

# Paimio Sanatorium: interrelationships within a technological system

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## Abstract

This paper discusses the water, sewage, ventilation and electrical systems at the scale of the patient room, as well as the scale of the site, in the Paimio Sanatorium (1928–1933), designed by Alvar Aalto. The theoretical underpinning for the study is the actor-network theory developed by the French sociologist Bruno Latour. Besides the social theory, it also assigns a role for material factors in the evolution of technological systems. In this theory, the relationship between social and material *actants* is reciprocal, an observation which opens up interesting angles into architectural research. The study aims to answer the questions: which *actants* modified the decisions regarding different technological solutions; how did they mediate this input; and what kind of impact did the processes make, in themselves, in return?

I deduced, that the building process of the sanatorium involved a lot of new technology, the application and development of which was an integral part of the architectonic meaning creation in a large-scale institutional construction such as this, and it succeeded in varying degrees. The success or failure of the design largely depended on how viable a network the *actants* were together able to assemble.

The examination of the relationship between architecture and technology in the building process of the sanatorium reveals which issues were critical for the architect and for the other *actants* in shaping the different solutions, and helps us understand why a certain system was developed further than another – and how modernism came to be expressed in Paimio Sanatorium.

Keywords: Alvar Aalto, Actor Network Theory, Paimio Sanatorium, Finland, Construction history



Figure. 1. This photo shows the key hygiene fittings for the patient room. Photo ark-byroo, 2015.

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## 1. Introduction

Beatriz Colomina has argued that, in the 20th century, the production of architecture shifted from the building site to the immaterial domain of the media: architectural publications, exhibitions and journals (Colomina, 1998, 14–15). However, when a building is eventually constructed, the architect has to face the local culture, other social stakeholders and the material reality. The architect's vision of a building is tested when it must be reconciled with various phenomena, and hence loses its autonomy.

I have studied Paimio Sanatorium (1928–1933), which is considered Alvar Aalto's international breakthrough design; on the one hand from the perspective of the architect's discourse and on the other hand, of the realisation of the building. I have examined the chain of events at the construction stage of the solutions that were ideologically important for Aalto within the framework of the interaction between the different stakeholders, employing Bruno Latour's Actor Network Theory.

Like Latour, I have understood technological systems as being heterogeneous, and not merely physical or mechanical. Social actors, such as individuals, companies and institutions, were equally treated as parts of technological systems. Moreover, they represented different values and attitudes, which also formed a part of technological systems. In this study, I approached the building process as a technological system. It then followed that the different *actants* were seen as shapers of the technological system.

The examination of the relationship between architecture and technology in Alvar Aalto's Paimio Sanatorium reveals which questions were critical in shaping the different solutions, and helps us understand why a certain system was developed further than another – and ultimately how modernism came to be expressed in Paimio Sanatorium.

### 1.1 Research question

A new architectural ideology was championed in the Europe of the interbellum period by architects active in CIAM<sup>1</sup>, who embraced in their professional discourse the rationalistic management techniques developed in the United States (Brunnström, 1990, Standertskjöld, 2010). Aalto drew influences from this culturally radical Modernistic discourse and applied new ideas to his work. He felt

that architecture should respond to the demands of the age, that is, modernisation (Schildt, 1984,1997). Although the ideology of Modernism ignored the significance of local culture in construction, buildings are inevitably cultural objects that are tied to both time and place (Hartoonian, 1997, 34–42). What is interesting to analyse is how did Aalto manage to reconcile international ideology and local building culture in a country where the degree of industrialisation in the building sector was relatively low, and in which way international discourse was brought into practical solutions in the Paimio Sanatorium project.

The systems for heating, ventilation, sewage and electrical installation developed rapidly in the early decades of the 20th century and the demand to incorporate them into the architectural overall design became paramount. Who knew how to employ these new systems and what were the critical points to consider in developing solutions? Were the systems sufficiently ready to be used as such, or did the architect or other project stakeholders contribute to their development? Special attention was paid to find out which building parts of the sanatorium Aalto was most interested in. The question that emerged from this is: Were these building parts that he paid special attention to the same that were highlighted the international discourse? And again, which technological systems did he pay little attention to? I will compare Aalto's approach to water, sewage, ventilation and electrical systems at a scale of the patient room, as well as the scale of the site. The subject matter of this research was to study in what ways specific architectural solutions were developed in the interaction between different *actants* in the heterogeneous building process, comprising both human and mechanical factors: who and what influenced the technological solutions and systems of Paimio Sanatorium, and in what way did these players influence the process, and how did the process affect them? This research attempts to bring out the interplay, especially between the architect, the client, the engineers, the builders and the building materials.

Special attention was paid to the role of the architect, whose aim was to convince all the other stakeholders of the superiority of his solutions: how did he express his ideas, justify his views and act to reach his goals? The working hypothesis was that the architectural solutions were influenced by the process of materializing the building by the other *actants* than the architect. The focus of this study is therefore on the process of design and construction.

## 1.2 Exploring documents in multiple archives

I allowed the actants I focused on to lead me to the salient perspectives and discourses. Also the architectural discourse relating to the technological system was seen as part of the reality of the research object, and of the architect in particular. Besides the written sources and archive material, the building itself served as evidence as it in some cases revealed something else than for example written documents and drawings. Different tactics were used in regard to the evidence; for example, the minutes of the Building Board and the Building Committee meetings, important source material, were considered both as determinative and as inferential evidence, and the contemporary literature as contextual evidence.<sup>2</sup>

The research focuses on the making of the building, the interplay between the stakeholders and their decision-making process. The timeframe of the building project extends from 1928, when the decision to build Paimio Sanatorium was taken by the Federation of Municipalities of South Western Finland and the architectural competition, open to Finnish architects, was launched, until 1933, when the sanatorium was inaugurated.

Texts written by influential architectural ideologists of the 1920s and the 1930s were analysed. In this research closer study of the international discourse was limited to the printed presentations of Le Corbusier and Walter Gropius at two CIAM seminars.<sup>3</sup> The selection of Aalto's texts was based on date of publication

and the value of the information.<sup>4</sup> The textual analysis was done by identifying ideas or ways to understand the relationship between the architecture and technology of the period. It focused on the strategies of the writer, and tactics dealing with the topical focal points of this research. Aalto's own texts were analysed in the same way as Le Corbusier's and Gropius's texts.

For the research into the execution of the building design, one of the two archives of major importance was the archive of the hospital itself. The minutes of the Building Committee and the Building Board are records of decision-making during the building process, of which most are preserved for posterity. The hospital archives also contained contracts, as well as the drawings and specifications of the engineers and companies responsible for executing different parts of the building. In both of these administrative bodies, the Board and the Committee, the same person acted as secretary. Most of the minutes are typed, and some are handwritten. In each document there are several sections, each one dealing with one subject matter only. The style of the documents is objective, the texts are short, and most often only the decisions are recorded. In the minutes of the executive body, the Building Committee, the discussion of alternatives and the grounds for decisions are mostly omitted. A robust narration of each building component or technological system was first compiled on the basis of the minutes of the Building Board and the Building Committee, the written contracts and the inspection records, which were arranged in chronological order. On the one hand, these documents were considered as factual documentation of the course of events. This narrative of each building part was compared with other source materials, such as drawings, specifications and the building itself. On the other hand, the minutes are part of the reality of the research object, the social interaction of the decision making process. The minutes reveal, e.g., the intentions of different parties and answer questions, such as who proposed what, whether someone objected to something, whether the administrative bodies altered the plans, in what way the solutions and decisions evolved, and who was entitled to act as the representative of these bodies in different situations. The matters that were not discussed in these meetings also reveal characteristics of the process. Besides the courses of action, the minutes reveal what was important for the body to record and how decisions were recorded.

Architectural drawings and other design documents were grouped to match the topical focal points of this research. The groups included drawings from the competition phase to the working drawings, and from elevation drawings to the smallest details and standards drawings. Within each group the drawings were arranged in chronological order. This method was useful for understanding the way in which the design was altered and, e.g. which solutions were abandoned. These considerations were then juxtaposed with the analysis of the minutes and the workshop drawings. Through this method I was able to trace which building parts received the most design effort and who participated in the process. Prior to this analysis, I compiled a database of the entire drawing material, which I would use as support for my analysis. The database also enabled me to carry out image searches.

### 1.3 Theoretical framework

I approached the relationship between the architecture and technology of Paimio Sanatorium through the perspective of the French sociologist Bruno Latour's Actor Network Theory. I have discussed the design and the construction of the building as a process of innovation. According to Latour, a new hybrid, which in the present study was represented by a building, acquires its shape simultaneously as a social, subjective and material entity. According to Latour, the success of any technological hybrid depends on how strongly interlinked is the network of *actants* representing different ontological categories. In the context of the Paimio case, I have investigated the developers, designers, builders and the material dimensions as such *actants*, who come together, connect and change one another to form a network. Latour uses the term to translate, when referring to the active changing. Below, I have applied Latour's theory in a critical

discussion of the delimitation of the research object and the nature of the groups affecting decision-making.<sup>5</sup> My aim was to reveal the interrelationships within the technological systems at Paimio Sanatorium.

The idea of reciprocity lends particular interest to the actor-network theory from the specific perspective of interpreting architecture, as it provides tools for tackling the interplay between social networks and the material reality in a technological process.

Rather than “actors”, the actor-network theory, developed by Latour and his colleagues, talks about “*actants*” that are heterogeneous in scope. *Actants* has been attributed with the ability to act. This attribution can be the result of a proposition, a technical artefact or another *actant* through *trials* of strength. An *actant* is ultimately defined by its strength. They form heterogeneous networks, in other words, they involve *actants* from many different ontological categories, and the strength of the collective thus formed depends on the strength of the hybrid that these *actants* have managed to constitute (Ylikoski, 2000; Latour, 1988, 252; Latour, 1999, 303–304). Action is something that takes place between people and things. Latour urges the researcher to observe the details in view and map out the chain of events. His example directs our attention to what networks reflect of themselves to the outside world (Lehtonen, 2000). In this work I have aimed to adhere to this type of anthropological approach in my analysis of the construction process of Paimio Sanatorium and have focused on the specific chain of events at the construction stage that somehow proved critical and that were taken under discussion.

Using Latour’s set of concepts I have looked into the hybrids of architecture, at once both material and social. From Aalto’s perspective, the aspects of ideological importance were, among others, the patient rooms and the district systems. For the client, however, providing care for the sick and to do so economically were the primary concerns.

The actor-network theory is interested in the processes through which *actants* mutually build and modify their respective operative situations and objectives. The mobilisation and persuasion of *actants* and the translation of their motives so that their inclusion in the network becomes a necessity are essential (See e.g. Latour 1999 [1987]; Ylikoski 2000) Although the *innovator* of the network, who initiates the formation of the hybrid network, is in a key position, success is primarily determined by the quality and quantity of the tools of cognition rather than, for example, the superior mental abilities of the *innovator* (Latour 1988; Ylikoski 2000).

Another methodological principle of the actor-network theory is the principle of generalised symmetry, which attributes equal footing to both human and non-human *actants* assigning the same explanatory weight to both. In other words, Latour aimed to erase the distinction between the subject and the object, or society and nature. The principle of generalised symmetry is linked with the aim of seeing the object as an active entity participating in a construct as well as with a serious attempt to investigate the significance of objects in human activity. The effect is not one-directional.

Regardless of the criticism<sup>6</sup> it has elicited, I find the actor-network theory a relevant angle to architectural research. By applying Latour’s approach, I have given the *actants* a chance to “speak for themselves” about where their interests lay in the design and construction task of Paimio Sanatorium. Furthermore, understanding the master of design as a collective emphasises the nature of design and building as a collaborative process. Like Latour, the point is to see one’s hero as a collective and not as a historical person (Ylikoski 2000). The impact of the collective on the architectural solution is particularly interesting in the case of a building that holds a canonized status. When discussing Aalto’s buildings we fail either to see or to understand the input of other designers. This

is the very aspect into which the approach and analysis suggested by Latour, provides useful insight. I would also argue that it is possible to make the inanimate architectural hybrid “speak”. For example, designs that have been discussed and explained through text and images express the designer’s knowledge of the material’s behaviour and his intentions regarding the material. The transition of the production method from manual construction towards industrial building methods was also in line with the architectural ideology of the time. The architect aimed to realise his view, to make the material speak, by applying industrial production methods. The reciprocity in the material becomes apparent in, for example, the aesthetically inspired use of material, low production costs or the qualities attributed by the material to the hybrid of which it is part, by way of its fire-resistance or heat-isolation quality. By scientific investigation of the architect’s work, I specifically mean his communication with other designers, the client, the builder and product manufacturers, in addition to the actual design work.

## 2. Analysis

The examination of Aalto’s texts and architectural work proved that the source of Aalto’s inspiration during the Paimio years were the informal discussions, seminars and exhibition held within the sphere of CIAM. Modernisation and the post-World War II housing shortage led the European debate towards town planning and, furthermore, architects were keen to respond to the challenges of their time. CIAM’s 1929 conference, which Aalto attended, was held in Frankfurt am Main, where an ambitious housing programme had been implemented, headed by the architect Ernst May. May extended the scope of design from *Siedlungen* to include the design of objects. Similarly, Le Corbusier stressed the large scale in his urban utopias, as opposed to the small scale in his theories about the biological needs of human beings and the examination of them within the confines of a dwelling. In his paper at the 1930 Brussels seminar, he likened human action with architecture as opposed to the static frame (Le Corbusier, 1931, 48–57). Aalto’s article “Asuntomme probleemina” (Our housing as a problem) from 1930 and “Bostradsfrågans geografi” (The geography of the housing question) from 1932 reflect these two scales and reveal the architect’s interest in both. In the next chapters I will discuss how Aalto succeeded in integrating the installations into architecture in the Paimio Sanatorium project, in other words, a conscious approach of issues in two different scales: the patient room, and the site.

### 2.1 Minimum apartment

The examination of the architect drawings revealed that Aalto conceptualised the two-bed patient room as a “minimum apartment”. The room was small in size, making space-saving design solutions necessary. Aalto improved the functionality of the room by way of adding details of his own design, and by approaching the room as a holistic problem. To approach the design problem from the perspective of a minimum apartment was justified by a number of factors: the serial production – the patient room was not a singular space, but was repeated 120 times in an identical form; space-saving, which resulted in meticulous scaling and placing the radiator on the ceiling; multiplying the space through added functional features, with the bedside table and night lamp as good examples; and emphasising individual patients’ privacy in a twin room by various acoustic means. Aalto had addressed the importance of acknowledging patients’ psychological and physiological needs as the basis for design in a talk he gave in 1931 in Oslo (Anon, 1931). The architect meticulously studied each individual solution for the patient room. When the project was nearing completion, he drew numerous diagrams analysing the functions of the space.

Owing to the small size, holistically designed furniture and integrated technical systems, the twin patient room of Paimio Sanatorium is based on an idea similar to the small apartments in German housing estates of the time. The centrality of

the patient room for Aalto becomes evident in the sheer number of drawings related to it. Aalto standardised the patient room with the objective of introducing the furniture designed for the room into serial production. He succeeded in integrating technical systems into his own design as advised by medical experts as well as sub-contractors and manufacturers. The essential values informing the design of the patient room were a quiet environment, preventing the spread of disease, fresh air, good heating and eye-friendly lighting. I interpret Paimio Sanatorium as a collective dwelling house, where each resident was reserved a private space, albeit small, and a great deal of consideration was given to facilitating shared activities and practicality.

The light fittings were a topical design task, as electricity was being used to a greater degree, and the quality of light bulbs was improving (Norvasuo, 2009, 33). Helge Kjälman had introduced three principles of overhead lighting in a 1927 issue of the Finnish Architectural Review: direct, semi-diffuse and diffuse, which were similar to the principles discussed by Gispen in his article of the following year in the *Deutscher Werkbund* publication *Innenräume*, a volume that Aalto had in his library (Kjälman, 1927, 37–41; Gispen, 1928, 147–152; Norvasuo, 2009, 37). Markku Norvasuo (2009, 53–54) argues that Poul Henningsen related to Aalto the method by which analytical and empirical approaches converged and were utilised in creating the form of a light fitting. Norvasuo also maintains that the overhead lighting in the Paimio patient room represented the view that gained popularity among architects in the 1930s, according to which light-coloured ceilings or walls could be used instead of reflecting surfaces incorporated in the lamp. According to Norvasuo (2009, 79), Aalto's patient room lighting design appears to be a compromise, in which technically appropriate lighting and an experientially satisfactory environment have been brought together.

Knowledge of electrophysics and the function of electrical equipment were essential for a lighting designer. Apart from the influences they apparently drew from Helge Kjälman, Aalto's engineer, and Poul Henningsen, the Aalto couple were in a privileged position in terms of accumulating and absorbing knowledge about electricity, as Aino's brother and Alvar's brother-in-law, Aksel Marsio, was one of the first pioneers of the electrification of Finland (Suominen-Kokkonen 2015). At the time of the Paimio Sanatorium project, he was heading the Helsinki Electricity Works, and chairing the Lighting Economy Agency of the Finnish Electricity Association. The remit of the agency was to provide information and advice in all matters regarding electricity (Kjälman 1930, 56–58; Norvasuo 2009, 35). Aksel Marsio's expertise must have had a crucial influence on Aalto's knowledge of lighting and electrical systems and encouraged him in the execution.

By juxtaposing the design documents and the realised lamps, I detected that the overhead light in Aalto's patient room underwent a transformation at the execution stage. Initially, the reflecting surface was part of the light fitting instead of a light-coloured area on the ceiling. The reason for the alteration of the solution was presumably the high production costs, with Paavo Tynell of the Taito Company, the designer and manufacturer of the lights, probably being able to help in reducing them.

Besides rays of light, Aalto also studied the reflection of sound. It would seem that a calm acoustic environment was an equally important factor as lighting in the sanatorium environment. This would be the rationale behind the splash-free, noiseless wash basin; the requirement of silent heating, water and drainage pipes repeating through the work specifications; the use of Enso's fibreboard and wallpaper to create a soft surface on the patient room walls.

Aalto was also interested in developing panel radiators, as indicated by his contacts with Wärtsilä Corporation at the same time as the Building Board was

debating whether ceiling radiators should as a rule be used. The profile of the Rayard standard radiators used in the ceiling of the patient room allowed for the connecting pipes to run inside the radiator.<sup>7</sup> The Spanish architect Mateo Closa has perceptively pointed out that the technical features of the ceiling radiator were hidden beneath a decorative shell, and considered this a characteristic of the older architecture (Closa, 1991, 92–93). Closa was not, however, familiar with the story of how the ceiling radiators became part of the design. In reality, Aalto would have had no opportunity to influence the design of the radiators, even if he had wanted to.

Maintaining a high standard of hygiene was a key ritual at a tuberculosis sanatorium, and a designer's interest would particularly focus on furnishings that would allow for immaculate hygiene. The schematic diagram shows the shape and positioning of two basins, a spittoon with a drain placed between them, and a screen standing between the wash-basin area and the door. The diagram illustrates the placement of piping in the rising within the wall facing the corridor, with the service hatch placed on the side of the corridor.<sup>8</sup> The number of risers was adjusted to the rhythm of the patient rooms. The Building Committee authorised Aalto to negotiate with Arabia porcelain factory on an order of Finnish-made special wash basins, designed by the architect himself, for the patient rooms, provided that these would be less expensive than the foreign alternative and that the State Medical Board would approve of them.<sup>9</sup> Aalto, the designer, played on the fact that they were Finnish-made in order to win the assignment. In the standard drawing of the patient room basin, the basin has been given measurements and the water trap is enclosed in the riser.<sup>10</sup> The Building Committee decided to order the basins from Arabia.<sup>11</sup>

The patient room spittoon is presented in two standard drawings. They differ from each other in respect of the placement of the water trap, which is placed in the riser in one drawing and in the room in the other. Both drawings show a conical glass spittoon with an inward-curling rim, with water running inside the rim fed by a 20-millimetre pipe.<sup>12</sup> A third drawing shows two variations of the glass spittoon with a circular flush and bottom valve. Type A has a straight and Type B an angled rotational piece. Type A has been referred to as the perfect rotational piece. The drawing is probably by Alvar Aalto.<sup>13</sup> The drawings in question represent yet another attempt to develop a universal type.

## 2.2 District systems

With reverse logic, the building design and construction preceded a number of fundamental decisions made on district systems, including sewage and electricity. When the time came to make these decisions, real alternatives did not exist. The building frame is scaled so that separate grey and black water routes could not be arranged, and all waste water had to be directed along the same pipes, which in turn limited the options for the waste water treatment system. The size of the technical spaces was so small that the sanatorium had no realistic prospect of building its own power plant, which as late as 1931 was still being discussed as a serious alternative to purchasing electricity from the local grid. The local electricity supplier exploited its monopoly status and showed no willingness to negotiate on its tariffs. The report obtained by the client states that establishing a self-sufficient power plant for the sanatorium would require the acquisition of larger boilers, and if the sanatorium relied completely on its own power plant and not even reserve capacity was to be purchased from the outside, two boilers and machines would be necessary. The report did not discuss the profitability of a self-sufficient power plant to any degree, as there was not enough information to back up such calculations.<sup>14</sup> The alternatives in district systems or their spatial requirements were not observed in the early stages of the building project regardless of the fact that the background organisations of the Building Board, including the city officials of Turku, had a wealth of technological expertise. Neither the principal designer, nor any other stakeholder, ever demanded that the installation systems should be designed concurrently with the



architectural design. Aalto did not actively participate in the discussion on the electricity contract or the method of electricity production.

From the perspective of today's building design, it appears unfathomable that the water, sewage and heating systems, as well as the electrical installations, were designed only after the architectural design was complete. The knowledge and skills of different specialists were not at the disposal of the architect until the construction had progressed to execution. The architect was assumed to be able to accept the requirements of installation technologies without any interaction with specialists in their respective fields, at a time when heating, water and sewage technologies were still novelties in large, modern institutions. The architect's competencies were possibly subject to unreasonable expectations.

The work on water, sewage and heating systems was delayed by one year from the initial schedule, because the Building Board had initially, in spring 1930, requested for offers without a reference plan. As a result of the first contracting round, it first commissioned a plan on the basis of which the second round of tendering was held a year later. The one-year delay in the water, sewage and heating system contract had a direct impact on the overall schedule of the project. Collaboration between the architect and Radiator, who designed the water, sewage and heating systems, was fruitful and productive. However, the contract itself was given to another company, Vesijohdoliike Onninen, which had been carrying a smaller contract on the site and was therefore familiar with the developer. Cooperation between Aalto and Onninen was not without its difficulties, and resulted in excess billing on account of many details, for example, the water traps for the wash basins and spittoons in patient rooms. In June 1931, the contractor notified Aalto that the water traps must be connected, as there was not enough space in the wall cavity for them. In December of the same year, it transpired that the installation method of the spittoons and wash basins would have to be altered again, so that the spittoons would have a separate water trap, which incurred additional costs.

Besides holding the role of principal designer, Aalto also acted as the representative of the client to the contractors. He was in charge of purchasing and requests for contracting tenders. Aalto actively attempted to influence the choice of contractors on many occasions. He succeeded in engaging a contractor very close to him for the concrete frame at a very early stage of the construction work, based on a quote that was only the fifth cheapest. His conduct eroded the Building Board's trust in him. He failed in his attempt to exert his influence in the selection of the water, sewage and heating systems contractor so that the contract would have been awarded to Radiator, the designer of the concept. He did, however, manage to agree with the State Medical Board and the Building Board in the middle of contract negotiations on the use of ceiling radiators in the hospital. He believed he would in this way be able to unsettle suppliers other than Radiator, when suddenly faced with a new solution, which would force them to raise their prices. Eventually, all three tenderers were, however, willing to give a financial guarantee as requested by the Building Board, to vouch for the flawless operation of the ceiling radiators. In other words, Aalto's tactic backfired. The concept of Rayard ceiling radiators, which was originally conceived by Radiator, did not deter the other candidates and Aalto failed to secure the business partnership he had been planning. Using Latours's concepts: Aalto failed the *trial* and could not translate the Building Board's actions. It is apparent that the relations between Aalto and Radiator deteriorated as a result of the decision. Aalto had probably specifically contacted the owner and director of Radiator, Arthur E. Nikander, who had contributed to the design by expending his know-how and had trusted in a gentleman's agreement with Aalto regarding the contract.

Aalto and a major Finnish plumbing company, Huber, had probably clashed in the course of their earlier collaboration - the innovative plumbing system at Turun Sanomat - as Huber elected not to place a tender in either of the contracting

rounds. Huber would have been able to provide Aalto with the necessary expertise as early as 1930.

Another unusual detail is that no actual ventilation design was made at any stage, and it simply emerged as part of the heating plan. Had Aalto been in the position to travel to the Brussels seminar in November 1930, he would have been able to listen to Le Corbusier's paper in which he discussed the provision of ventilation and daylight as separate issues. In terms of ventilation, Aalto took a more traditional line and showed very little interest or mastery in resolving this system. The building was initially also to be installed with a central vacuum system, but this was never designed nor realised. Aalto requested for quotes on minute current devices, but as a designer he had no interest in these systems. In terms of electricity, his interest was limited to the light fittings as functional and design objects.

### 3. Discussion

One of the key questions in this study was to delimit the object of study. By analysing Aalto's writings as well as his drawings, I formed an opinion on which angles were important for the architect from the perspective of architectural theory. In addition, I also tracked the decision-making process of the Building Board and identified a number of topics that it discussed intensely and that caused conflicts. I followed these points of disconnect, which Latour has dubbed as *trials*. These *trials* of the building process, such as dissenting opinions and disruptions of production, revealed the intentions of actants, and because of them the technological solution often got a new direction.

I also applied Latour's theory in a critical discussion of the delimitation of the research object and the nature of the groups affecting decision-making.<sup>15</sup> My aim was to reveal the interrelationships within the technological systems at Paimio Sanatorium to the extent that they affected the architectural solution. However, the material posed certain challenges. The Building Board mainly recorded the decisions it made. This led me to assume that whenever debates or discussions were documented, they must have been crucial. In addition, there were several decisions made on issues that raised conflicts, and yet no discussion or decision had been recorded.

Latour's observations on descriptions of innovation and the intertwining of forces as events that do not lend themselves to generalised concepts formed, in my judgment, a sound basis for selecting a case study as the angle to my topic. Aalto absorbed international influences and applied them in practice in his home country which was still deeply agricultural and struggling in the throes of economic depression. In the field architectural research, Annemarie Adams, among others, has stressed that doctors and architects both left an imprint in hospital design and that modern hospitals in turn shaped medical practice. In line with the theme of reciprocity, I have discussed in this study how the prevailing material reality affected the design solution.

The standards that Alvar Aalto designed for Paimio Sanatorium can be interpreted through Latour's theory of the locality of scientific knowledge. Firstly, Alvar Aalto insisted on including the master drawings, cost calculations, work specification, working drawings and the standard drawings as part of the working drawings in his design contract,<sup>16</sup> which shows that it was somehow necessary to establish the concept of the standard in relation to the client, as the concept was in this context in all likelihood completely new to the latter. The architect created a large number of standard drawings in conjunction of the design work for Paimio Sanatorium; a practice that the contract thus legitimised. Some of the standards were enclosed with the application addressed to the State Medical Board, based on which the state authority decided to grant the permit and funding for the project.

Aalto's intention behind this course of action was to bring an interesting phenomenon into his own designer's studio, and under his scrutiny, so that he could work it the way he wanted to and eventually to the design standards that could enter industrial production - an interpretation that has only grown more convincing in the course of investigation into Aalto's tactics as the chief supervisor of Paimio Sanatorium acquisitions and purchases. Latour's thesis of the locality of knowledge and knowledge management seems to be highly accurate. According to Latour, the secret of an *innovator's* success lay in the material practicality of the innovation, not in the intellectual superiority of the *innovator* (Lehtonen, 2000).

According to Petri Ylikoski, there are three salient themes that run through Latour's later work. Firstly, Latour pays attention to the material aspects of scientific enquiry and aims to incorporate the fields of objects and non-human actors in his social research. His second major theme is the locality of knowledge and management. Scientific knowledge is valid only in the special conditions of a laboratory and when analysing any given piece of knowledge, it is essential to know where, how and by whom it was produced. Thirdly, Latour has no intention of sharing the understanding of scientific activity held by his object of study and uses his own set of concepts instead of those of the latter, since, in his view, the understanding held by the object of study is something to be explained, not an explanatory resource.<sup>17</sup>

The winning competition entry showed that Aalto was capable of taking the objectives of the clients, that is, the federation of municipalities and the State Medical Board, which oversaw the construction work, and turn them into action that were in consensus with his own objectives. Aalto was keen to make sure that the progress of his hospital project was reported by the press in a positive light. A delegation from the 1932 Nordic Construction Days, held in Helsinki, also paid a visit to the hospital building site. Aalto was made into a hero, while the other parties who had contributed in an essential way to the project did not actively feature in the publicity, although some of them were indeed mentioned. The project presentations in *Arkkitehti* (Finnish Architectural Review) did not include information about any other designer's innovative solutions for the hospital.

In a Latourian reading, the collective remained invisible apart from its *innovator*, which was enough for the audience. The other actors and their crucial input were forgotten. In conjunction with the project description of Paimio Sanatorium in *Arkkitehti* the feats of modern engineering, such as the ventilation system, were not highlighted as would have been customary for other hospitals of this calibre. The credit for the success, which was the result of the work by the entire collective, went to Aalto alone.

Latour would talk about the achievements of the collective referring to the individual's name, while he would point out that the collective comprised of entities belonging to different ontological categories. In the case of Paimio Sanatorium, Alvar Aalto would stand as a reference to a collective formed by all the social actors and inanimate entities together. In my opinion, Latour's description of the collective reveals something quite essential about architecture, and is well-suited to the study of architecture, in which the role of the designer is traditionally, and often disturbingly, assigned to a single individual, although anyone familiar with the field will know how necessary it is to see architecture as a collective and an applied undertaking.

It is much easier to make the inanimate speak in the field of architecture than in many other disciplines – an aspect for which Latour has been criticised. For example, architectural drawings are an essential part of the development of ideas, as well as their communication or translation, if so wished. It is the architect's job to understand the material and let it speak its own language. Latour's view that a project will never amount to anything as long as its idea remains pure, is fascinating from the perspective of architecture. A project can

only materialise if it is exposed to and intermingles with other elements. And only when the resulting machine or object becomes unquestionably established, so that this synthesis is forgotten, can an idea be perceived as “pure” (Lehtonen 2000). When examining the relationship between architecture and technology, it would be unrealistic to remain exclusively in the domain of ideas.

According to Latour’s theory, the *actants* produced affect the nature of scientists, laboratories and external actors, and thought, by partly redefining them. This process of production is not one-directional. In my discussion on the architecture of Paimio Sanatorium in the light of this theory, I pondered whether the outcome was one that Aalto had hoped for, and arrived at a conclusion that in a way, it was not. At least, the sanatorium did not turn out the way Aalto had wanted at the competition stage or in April 1930, when the master drawings were created and the State Medical Board approved them. Tracing back the evolution of design solutions exposes the transformation, adaptation or development of the architect’s thought.

#### 4. Conclusions

For Alvar Aalto, the social dimension of the Paimio Sanatorium project was about contributing to the defining of the human network for the project and communication with the network members. Attaching competent collaborators to the project was of decisive importance. The technological process of Paimio Sanatorium found its shape through Alvar Aalto’s subjective vision, which was informed by the international architectural discourse. Personally witnessing and participating in this discourse strengthened Aalto the project *innovator’s* confidence and courage. Aalto developed his vision through interaction, by participating in exhibitions and expressing himself in writing. The sanatorium project developed simultaneously as a social and material undertaking, through *trials*. In other words, the heterogeneous *actants* were placed under constant testing. This process also served to change the train of thought for its *innovator*. For example, the concept of the minimum apartments, with which he was able to personally familiarise himself during the design work for the sanatorium, inspired him to develop the daily environment of the patient. In Paimio, a new type of consumer found a home in the patient room, which Aalto designed based on the international discourse he had embraced. The focal points of his interests are revealed in the successful integration of the different installations in the patient room, although these very systems proved a problem in a larger context, in which the installations were designed only after the architectural design was complete. Aalto’s conduct during the contract negotiations reveal his aim to direct the actions of the social community, even by overstepping or stretching the boundaries of his role, if need be. In Latour’s terms, the question was about translation or attempted translation. It is clear that he also learnt a great deal from the processes that he was unable to control, and the outcome of which was not architecturally sound. The task of the researcher is to follow the *actants* and to register any changes in them and the impact resulting from these changes. As Latour points out, a social scientist cannot know before the fact, what society is made up of. It is something that only the *actants* themselves can disclose (1988a). In a similar vein, an architectural researcher cannot know in advance what architecture is made of, as I myself learnt from this work.

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Verbal information has been provided by Renja Suominen-Kokkonen in personal conversation on March 18, 2015.

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<sup>1</sup> The French name of the CIAM organization was Congrès Internationaux d'Architecture Moderne, and the German name was Die Internationale Kongresse für Neues Bauen.

<sup>2</sup> David Wang classifies evidence of interpretive-historical research in four categories: determinative, contextual, inferential and recollective evidence. Wang 2002, pp. 154–158.

<sup>3</sup> CIAM's seminar held in 1929 in Frankfurt am Main, *Die Wohnung für das Existenzminimum*, and the one held in Brussels in 1930, *Rationelle Bauweisen*.

<sup>4</sup> I used as primary sources those articles that Göran Schildt has discussed in *Alvar Aalto in His Own Words*, edited by him. See Schildt 1997.

<sup>5</sup> In his work *Reassembling the Social*, Latour argues that, instead of preconceived theories and methods, researchers ought to pay attention to oppositions and uncertainties, the five most salient of which according to Latour are the nature of groups, action, objects, knowledge and sociological research. Latour 2007, passim and especially pp. 21–22.

<sup>6</sup> Reijo Miettinen has identified three problems in applying the principle of generalised symmetry in innovation studies. Firstly, limiting a network of entities to serve empirical analysis is difficult. Secondly the theory relies on a one-dimensional view of human activity. Thirdly, the principle of generalised symmetry is ill-suited to describing non-human actants and their activities. Latour's assumption of each actant's ability to speak has also been considered problematic. Miettinen 1998, p. 30–33. See also Lehtonen 2000, p. 292, for the third point.

<sup>7</sup> Contract No. 4 of Vesijohtoliike Onninen, July 9, 1931. Documents related to the Paimio sanatorium project. AAM.

<sup>8</sup> Drawing 50-365. AAM.

<sup>9</sup> Building Committee August 16, 1930, Section 6. PSA.

<sup>10</sup> Drawing 50-177. AAM.

<sup>11</sup> Building Committee November 20, 1931, section 3. PSA.

<sup>12</sup> Drawings 50-152 and 50-203. AAM.

<sup>13</sup> The drawing 50-192 bears the initials "A. A.". AAM.

<sup>14</sup> The letter of Central Co-operative Hankkija to engineer Kilpi, October 16,

1931. Attachment A. Building Board October 17, 1931, Section 9. PSA.

<sup>15</sup>In his work *Reassembling the Social*, Latour argues that, instead of preconceived theories and methods, researchers ought to pay attention to oppositions and uncertainties, the five most salient of which according to Latour are the nature of groups, the nature of action, the nature of objects, the nature of knowledge and the nature of sociological research. Latour 2007, pp. 21–22.

<sup>16</sup>The contract signed between the Tuberculosis Sanatorium of Southwest Finland and architect Alvar Aalto, dated June 28, 1929. AAM.

<sup>17</sup>Ylikoski refers to works following the seminal 1979 work *Laboratory Life*, which Latour co-wrote with Steve Woolgar. Ylikoski 2000, pp. 297–298.