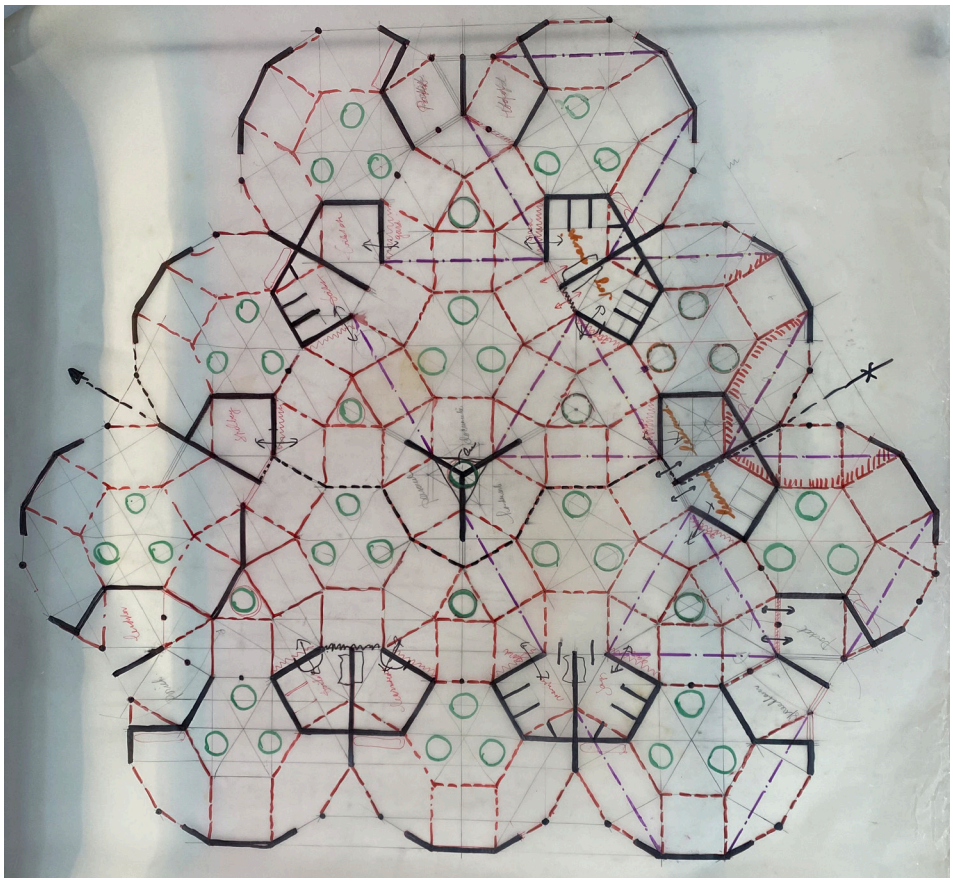


Figure 14: Jan Verhoeven, Smaller division in the modular clusters (HNI)

[65] Smit, Ellen. "Het verhaal van een andere tekenwijze. De structuralistische architectuurtekening in Het Speelhuis van Piet Blom", *Bulletin KNOB*, 2018, 117(2): 84.

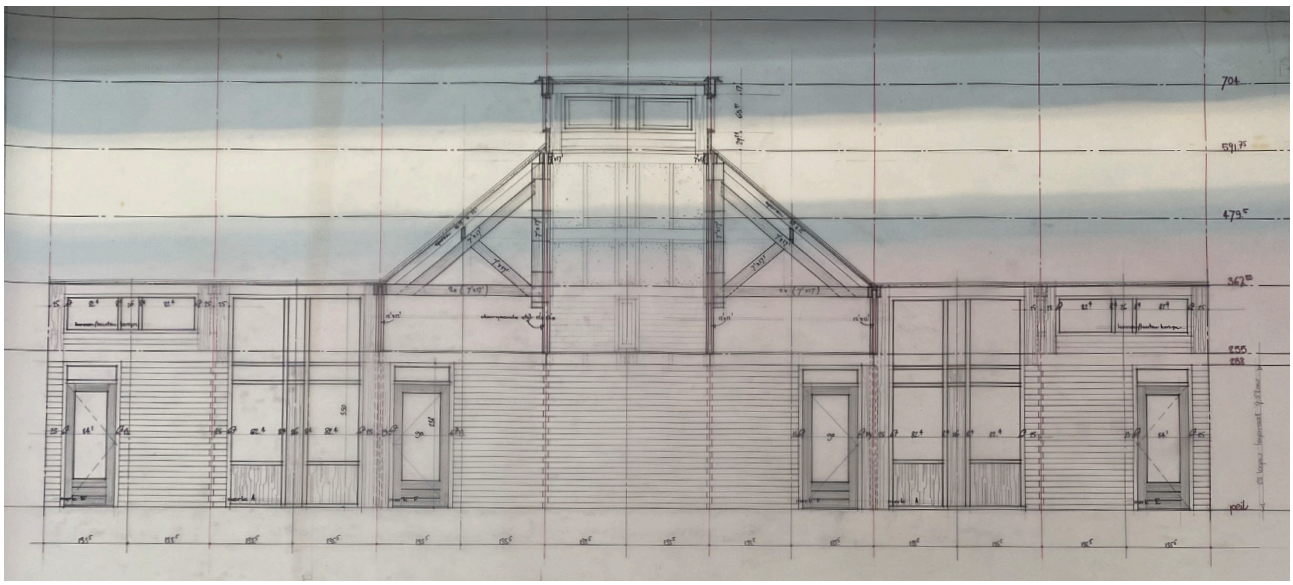


Figure 15: Jan Verhoeven, Section of the structure (HNI)

d) Basisschool Airborne was a single-story building so there was no representation of analysis with overlapping layers of plan as Het Speelhuis. However, in Figure 16, the sketch showed the overlapping layers of geometry which reflected the “aesthetics of number” in structuralism theory. The spatial layout of the building was refined by the outcome of these overlapped geometries. The first layer consisted of twelve dodecagon clusters, drawn in red lines, defining the fundamental composition of the building. The second layer included nine nonagon clusters which had a different location than the six-nonagon layer mentioned in the last sketch. These two layers together detracted the space of classrooms from the dodecagon clusters. In the diagram (Figure 17), it is clearer to see the inspiring hierarchy in the structuralism aesthetic.

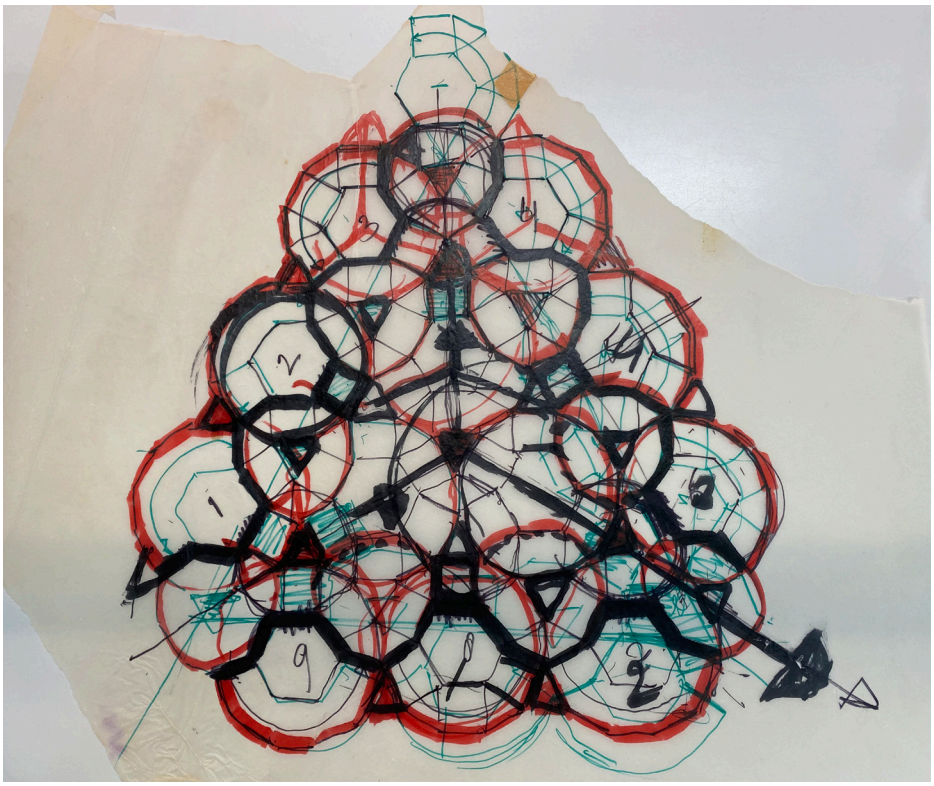
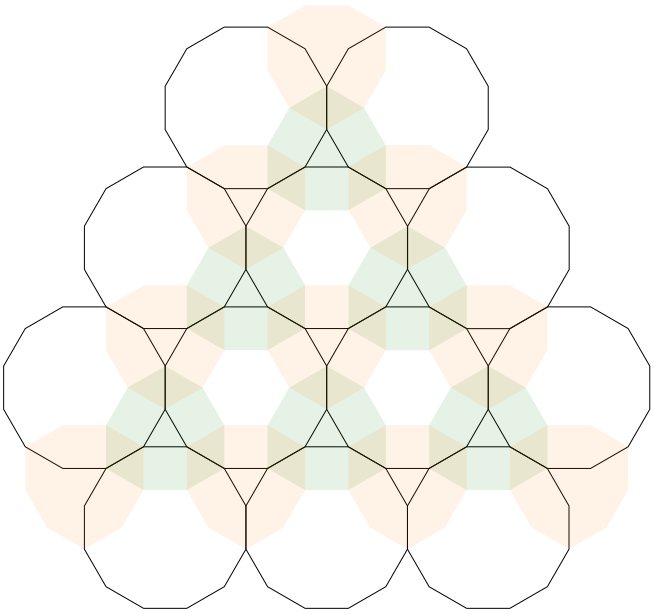
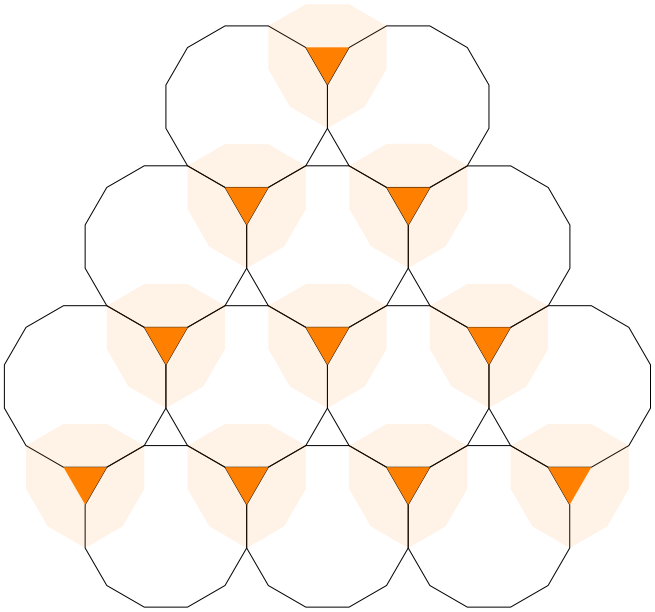


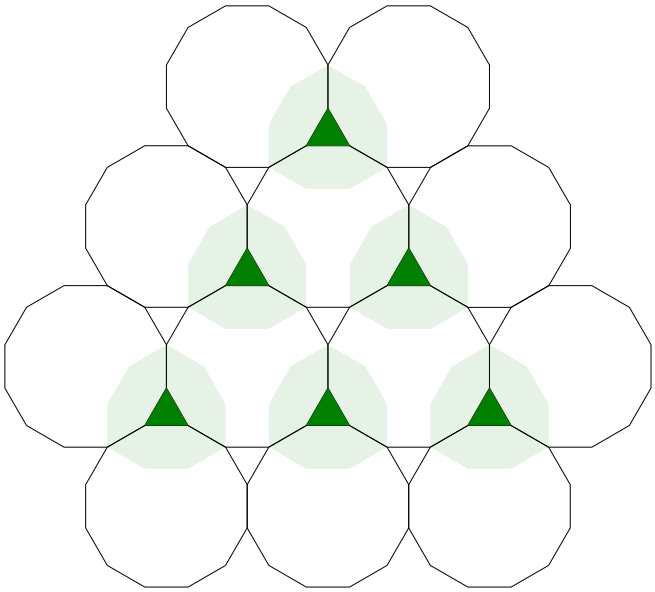
Figure 16: Jan Verhoeven, Hierarchy of plans (HNI)



First layer: twelve dodecagon clusters, a fundamental composition of the building



Second layer: nine nonagon clusters, taking the triangular gap between two clusters as the centre



Third layer: six nonagon clusters, also taking the triangular gap between two clusters as the centre, but in different locations

Figure 17: Analysis of the overlapped geometry

3.4 Discussion: Architectural Impacts on the Social Interaction of Kids

Among the eleven school buildings designed by Verhoeven, there were two Montessori schools and two Jenaplan schools[66]. Although Basisschool Airborne was a normal public school, the way that he cared about the users and the strategies that he used for school building were deeply rooted in his mind that became a guide for all school-building projects. In the discussion, the text tries to conclude how the pedagogical theories had similarities and collaboration with Verhoeven's structuralism design philosophy and how these theories were revealed in architectural design.

3.4.1 School Environment and Atmosphere

a) Children's autonomy

In terms of the functional layout, the classroom, and playroom took the most part of the clusters while functions for adults such as the offices, administration rooms, and staff rooms were considered less dominant. It corresponded to the pedagogical idea that children should play the most important role in the educational system. The autonomy of the children had priority over the authority of the teacher[67]. Children should choose the areas they wanted to occupy, the friends that they wanted to play with, and the activities that they were interested in, which was an important practice for them to assimilate into the unfamiliar environment. Apart from the layout, the autonomy of children was also emphasized in the spatial design. Classrooms were separated into centripetal clusters of equal size, where children with similar characteristics were divided into the same and smaller groups. It represented fairness and decentralization that every child was equally important and every group was equally fair.

b) Sense of community and family

Behind the universal design strategies in Verhoeven's projects, laid his universal notion and philosophy. In an interview, Verhoeven mentioned the term "identity"[68]. He took community as an individual collective, where each resident or student was equally crucial and non-negligible. The relationship between individual and community had been always the main focus in Verhoeven's design, which conveyed humanism care. From this perspective, although with different functions, school, and housing had similar attributions, which explained why they were the main areas of structuralism designs.

For Verhoeven, identity was not only important for individuals but also for the architecture itself. He would like to make the building "grow" from the earth as if it was always there[69]. In the design, the 10-centimeter steps also met the concept of growth, where the gaps upstairs and downstairs made the building more integrated into the topography. The slight gap was not enough to be considered a threat, instead, it trained children's athletic and meticulous observation abilities. Using vernacular material and style did not mean building something old and similar, but to build a home-like environment where people can find their own way. As Verhoeven put it: "I think it's important that you let people discover themselves and not grow followers. We are all unique and must find our own way[70]". These kinds of people-oriented

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[66] Zahle, Mette. Segaar-Höweler, Dorothee C and Andrea, Prins. *Jan Verhoeven. Exponent Van Het Structuralisme, 1926-1994*. (Rotterdam: Stichting Bonas, 2012), 98.

[67] Boekholt, P.Th.F.M. and de Booy, E.P., "Het basisonderwijs Ontwikkeling van het kleuteronderwijs en lager onderwijs", *Geschiedenis van de school in Nederland vanaf de middeleeuwen tot aan de huidige tijd*. (Assen/ Maastricht: Van Gorcum, 1987), 241.

[68] Bosker, Bert. "Techniek is middel, nooit doel in de architectuur", *ab: architectuur/bouwen* (3) 2 (1987): 56.

[69] Ibid., 57.

[70] Ibid., 57.

thoughts almost coincided with the pedagogical thoughts that had paid increasing attention to children themselves.

According to the committee of 1953[71], pre-educational children were not the miniature version of primary school students whose existences kept developing and changing at all times. They needed a transitional process to build relationships with others besides family members, which is an emotional rather than academic preparation for entering primary education. Therefore, it is necessary to establish a family-like atmosphere in kindergartens where individual differences in the degree of reliance on family should also be taken into consideration.

3.4.2 Pedagogy Strategies

a) Montessori philosophy

As has been mentioned in earlier chapters, Maria Montessori emphasized the sensitive period of pre-educational kids in terms of order, movement, and social life. In the sensitive period, children are in an unfinished state when they have neither been trained by the rigid discipline, nor lost in the fixed route of academic development. As was emphasized by Verhoeven, children should be allowed to freely observe the world from their own perspective and be inspired by what they are interested in[72]. An ordered space was essential for building the study pattern. Maria proposed daily maintenance for the interior finishes such as rearranging books on the shelves and putting back the chairs. While for the architecture itself, a logical spatial order was as important as the interior environment. Compared to complex buildings, where the winding circulation would be hard for developing children's brains and establishing comprehensive logic.

For Maria Montessori, repetitive movements could help build procedural memory which later shaped the characteristics. The repetitive movements not only lay in daily behavior, such as sweeping the floor and wiping the glass but also in the movements between spaces. The repetitive units of the structuralism design allowed children to clearly understand the scope and functions of the school, which not only met the demands of sensitive period of order but also enhanced the pattern of daily routine by repetitively moving between modules.

In Montessori's theories, education was reflected in every speech and action. The mixed-age groups allowed younger kids to have contact with older ones. In Basisschool Airborne, instead of solid partitions, the division of space is achieved through threshold spaces. The openness and softness of partitions enabled cross-age communication to more naturally occurred. Younger kids can establish procedural patterns by imitating the behavior of older kids, while older kids would set an example for younger kids. In this case, unconscious education happened not only between students and teachers but also among different groups of students.

b) Jenaplan philosophy

The main difference between Montessori and Jenaplan philosophies was that in Jenaplan theories, themes of education were clearly defined: communication, play, work, and celebration, which was also related to spatial design. Because the building consisted of repetitive units, the spaces could be flexible and polyvalent. The central area can be the public traffic space for kids

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[71] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 17.

[72] Roos, Jeanne. "Jan Verhoeven, omdat hij bouwen een van a tot z menselijk proces vindt". *Het Parool*, May 13, 1976.

to meet friends, elder students, and teachers while it can also be the hall for celebrations and lectures. Dodecagon classrooms were the places for students to work while they can also be the play room to entertain. As has been mentioned, in Verhoeven's sketches, the number of classrooms for primary education and pre-education was not firmly decided. As the units were all the same, the function can be changed according to the need. Moreover, the activities were not limited in the architecture. In the regulation of 1953, outside spaces had equal significance as interior spaces[73]. On one hand, kids can have closer contact with nature, which for both educators and Verhoeven was essential for education[74]. On the other hand, there were enough areas for them to hold different events. In traditional pedagogical systems, children were well-protected in a narrow space. However, it was equally important as an academic achievement to allow them the freedom to work practically and independently as far as they are in a relatively safe environment[75]. The richness in Jenaplan education embodied in the repetitive form of structuralism design that there were infinite possibilities to fulfill the needs of creativity in education.

3.5 Architectural Typology Transformation during the 1950s and 1980s

In the former chapters, it was proved that the combination was mainly determined by the development and demand of pedagogy and society. Architectural theory, namely structuralism ideas, was more to respond to the requirements of school buildings to cater to the new pedagogical theories and provide functional spaces for school reformation rather than a decisive factor of the combination. However, in the post-war context, the emergence of the structuralism movement and new types of school buildings were also a destined result, instead of merely a resonation of pedagogy. It had its own tendency and traceable process of development.

Firstly, after the war, the traumatic memories evoked the pursuit of solidarity and human rights. Therefore, the core ideas of new pedagogical theories and structuralism theories both contained humanism concerns, highlighting the sense of community and user participation. Humanism care determined the resemblance between the two fields and ensured the success of the adaptation of new architectural style to new pedagogical requirements. When looking back on the development of school building typology in the post-war period, there was already a tendency of designing polyvalent and flexible spaces. Since the 1950s, a modular typology occurred in school building experiments, using pre-fabrication modules to realize high-efficient and wide-implemented school buildings[76]. In the beginning, the dominant type of spatial layout was corridor school where classrooms were modular units arranged next to a wide and straight corridor which was also a functional space for flexible use (figure 18)[77].

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[73] Vereniging van Nederlandse Gemeenten and TNO Instituut voor Gezondheidstechniek. *De Nieuwe Kleuterschool : Rapport Van De Studiecommissie Voor De Bouw Van Kleuterscholen*, Blauwe Reeks Vereniging Van Nederlandse Gemeenten. (No. 29. 's-Gravenhage: Vereniging van Nederlandse Gemeenten, 1959), 17.

[74] Leusder Krant, "Jan Verhoeven, architect van de Montessorischool: 'Met architectuur kun je inspiratie geven aan mensen en er uit halen wat er in zit'". *Leusder Krant*, September 27, 1979.

[75] Roos, Jeanne. "Jan Verhoeven, omdat hij bouwen een van a tot z menselijk proces vindt". *Het Parool*, May 13, 1976.

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[77] Verlinden, Johannes. and Zietsma, Jouke., *School building in the Netherlands*, (Den Haag: the Netherlands Government Information Service, no date.): 19.

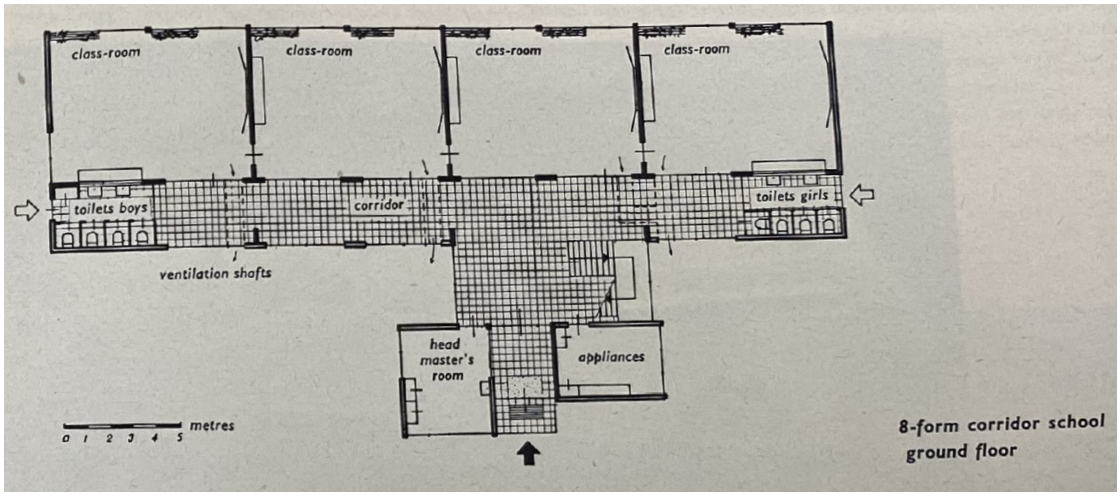

Figure 18: J. Zietsma, 8-form corridor school, "The construction of schools and its practical and economical requirements", *School building in the Netherlands* (HNI)

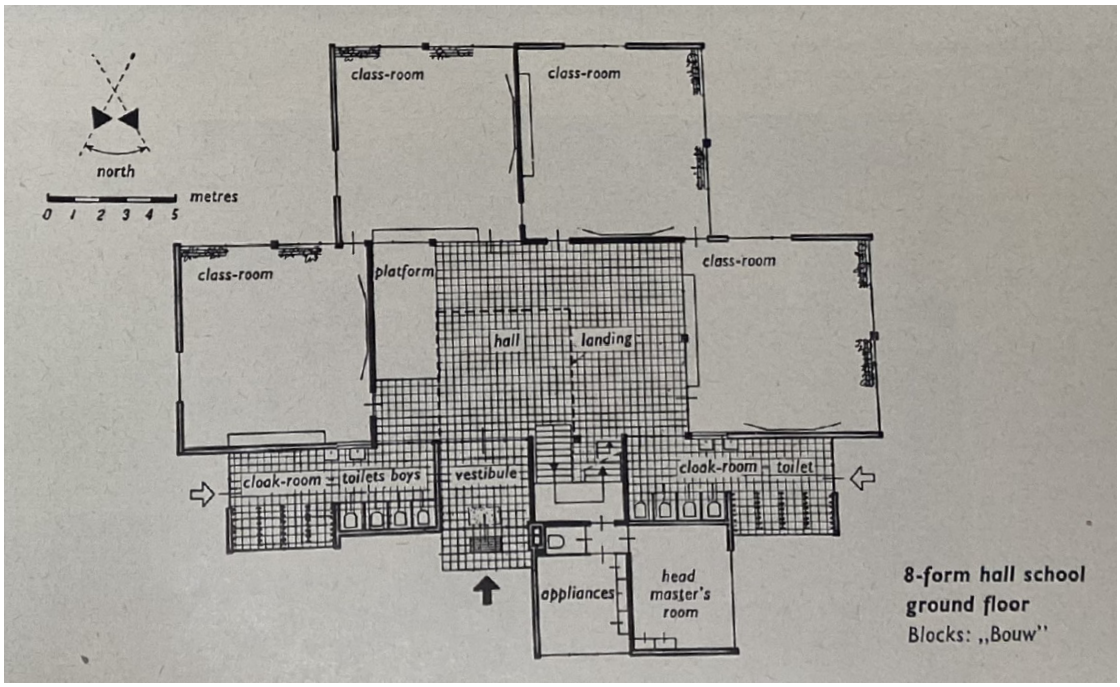

Figure 19: J. Zietsma, 8-form hall school, "The construction of schools and its practical and economical requirements", *School building in the Netherlands* (HNI)

Due to the austerity in the budget for education in the 1960s, buildings were required to be built more economically. Thus, corridor-less school typology occurred where the public space functioned as a central hall for traffic, assembly, and free activities (Figure 19)[78]. However, to fulfill the large demands of school buildings, most of the buildings were built for emergent use which was not suitable for long-term use. There were only classrooms and a brief public space for other functions that lacked spaces for comprehensive education such as gym and library[79].

[78] Verlinden, Johannes. and Zietsma, Jouke., *School building in the Netherlands*, (Den Haag: the Netherlands Government Information Service, no date.): 19.
[79] Ibid., 24.

Therefore, hall school was developed to contain more functions and hierarchies in the building (Figure 20). It had fewer traffic routes, clarity in functions and the sense of space, and the public hall with flexible functions. These principles were more feasible in small-scale buildings for pre and primary education schools. Basisschool Airborne had a similar core to hall-school. The central hall in the middle tied the whole building as a community, building a harmonious relationship with other parts of the building.

Since then, in the 1970s and 80s, more functions had been introduced into the school building when the regulations of pre and primary education were improved. At the beginning of 1950, there were only classroom, canteen, garden and backyard. Parking, office, teacher's room had been gradually added and even library, auditorium, gym and central hall. After the education reformation, the configuration of the school building was no longer classroom-dominated. More attention had been paid to children's diversity and autonomy. Health care and special care for disabled people were also regulated.

In summary, "basisschool" typology was not only the product of the development of pedagogy under the background of shrink of budget and the poor quality of students but also catered to the trend of the development of architecture. The demand for pre-fabrication modules, the sense of community, and the requirements for flexibility and multifunction in the space contributed to the emergence of structuralism ideas. Through the development of school buildings from kindergarten to basisschool, people can have a retrospective wandering in both architectural and pedagogical fields.

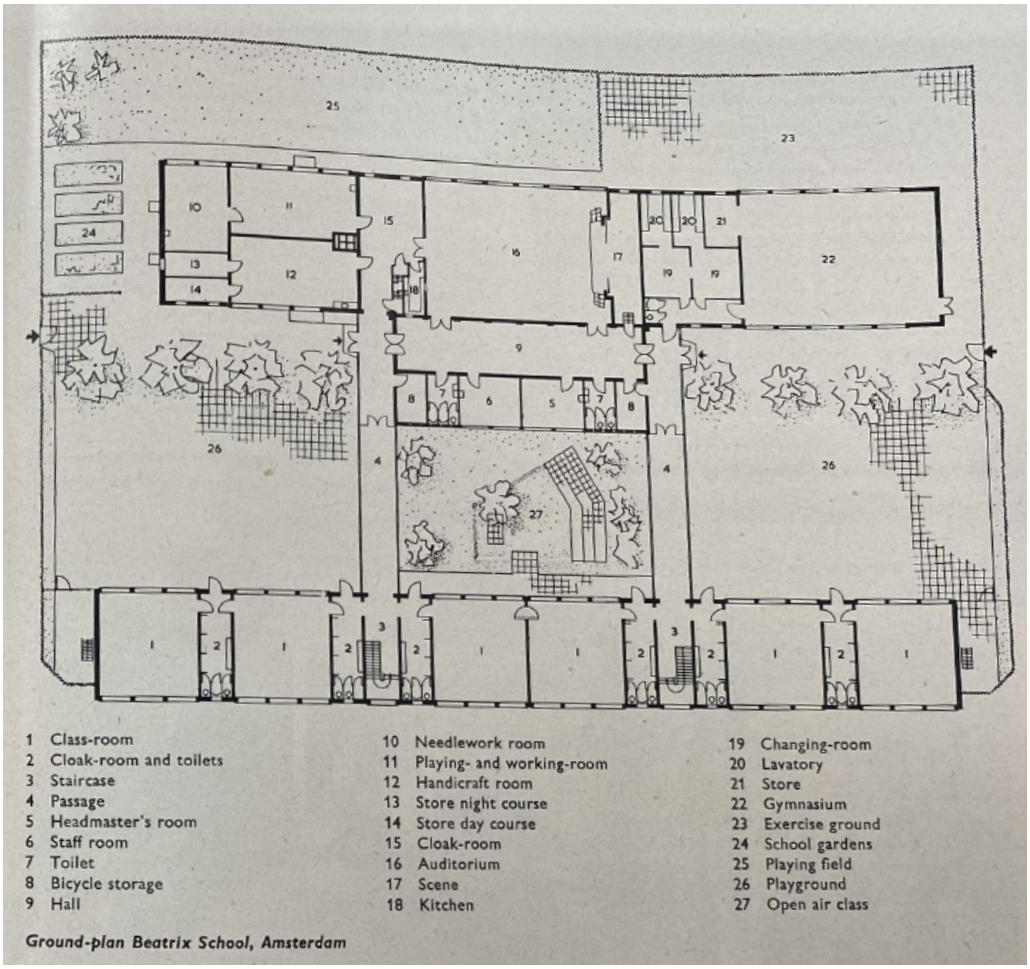

Figure 20: J. Zietsma, Ground floor plan of Beatrix School, "The construction of schools and its practical and economical requirements", *School building in the Netherlands* (HNI)

4 Conclusion

In 1980, kindergarten and primary school in the Netherlands were combined into a new type of educational institution: basisschool. The main reasons behind included the shrinkage of the educational budget in economic conditions, the school reformation in social demand, and the children-oriented theories in pedagogical development. Basisschool also developed into a new architectural typology that was multifunctional, emphasizing user/student participation and comprehensive experiences. The flexibility and openness in basisschool reflected the core of the structuralism movement, which had similarities in the direction and focus with pedagogical theories during the post-war period. They both paid the most attention to the physical and mental requirements of the users/students, trying to establish the sense of community and spatial cohesion, which make it possible that people with different ages, backgrounds, and classes can encounter in the mixed-used space.

Through the case Basisschool Airborne by Jan Verhoeven, it is more obvious to see the resonation between the pedagogical and architectural theories and how the structuralism design implicitly fulfilled the requirement and guidance of children's education. The thesis mainly compares Montessori and Jenaplan philosophy and Verhoeven's design strategies. Pre-education period for Maria Montessori is a crucial period in children's growth when they need more autonomy and freedom to build nice characteristics, the right perception of order, and the potential tendency of future career through various activities and abundant social interactions. To meet the target, a qualified environment is required where provided not only enough spaces for work, play, and public mixed-use, but also special concerns about health, sanitary and unpredictable chaos. The vernacular materials and introduction of light in Verhoeven's work extracted the indifference of modernity but created a sense of locality and community that was more suitable in school buildings. The repetitive modules and spatial rhythm benefited the growth of children's brains, facilitating the teaching methods which encouraged students to maintain an orderly routine. The polyvalent spaces reflected the flexibility and openness in structuralism theory, especially the expansion concern in this school, indicating a sustainable manner in both architecture and education.

During the post-war period, in multiple fields, unity and people-orientation were the keen factor and concerns. Basisschool was not only a resulting product of the development of pedagogy but also that of architecture. It was inevitable to develop a typology that carried the expectation of peace, love, and constant stability. Although pedagogy and architecture developed respectively, the era already provided the best condition for structuralism ideas to land on the school buildings.

The ambition of the thesis was to study the whole process of pre-educational institutions, from kindergarten to basisschool. However, in this text, the main focus was on the basisschool typology which was a result of the development process. Actually, there were rich steps in between commendable attempts to experiment with both the multifunctional complex and structuralism ideas. It would be more discovery when the research ventured deeply into the gradual developments taking one decade as a unit period. In this case, more resemblances would be found between pedagogy and architecture and more drivers might be found to explain a specific decision made in history and bring them more meanings in the contemporary era.

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Figure

Figure 1: Ger van der Vlugt, Johan van der Keuken, Ronald Roozen, and Kinold Klaus, "APOLLOSCHOLEN - MONTESSORISCHOOL EN WILLEMSPARKSCHOOL, AMSTERDAM", AHH, 1983. Digital image.
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Figure 2: Broekbakema, "FACULTEIT BOUWKUNDE TU DELFT", Broekbakema, 1970. Digital image.
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Figure 3: Jan Verhoeven, cited in Zahle, Mette. Segaar-Howeler, Dorothee C and Andrea, Prins. *Jan Verhoeven. Exponent Van Het Structuralisme, 1926-1994*. Rotterdam: Stichting Bonas, 2012.

Figure 4: Verhoeven, Jan. “VERH.110371969 Basisschool Airborne aan de Bram Streeflandweg te Renkum-Heelsum in opdracht van de Vereniging voor Protestants-Christelijk Kleuter- en Lageronderwijs, 1976-1980”, Verhoeven, Jan fonds, Het Nieuwe instituut, Rotterdam, Netherlands, Inventory number VERH0063, r28.10.

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