Finnish Perceptions of Log and Log Architecture

Matti Lakkala (corresponding author)
Oulu School of Architecture, University of Oulu, Finland
matti.lakkala@oulu.fi

Aale Luusua
INTERACT Research Group, University of Oulu, Finland
aale.luusua@oulu.fi

Janne Pihlajaniemi
Oulu School of Architecture, University of Oulu, Finland
janne.pihlajaniemi@oulu.fi

Abstract

The use of log construction is increasing in Finland. This development is desirable for ecological and economic reasons. However, due to changes related to the technical properties of logs and their overall popularity, introduction of novel building typologies and urbanization in general, it is unclear how the public currently experience logs as a construction material and technique. Thus, in this paper our aim is to examine logs and log building holistically as a phenomenon in the Finnish context, and to explore *what kind of perceptions of the log as an architectural material there currently are among Finnish laypersons.* To do so, we analyse interviews conducted among 18 Finnish laypersons. The study method utilized a semi-structured interview combined with a walk-along interview in a log construct built by our research team. Results are discussed through the lens of relevant wood research and the Finnish history of logs. Results suggest that logs are currently perceived as a topical and trendy material because of their naturalness, warmth, and healthiness. Stereotypes related to logs, such as ruralness or traditionality, are changing or begin to appear differently. The visibility of log structures was found to be meaningful to the study participants in various ways.

Keywords: log building, log architecture, layperson perceptions, design ethnography, interviews.

Introduction

The Finnish word "hirsi" is translated as "log" in English, but unfortunately it is not a very good translation. The English word "log" also refers simply to a cut section of a tree trunk; in Finnish there is a different word for that. In Finnish, "hirsi" is a tree trunk that is tooled to be used solely in construction, usually for walls. In this paper, use of the word "log" should be understood as a building material and is used in much the same way as, for example "brick" or "concrete" are used in the building materials context.

Log building – an ancient, previously significant, but until recently almost forgotten method of construction – seems to be currently at the verge of a renaissance in Finland. During the last decade, log construction has more than doubled its share of all new prefabricated detached houses sold in Finland. According to the Finnish company RTS Ltd, which specializes in conducting market research concerning detached houses and other small-scale residential buildings in Finland, 22% of all new prefabricated detached houses in Finland are currently built of industrially produced logs, while in 2010 the share was 10% (Mölsä, 2019). There seems

to be a growing interest among public and private customers in using log as a material for public and larger apartment buildings too (Lakkala & Pihlajaniemi, 2019).

Wood as a renewable and reusable natural resource is a unique building material in terms of sustainability; thus using wood in construction can be an efficient way of reducing the emissions of the construction sector (UNECE, 2018). This global driver behind the increasing use of wood in construction is the reason why the increased share of log building could be seen as desirable and even be supported. The increased use of wood-based construction products can have also economic advantages for such countries that have an important forestry sector because, as pointed out by Ramage et al. (2017), timber-based construction materials and engineered wood products are among the highest-value forest products. This benefit might be appreciated by Finnish consumers as well, in the context of log building.

However, the architectural concepts of log and log building are currently unclear, thanks to recent developments: rapid changes in overall popularity, potential shift of use context from rural to urban, introduction of novel building typologies for log as well as considerable advances in technical properties of logs. This incoherence and the swift changes, together with the strong cultural history of log building in Finland, set challenges for the architectural design of contemporary log buildings. From the viewpoint of architectural design, the cultural history and the novel developments of log lead to strong contradictions of traditional and contemporary, natural and industrial as well as rural and urban (Luusua et al., in press).

Besides stakeholders such as designers, planners or other relating building industry professionals, whose perceptions were mapped in a prior study by Luusua et al. (in press), one important group of people whose opinions should be considered when forming the current understanding of industrial log building from the viewpoint of architectural design, are laypersons. Laypersons present the views and experiences of users of log buildings and consumers of log products. In addition, knowledge of the aesthetic and functional requirements of consumers can lead to competitive advantages for the forest industry and improve consumer satisfaction if product development is done according to this knowledge (Nyrud et al., 2008). Therefore, in order to inform the architectural design of log buildings and design and development of log products, our aim in this paper is to examine holistically log and log building as a phenomenon in the Finnish context, and to gain insight of *what kind of perceptions of the log as an architectural material there currently exist among individual Finnish laypersons.* To do so, we analyse interviews conducted among 18 Finnish laypersons. The purpose of this study is to gain an in-depth understanding of different ways of how the interviewees, as Finnish individuals, currently view log as an architectural material.

Development of log construction in Finland

The interviewees of this study are all Finns. Therefore, it is reasonable to present here a brief overview of the historical developments of log use in Finland in order to better understand the background and current situation of log building in Finland, as these strongly affect the views of the interviewees. The historical developments and current situation of log also serve partly as motivation for this study.

The log building technique had been in use in Finland apparently for thousands of years, but in the beginning of the 1900s, log construction made way for new industrial materials (Soikkeli & Koiso-Kanttila, 2006). Until then, log had been the primary material for virtually all buildings in Finland, such as dwellings and churches, but after the early stages of industrialization, log was used only to build sauna huts and summer cottages (Heikkilä, 2002). Solutions used in these secondary building typologies were simplified versions of traditional constructions by skilful craftsmen; based on this simplified tradition, the industrial production of logs was started in the 1950s (Jokelainen, 2005). Earlier studies have shown that especially the shortcomings of aesthetic and architectonic quality of industrially produced log buildings caused significant damage to the appreciation of log among architects, planners and building officials (Heikkilä, 2002). However, log is not

currently disapproved of categorically; it can be considered acceptable if combined with high-class architectural design (Luusua et al., in press).

Over time, a lot has happened with log in terms of technical properties. While logs have been traditionally hand-hewn from single trees, contemporary logs are industrially manufactured in factories, by using sophisticated wood-working machinery, out of glued laminated timber: 'The laminated log is made of kiln dried dimensioned lumber of pine (Pinus sylvestris L.) or spruce (Picea abies L.) and glued together from two or more pieces, with either a vertical, horizontal or cross seams.' (Sinkko et al., 2019) Thus, contemporary logs are accurate industrial products. The twisting and cracking of traditional logs are eliminated by the kiln drying and the gluing. Because of gluing, the sizes of logs are not restricted to the size of available timber. Logs that are glued with cross seams are called "non-settling" logs. By using non-settling logs, the settling, a major deficiency of traditional log buildings, is eliminated. The shift from handcraft to industrial production has naturally an effect for the visual appearance of logs as well and offers many new possibilities for architecture. In addition, due to urbanization in Finland, the use context for future log buildings is increasingly in urban areas. Not to mention the challenges set by the amount of housing needed for future urban inhabitants, the requirements for architecture in these novel uses for industrial logs are different, but also higher than ever before in terms of architectonic quality.

To summarize, there is currently an ongoing, rapid development, where the utilization of log construction is increasing, and neither the use context of logs, nor the log itself are the same as in the past. Both the magnitude and the speed of this development create uncertainty in defining what the log itself is today, but also in defining what contemporary log architecture should be like; the perceptions mapped in this study will help in addressing these issues.

Figure 1. A cross-section of non-settling lamella log, dimensioned 275x275mm. [Kontio Log Houses]

Perceptions of wood among consumers

Logs are a specific subset of wooden construction materials. Therefore, it should be addressed also from the viewpoint of how wooden products are perceived in general. An emerging body of literature exists that tries to understand the large field of how wood and different wooden products are perceived and experienced among various professional groups as well as laypersons and how wood might affect building occupants. Before analysing our results, we will briefly discuss this related work.

Nyrud and Bringslimark (2010) have conducted a comprehensive review on studies that map the possible psychological benefits of interior wood use. Previous research has shown that simply looking at nature or natural elements can benefit human health and well-being; thus it is relevant to ask whether wood as a natural product, used as part of the built environment, might have these same effects (Nyrud & Bringslimark, 2010). They summarise that studies related to this topic focus generally on three types of psychological responses that are closely related to each other. These are '1) perception of wood, including both visual perception and tactile sensation; 2) attitudes and preferences (aesthetic evaluation) of various wood products; and 3) psychophysiological responses toward wood' (Nyrud & Bringslimark, 2010). Even though the studies reviewed were so diverse in terms of research strategies and exact scopes that no clear conclusions could be made regarding psychological benefits of wood use in interiors, some congruences could be drawn between the studies. For example, it was concluded that wood is perceived as a natural material, and if wood products are preferred over other products, naturalness is the reason why (Nyrud & Bringslimark, 2010).

Strobel et al. (2017) have linked the existing literature on consumers' understanding of interior wood products to physical properties of wood in the European context. They noticed that perceptions of wood were generally positive, but were also affected by context, trends, and cultural expectations. Cultural expectations are the reason why we argue it is important to understand thoroughly the current situation of the log, particularly in the Finnish context. Høibø et al. (2018) investigated whether there are differences in preferences for urban building materials between native and immigrant Norwegians and found that only minor differences exist between the two groups. However, they also concluded that materials, such as concrete and steel, which in past decades have been used in urban construction, are more preferred in the urban environment than, for example wood, despite the fact that in Norway wood is used extensively in houses outside cities (Høibø et al., 2018).

In the European context, physical properties of wood, such as colour, grain and thermal conductivity were found to make wooden spaces cosy and warm (Strobel et al., 2017). Grain and scent were seen as indicators of the naturalness of wood, and engineered wood products such as fibreboards were no longer considered as natural because of the higher degree of transformation and lack of grain (Strobel et al., 2017). In terms of building material naturalness, similar results have been achieved by Burnard et al. (2017), as one of their conclusions was that among respondents, solid wood was ranked as more natural than wood-based composite specimens, such as OSB. These results provide an interesting viewpoint in the case of industrial lamella log too, which is – although not nearly as much processed product as the two aforementioned – a composite of wood and adhesives as well; thus, its perceived naturalness might be compromised.

Besides the perceived naturalness, visual properties of wood affect also the perception of how preferable wooden surfaces are. Nakamura and Kondo (2008) note that knots are a reminder of tree branches and thus are evidence of the biological origin of the material, but knottier tree surfaces lead to busier eye patterns of the participants when looking at wooden surfaces. The authors conclude that this information can be exploited by designers when finding the optimum natural impression of lumber (Nakamura & Kondo, 2008). In a study by Nyrud et al. (2008), consumers' preferences for wooden deck materials were investigated using sensory analysis. Among the five decking samples, consumers preferred the untreated natural wood with moderate colour intensity and a homogenous visual surface defined by characteristics such as colour,

fractures, knot size, shape, density and patterns. Decking materials and treated wood products in general seem to be one central focus area of perception studies in wood (e.g. Fell et al., 2006; Gamache et al., 2017; Vlosky &Shupe, 2002; Vlosky & Shupe, 2004). Another specific wood product studied is flooring (e.g. Jiménez et al., 2015; Jonsson, 2005; Manuel et al., 2015; Spetic et al., 2007).

Based on this literature review, perceptions of the log as a wooden product is a totally unexamined area, which forms a clear gap in existing knowledge that the present exploratory study begins to cover. Furthermore, instead of referring to any specific application of wood, studies in the field seem to focus largely on quality aspects of wooden surfaces in general (e.g. Jonsson et al., 2008; Nyrud et al., 2008). Therefore, for example, Jonsson et al. (2008) propose that 'continued studies could probe more into how the application and context may impact both preferences and perceived attributes'. In addition, Nyrud and Bringslimark (2010) recommend, after reviewing current literature on the topic that, 'to enhance external validity, more studies should be conducted in field settings outside of the laboratory'. These remarks serve as good motivators for our study setting, in which we conduct our interviews in part exploiting a 1:1 scale wooden pilot pavilion. This is discussed more closely in the next section of this article. In addition, previous studies mainly deal with interior use of wood, but since the log is a structural material often visible throughout log buildings, our aim is to map perceptions of logs holistically, and not to exclude their exterior or structural use.

Materials and methods

During autumn of 2018, we utilized semi-structured interviews (e.g. Denzin & Lincoln, 2017) to explore the question of *what kind of perceptions of the log as an architectural material there currently are among Finnish laypersons.* Interviews were conducted as part of the Modern Log City research project at the Oulu School of Architecture. Executed between 2016–2019, the project aimed to seek and develop novel architectural expressions for log buildings suitable for the urban environment and to study the utilization of mass-customization in the design process of log buildings. Preliminary remarks of the interviews were presented in Finnish language in the final report of the project (Lakkala & Pihlajaniemi, 2019); however, here the results are fully presented and discussed through relevant literature, making them scientifically relevant. The interviews consisted of two parts. The first part took place in a meeting room at the Oulu School of Architecture, University of Oulu. For the second part, which took place directly after the first, the interviewees were taken to the Timber Tetris pavilion, located near the main entrance plaza of the University of Oulu, in front of the Oulu School of Architecture.

Timber Tetris – a log-structured pilot pavilion

Timber Tetris is a log-structured pilot construct executed within the Modern Log City project. As part of the architect education in the Oulu School of Architecture, a workshop for students of architecture was organized in order to design and build a roof for an existing log structure. This existing log structure had been the result of the previous year's similar workshop (Luusua et al., in press). After it had been erected in Helsinki for the summer of 2017 and dissembled in the autumn, the pilot pavilion was then reassembled along with heightened log walls and a roof structure in its current location in Oulu in the spring of 2018.

Figure 2. The second part of each interview was conducted at the Timber Tetris pilot pavilion, pictured on the right. [Matti Lakkala]

Figure 3. Log structure of the pavilion. [Matti Lakkala]

Logs for the pavilion were industrially produced and pre-cut, leaving only the assembling work to be done at the construction site. The pavilion is constructed using untreated, planed spruce logs, 90mm in width and 185mm in height by cross-section. The logs are about half of the thickness of logs used in constructing buildings for year-round occupation. The logs are glued together out of two adjacent lamellas of wood. A single lamella is made from timber that is lengthened with finger joints resulting in visible vertical seams on the side of some of the logs. The architectural appearance of the construct is very minimalistic, showcasing the log walls and structure along with the characteristic details of log.

Participants

The semi-structured interviews included 18 participants. Because of the location of the pavilion, it was seen as convenient to seek participants using information channels of the University of Oulu. The interviewees were recruited with an online notification published on the University of Oulu's intranet as well as via an email invitation to the student email list. Participants were rewarded with a movie ticket for taking part. Interviewees were chosen so that the sample would include both women and men (10 and 8, respectively), students and staff (10 and 8, respectively) and that both genders would be represented among students and staff. Almost half of the participants were of the age group 20–29, the rest of the participants represented other age groups somewhat equally. Regarding university disciplines among the interviewees, a variety was represented. Participants with backgrounds in humanities, technology, economics and medicine, as well as participants working in non-academic duties at the university took part in the study. Thus, we achieved acquiring a well-balanced sample of interviewees with varying backgrounds. This allowed us to obtain a broad

view of how Finnish individuals currently view log as an architectural material. A breakdown of participants is presented in Table 1.

Participant	*Discipline*	*Female/male*	*Age range*
Staff member #1	Languages	Female	30–39
Staff member #2	Natural sciences	Male	30–39
Staff member #3	Economics	Female	20–29
Staff member #4	Supporting duties	Female	60–69
Staff member #5	Construction techn.	Female	40–49
Staff member #6	Education	Female	40–49
Staff member #7	IT	Male	50–59
Staff member #8	IT	Male	60–69
Staff member #9	Administration	Female	50–59
Staff member #10	Education	Female	30–39
Student #1	Natural sciences	Male	20–29
Student #2	Economics	Female	20–29
Student #3	Medicine	Male	20–29
Student #4	IT	Male	20–29
Student #5	Music	Female	20–29
Student #6	Process techn.	Female	20–29
Student #7	Economics	Male	10–19
Student #8	Economics	Male	20–29

Table 1. Breakdown of the participants. [Authors of the article]

Research methods

In this exploratory research, semi-structured interviews were considered as a suitable method to gain broad, in-depth insight of the views and opinions regarding the scope of this research. Our procedure of semi-structured interviews consisted of two parts. In the first part, log and log building were discussed on a more general level. Questions related to, e.g., the overall image of log among consumers; properties of logs in more detail; logs in rural or urban settings; personal attitudes and experiences related to log construction; views of the technical properties of logs, such as fire safety, cost-efficiency and sustainability. In the second part, the discussion was brought to a more concrete level when moving from indoors to the pavilion. In the pavilion, the interview took place while moving in the pavilion, so that the interviewee could get a concrete understanding of the log construct and its details. Questions in the second part dealt with the overall impression of the construct and how it seemed to fit the surroundings; details such as corner joints, bevels, surface texture as well as dimensions of the logs and regarding these, also suggestions for improvements that the interviewees might have. The composite nature of the logs, that is, the combination of adhesive and solid wood, was discussed profoundly, also reflecting views of interviewees' perceptions in the first part of the interview, and whether they viewed this material as being log.

Visiting the pavilion enabled us to deepen our understanding of the opinions of the participants. When utilizing this real-life example of log construction, it could be assumed that the participants' views were precisely related to modern, industrial logs as a specific timber-based product. Furthermore, it could be

assumed that our results reveal perceptions related specifically to log and log building, taking into account also the impact that the application and context has for perceptions of wood. For architectural design, we believe that this type of information is very relevant, as it is characteristic for architectural design to take into account various factors of application and context when making decisions about a design.

Both parts of interviews were audio recorded. In addition, for the second part of the interviews, a portable video camera (GoPro) was attached to interviewer's chest. This allowed us to record, in addition to the vocal communication, also the expressions and gestures of interviewees as well as the exact places of the details under evaluation, in the case that this would be unclear based on the audio. Altogether, the interviews resulted in approximately nine hours of audio material, which was then transcribed into roughly 120 pages of text documents. Transcriptions were used in analysing the interviews; video material offered visual assistance when needed.

The approach for analysing the transcriptions followed a process of qualitative analysis (O'Leary, 2009), in which raw data is transformed into theoretically meaningful understanding through an iterative six-step cycle. Coding and categorizing of the data were done by using appropriate computer software (NVivo 11). We did not have any predefined theoretical concepts guiding the analysis, as the aim of this exploratory study was to map and describe perceptions of individuals in a holistic manner. However, the relevant literature has framed the discussion of our findings. We have allowed themes and remarks to come up freely during close readings of the material as single narratives and by contrasting participants' answers. As is common with an approach like this, the results do not focus merely on recurrent themes, but also showcase more rare views and opinions so that the whole range of perceptions and opinions of the participants would be presented.

Limitations

Some natural limitations of this overall method should be taken into consideration. The sample size used to gather the qualitative data for this in-depth study is small; thus, the results should not be interpreted statistically to present opinions and views of Finns in general. The results as such can be very useful for designers, for example; beyond this, the results should be considered as insights that merit further investigation to validate them on the scale of a larger population. In addition, this study deals with Finnish industrial log building, especially in the Finnish context, which leads to an obvious limitation in geographical coverage of the results.

Perceptions of Log and Log Architecture

Emerging, topical, even trendy

Overall, the current image of log building was considered very positive among participants. Respondents described log as currently emerging, very topical, or even a trendy building material. One clearly important reason behind the positive image and trendiness was the perceived healthiness of log. In the literature review, the studied health benefits of wood use were related to psychological responses toward wood as a natural element. However, among our participants, log was perceived as being healthy in a different manner. Respondents pointed out the recent and many reports in the Finnish media about the health issues caused by indoor air problems of various buildings and stated that log building is even considered as a solution for these problems. Log was perceived as healthy material in general, but not many of the participants elaborated on exactly what makes log a solution for indoor air problems.

Regarding the indoor air problems of Finnish public buildings, some participants brought up log's "ability to breathe" as a reason for the healthiness of log. This is a popular term which is often related with log building in Finland. Some participants related it with the airtightness of the log wall, stating that air can penetrate a log wall more easily than a layered wall structure, which is a common misconception. Breathability means the hygroscopic properties of wood; that is, log can absorb and release indoor humidity. This ability prevents

condensation of water inside the wall structure. The condensed water inside layered wall structures can lead to growth of mould or other microbes, which is obviously a threat to occupants' health.

Especially the sense of trendiness of log building seemed to be closely related to recent built examples of public log buildings. The log school campus of Pudasjärvi (see e.g. Dejtiar, 2017), which in Finland is arguably the most famous of the realized public log buildings, emerged repeatedly as one positive existing example in the interviews. It is noteworthy that it is precisely the indoor air problems that have driven many Finnish municipalities to replace, for example, old school buildings with new log-structured ones; there could be a connection between the perceived healthiness, sense of trendiness and public log buildings. One respondent was under the impression that currently when a new school is built, a log-structured alternative is always considered. This might be the case in some municipalities in Finland, but certainly not nationwide.

Log was considered also a robust, long-lasting material by our participants. It was perceived as durable in against the weather and also in general. Many of the participants mentioned these aspects intuitively when asked to describe log. Other reasons for the positive image of log building mentioned by our participants was that log is considered a traditional material and thus associated with the "good old days" (S6).

Log was perceived as sustainable, because of its renewability. Many of the respondents were, however, conscious on this matter pointing out that the sustainability of log, achieved by renewability, depends on the sustainability of forest management. This was evident in statements such as 'I guess we cannot fell all of our forests and make something of them'. (SM6) In addition, log was considered a local material in the Finnish context. This was related to the sustainability of log, as one respondent suspected that shipping Finnish logs around the world might not be very environmentally friendly. Besides renewability, also log's recyclability was well acknowledged. Participants had personal experiences of old demolished buildings, of which logs had been salvaged for reuse. In Finland, log houses have been traditionally moved from one place to another by dissembling the log frame and then rebuilding it elsewhere, which was also mentioned by our participants; this is one indication that cultural history affects the recognized qualities of log.

As a further explanation for the positive image of log building, log was considered as a valuable and elegant material, also when compared to wooden building in general. Log was stated to be fragrant, to create a good acoustic environment, and to be beautiful in general. In addition, some participants felt that by using log, people usually want to build something a bit differently, to stand out from the others. One participant stated that by using log, people seek a sense of uniqueness, and because of the values that log currently represents, log itself can be understood as an image factor when used in a building.

Finnish, natural and warm

Besides being a local and thus sustainable material in Finland, log was considered a particularly Finnish material. It was said to be an important part of the Finnish national imagery, and associated with the Finnish forest and nature in general. When considering the cultural history of log buildings in Finland, this view is not surprising.

One respondent supposed that log reminds people of nature, and another described log as being a natural or organic way of building. One respondent believed that the more the Finns urbanize, the more they long for nature, forest and wood, and log walls can satisfy this longing. This is an idea which is explicable with the concept of biophilia (e.g. Kellert et al., 2011). The connection between log and nature was also expressed in other ways. One respondent described that log is a biological material taken from the woods, and thus not something manufactured by man. In addition, log was seen to be situated on the interface of lifeless and living. One participant described that in houses constructed with logs, a certain sense of livingness remains, especially compared to, for example, concrete. Naturalness itself appeared to be a pleasant quality of log.

One feature of log that recurred in the interviews was warmth. By warmth, participants mainly referred not physical warmth or good insulation of log walls, although these things were mentioned too, but to psychological warmth; a sort of a warm feeling or atmosphere. Log was also described as a cosy material, which was mentioned together with the feeling of warmth by some participants. One explanation for cosiness was positive childhood memories of a log cottage. Besides warmth and cosiness, log was also perceived as a soothing material. This was encapsulated well by one respondent, who had visited the aforementioned Pudasjärvi log school campus: 'It is a totally fantastic feeling to be inside the building. The atmosphere somehow exudes the ability to breathe and warmth. I too felt very peaceful there'. (SM6) Perhaps because of the naturalness and these other qualities of log, one respondent described log as a particularly "humane material". (SM1)

Traditional in the countryside, novel in the urban context

Log building was strongly connected with rural environments. One of the main reasons for this seemed to be that log buildings are traditionally seen in the rural environment. It was stated that log building has long traditions in the countryside. In addition, the rural environment was seen as a place where forests and nature are near, and for that reason, log building was well suitable there. However, the rural environment or countryside were not one clearly defined setting but could include several non-urban milieus. Besides the rural village or farmland, log buildings were seen as especially suitable in natural environments, such as forests or rocky lakeshores in the wilderness; all desired surroundings for a Finn's summer cottage. One participant described that the countryside is a good place for log buildings, because there the buildings have enough space around them, as she had the mental image that log buildings are usually large buildings.

The viewpoint that log is suitable for the countryside because of tradition emerged also inversely: participants had not seen examples of log buildings in the urban context, and therefore it was easy for them to say that log buildings are more suitable in the countryside. One participant admitted that this is merely a mental image, since he had lived his whole life in an urban area, and therefore could not describe the looks of a typical log building in the countryside. Our participants were nearly unanimous about the fact that log buildings are currently very rare in the urban context. A few participants had observed however, that in their neighbourhoods some log-structured detached houses were under construction. This is an observation that could be expected since the relative popularity of small-scale log houses is increasing, as mentioned in the introduction. Here as well, the log school of Pudasjärvi invoked very positive connotations as it was mentioned as an example of contemporary log building in an untraditional, non-rural context, which is not, however, very urban either.

Another inverse logic for why log is more suitable for the rural setting was that in the countryside buildings are mainly relatively small in scale, which was seen as characteristic for log buildings, while larger buildings, such as blocks of flats, are mainly located in cities. Some participants were sceptical towards large-scale log building, as well as log building combined with the density of building in cities, because of the combustibility of wood.

Participants were suspicious in general about the suitability of log buildings in cities. Several noted that log buildings in the city centre would look odd, because other buildings there are built of concrete and stone. Some participants speculated that if there would be a larger entity of log buildings in a city centre, it would be more suitable. A few participants reckoned that log buildings should have some natural surroundings, even in the urban environment. This view was repeated when visiting the pavilion as many participants reacted positively to the few elements of forest, such as pine trees and brush of the forest floor, that are the primary surroundings of the log pavilion.

Overall, it was evident in our interviews, that people have difficulties estimating the suitability of log buildings in the urban setting, or their judgement is at least heavily affected by the fact that log is a so little used and

seen material in that context. One participant aptly encapsulated this dilemma by stating that it would be nice to have log buildings in the city, but added, a bit amused: 'I do not know if Valkea[1], for example, was built out of logs – what would it be like then?' (SM3) In terms of understanding log as a contemporary architectural material, this question is highly relevant, as it is currently extremely difficult to answer even for a highly trained professional in the built environment field, such as an architect.

Even though our participants were not used to seeing log buildings in the urban setting, they perceived log buildings primarily as suitable for the countryside and had difficulty imagining what a log building would look like in an urban setting, many participants thought that it would be nice to see an increase of log buildings in the urban context. Some participants stated that the increase of log building in cities would be refreshing in general, while some felt that with log buildings the cityscape would have more distinctive buildings compared to existing ones. Log in the urban environment was considered as something novel. A few participants pointed out that because of the log's reputation as a healthy and ecological material, people would probably be willing to accept log buildings in urban settings as well, despite the fact that it assumingly would be perceived as a rather odd material there. One participant believed that log would distinguish itself in the urban context, because it is so rare there. She added that by using log, values like naturalness and sustainability could be disclosed visually.

Public buildings are usually located in urban milieus and currently it is not common that these are log buildings. When asked how log buildings would fit for different types of public buildings, many participants mentioned schools as a type that was well-suited for this purpose. In addition, day care centres, buildings for assisted living or nursing homes were mentioned among the building types that would be appropriate as log buildings. One participant described that log is best-suited for places where humaneness is emphasized, adding, 'What better material would there be for building a library than log?' (SM10) One potential reason for mentioning these particular building types as suitable for log is that, excluding the library, there has been recent built examples of each of the abovementioned building types in Finland.

Moreover, it seemed that log was more easily imaginable among our participants in public indoor spaces, than in the urban environment in general. This raises the question: Should log buildings even look like log buildings on the outside? One participant, who felt that log buildings would have potential in cities, stated that it is probably possible to make the log look like brick by means of civil engineering, if the suitability for the milieu would be an issue. One participant had personal experience with this also. She was aware that nowadays such log houses exist that, by the appearance of the house, cannot be estimated to be built out of logs, even though the logs are visible. By this it was meant that these houses look just like houses with wooden facades, because cross-section profiles of logs are available that resemble typical wooden façade panels, solutions for corner joints exist making the end of the wood not visible, and layers of logs are even, instead of the traditional half-lapping layers.

The "log-ness" of (glued) log

Log and log building in general are concepts that as terms are probably familiar for most of Finnish people. Even though industrially produced glued logs have virtually superseded the traditional, hand-hewn logs in construction, the first mental images of log among our participants were mainly more closely related to so-called original logs, which are made of one tree trunk. The first images that many of our participants had of log was that it is a thick or sturdy piece of natural wood. Some participants described log as a cut down tree that is processed very little before being used in building. We suspect that this is due to the strong and well-known cultural history of the concept of log building. However, many of the primary attributes of log that our participants mentioned intuitively could be used to describe glued logs as well. Few participants were aware of the current dichotomy of log, noting that these days log generates two separate images for them,

[1] A major shopping center in the city center of Oulu.

which are the one of traditional log in old buildings, and secondly the one of contemporary, industrially produced log in current building.

Our interview protocol allowed us to study this contradiction more closely. We wanted to understand better how the mental image of log and log building differs from the contemporary practice of log building; under which conditions could this material and technique still be perceived as log, to which so many positive connotations are related?; and finally, should the contemporary log still be referred to as log? The mental image was discussed in the first part of the interview, while the contemporary glued and industrially produced log was evaluated in detail when visiting the pavilion.

Apart from the attributes of individual logs, the way of building, that is the method itself, appeared meaningful for the definition of log and log building. This was evident in statements like logs are usually used in walls; log construction is a strong wooden structure; or, log is not merely a decorative material, but with it, an entire house can be built. The way of building a log house was contrasted with a puzzle or building with Lego blocks. Another characteristic feature that was seen as constituting a log building was that a log house can be assembled basically without nails or glue, and that it stays together because of the corner joints. The corner joints in general were something that our participants perceived as interesting and amusing because they showed how the log house was built one log at a time. These aspects were brought up in the first phase of the interviews and were further elaborated when visiting the pavilion as well. Thus, using the term log or log building, besides referring to a construction material, includes a reference to the construction method as well.

Thickness was also an important factor for log-ness of log. When our participants felt and saw the thickness of the log walls of the pavilion, many had the mental image that the logs should be thicker. Almost everyone still perceived a wooden beam of those dimensions as log, but stated that if it would be thinner, it could no longer be called a log; then it would more closely resemble a regular timber plank. In addition, the firmness was considered in connection with the thickness of the log as one respondent noted that if the walls would be thinner, the structure would seem too weak or shaky, but as it is, it feels solid and firm.

The shape of the cross-section profile of the log was principally perceived as positive. Some participants noted that the shape of logs can vary, being for example round or square. However, one respondent noted that log for him would rather be more natural round wood. In addition, one participant was very critical towards the appearance of the logs used in the pavilion, stating that it is completely unnatural. ‘Its shape is unnatural, its proportions are unnatural, it is ridiculously planed’. (SM2) On the other hand, some participants felt that the surface of the log could be even smoother.

The most significant difference between so-called original and contemporary logs among our participants was adhesive. Few participants were obstinate in their idea that glued logs are not real logs. The main issue seemed to be doubts about how glue affects the major reason that log is currently so popular in the first place, the log structure’s breathability and healthiness in general. For some participants, the presence of glue and its impacts on indoor air seemed to be a prerequisite for the log-ness of industrially produced log: ‘If the lamella-log house is as risk-free as a natural log house, then it can be called a log building’. (SM10) One participant was worried about how the layer of glue affects the wall’s ability to breathe. It was also suspected by another participant that glue might cause some emissions into the indoor air. One participant was suspicious towards the glue, because she knew that in some cases gluing a plastic mat on a concrete surface that had not been completely dry had caused health issues for building occupants.

Some participants were not critical towards the glue. One participant pointed out that the amount of glue is still very small: ‘Ninety-nine point something is after all wood, so I still consider it as log, even though it is composed of multiple pieces of wood’. (SM5) Some participants felt that glued log still can be regarded as log, stating that it is merely the result of a natural, even desirable product development of the log. Some

participants accepted this as an inevitable development. One respondent encapsulated this view aptly describing the industrially produced lamella log as a modernized version of the ancient building material.

Discussion

Log is perceived as healthy and therefore desirable

Overall, many of the primary attributes that were connected with wood in general in the literature review emerged in the context of log as well. Strobel et al. (2017) found that physical properties of wood, such as grain and scent were perceived as signs of the natural origin of wood, but also as making wooden spaces appear cosy and warm. Log building too was viewed to arouse sensations of warmth and cosiness; it was considered soothing because of the warm feeling. Thus, not even the composite nature of contemporary glued log faded the effect; this indicates that the perceived level of processing in glued log is still very low. In addition, wood is perceived as very natural material (Nyrud & Bringslimark, 2010), which was the case with log too among respondents. However, although naturalness was seen as one of the key factors that make log desirable among Finns, it did not seem to be the main reason for desirability, unlike with wooden products in general, as found in the literature review. Instead, a more essential reason for desirability of log seemed to be healthiness and health benefits of using log.

Healthiness of the structure, that is, the ability to breathe, was mentioned also as one reason for the soothing nature of log buildings. In earlier studies, wood has been expected to have psychophysiological effects for human health in the same manner than nature (Nyrud & Bringslimark, 2010), and according to Burnard et al. (2015), wood use in interiors reduces the stress levels of occupants. However, the perceived healthiness related to structural safety of wooden structures in terms of moisture-related problems seems to be characteristic for log structures, but in the light of our literature review, not for other wooden products, or for wood in general. It is also possible that perceived healthiness of log structure is especially apparent in the Finnish context, due to the understanding of the traditional way of log building and current Finnish building practices, as the most common way to build a log house in Finland even today is to utilize log as the only material for the walls, without any additional insulation layer. This seems to be rarer in other countries, where outer wall structures of simply solid wood can be even prohibited by regulations related to the energy consumption of buildings, although there might be other reasons as well for not using such wall structures. In such countries, where wall structures of solid wood are not common, it is understandably not something that comes up in studies regarding perceptions of wood. In Finland, the perceived healthiness or structural safety of log walls in moisture-related issues could be due to the understandability of log walls, which appear as a very simple, almost “foolproof” structures. Perceived healthiness can be also due to the quite well-known cultural history of log since, as stated in the interviews, it reminds people of the “good old days”.

In Pudasjärvi, one of the key reasons for the municipality to build a log-structured school building was severe problems in indoor air quality in the municipality’s existing school buildings (Lukkaroinen, 2016). After the seminal example of Pudasjärvi, other municipalities in Finland have built log schools as well, and many have had similar drivers for these projects. When these projects are combined with somewhat high coverage in the media, it is no wonder also laypersons feel that log is a healthy option to consider in single-family houses as well. This, and the fact that schools are important public buildings for the community, foster the sense of log’s trendiness. It was directly stated by our participants that the sense of log’s trendiness is related to recent built examples of public log buildings. Public buildings seem to be also very efficient examples in disseminating the positive qualities of log, since they are, as the name suggests, open to the public. Some of the respondents had visited Pudasjärvi log school and had positive experiences related to warmth, cosiness, acoustics and the soothing nature of log.

In addition, healthiness was even stated to be a prerequisite for the "log-ness" of the contemporary glued log. Despite the composite nature of glued log, it was still perceived as log; however, if the presence of glue was to risk the healthiness of log building, glued logs could no longer be perceived as log. To conclude, then, the desirability and sense of trendiness of log among our participants in the Finnish context seems to be closely intertwined with the perceived healthiness of the structure.

Stereotypes concerning log are changing

The perception that log is a construction material primarily for building in rural milieus could be understood as an existing stereotype, since our interviewees felt this even though they had no personal experiences with log. Another stereotype was that log is not suitable for the urban environment; it was even acknowledged by our participants that it is merely a mental image created by the fact that urban log building is so rare. It seems that these stereotypes' origins date to the beginning of industrialization in Finland, when the use of log almost came to an end as log was considered an old-fashioned construction material. These stereotypes do not appear only in the views of laypersons. Almost twenty years ago, critical attitudes of building officials towards log building in urban areas were reported by Heikkilä (2002). Here again, similar issues concerned wood in general; in a study mapping the main barriers for wood use among architects and other professional stakeholders by Viļuma et al. (2017), stereotypes were mentioned as one of the main barriers in Latvia.

However, besides these rather negative stereotypes, new ones are associated with log also, or the old ones begin to appear differently. Traditionality, for example, seemed to evoke mainly positive connotations among our respondents, whereas being old-fashioned was the reason log was abandoned in the first place. In addition, healthiness is clearly one emerging stereotype for log. Healthiness was described in many ways, but the precise reasons why a log house is healthier in terms of indoor air problems was not necessarily understood in detail. Naturalness, and therefore sustainability due to renewability, could be seen as an emerging, positive stereotype of log as well. The meaning of these new stereotypes could be fundamental in the possible acceptance of future log houses in the urban context. Because of the perceived good qualities of log, our participants hoped to see an increase in urban log building and felt that even though log would appear as a rather odd material in the urban environment, people would be willing to accept log because of its exquisite qualities. Viļuma et al. (2017) conclude their study by stating that stereotypes are difficult to change; instead new, positive ones should be created. In the light of this study, new positive stereotypes for log could have the possibility to overcome the old ones.

The visibility of log structure is meaningful in various ways

Before industrialization, when log was used extensively in Finnish building, log was used also in urban construction, but it was only used as a structure, clad both inside and outside (Kaila, 1996). However, as one more conclusion, we would like to highlight that many of the attributes of log building, currently perceived as positive qualities, presume that the log structure is not covered. Statements referring to the fragrance of log and that it creates good acoustics or a cosy and warm environment are not applicable if log walls are covered. Log, and wood in general as natural elements, have potentially many restorative effects related to psychophysiological responses, which obviously apply only to visible wooden surfaces where one can see the grains, which are the sign of a log's natural origin. In order to fully exploit breathability, a perceived health benefit that seems to be characteristic especially for log, log walls need to be unclad. These qualities are mainly perceived in log house interiors, and do not necessarily require logs to be unclad on the outside as well.

However, when considering participants' views of log buildings in the urban environment, there too log buildings of a characteristic appearance were desired. This was evident in views such as logs in cities would be refreshing, or that log buildings would be distinctive or personal-looking buildings within the cityscape. Exposing logs on the outside of structures was seen to have also other meanings. Using logs was seen as an

image factor because of the values that log currently represent. A complementary view for this was that by using log, values like naturalness and sustainability could be disclosed visually.

All this supports and is supported by the finding that the construction method itself appeared meaningful in perceiving log and log building. The way of building, including visible corner joints, was perceived as interesting and amusing because this revealed that a log house is actually built one log at a time. This way it is a totally transparent way of building; its qualities such as breathability and healthiness can be understood very easily at first glance. Besides being desirable for laypersons, revealing the log structure of a building has been discovered to be important for architects as well, being crucial for the architectonic quality of high-class log architecture (Lakkala & Pihlajaniemi, 2018). In addition, the desire to reveal the log structure was explained by the building's owner's opinion that log is an important image factor, and that the log-ness of the building is disclosed clearly when the log structure is visible (Lakkala & Pihlajaniemi, 2018).

However, although the distinctive cultural signals of log building, such as corner joints and the assembly of single logs themselves, aroused positive feedback among our participants in the pilot pavilion, the most important factors of desirability for log houses seem to be the healthiness, sustainability and other pleasant qualities that are mainly perceived inside a log house, such as warmth and cosiness. Even though the visible signals of the log construction method disclose that a house is indeed a log house, many of the most important factors that seem to make log a desirable material can be achieved with a log house that does not look like a log house, by means of exterior cladding or utilizing novel, hidden corner types and minimalist cross-section profiles of logs. To achieve these benefits, it is enough that there is a wooden surface on the inside – for the feeling of warmth and cosiness an interior cladding would do – and for the perceived healthiness characteristic for log that the walls are solid wood.

As mentioned before, log buildings were desired in the urban environment, but on the other hand viewed as not suitable there. An interesting question related to these issues is, what could urban log buildings be like? This was found to be difficult to imagine among participants, which it undoubtedly would be for anyone. The answer is most likely related to consideration of the extent to which future urban log buildings should look like log buildings. In basic Finnish inland conditions, the current structure of a contemporary log wall should be adequately durable and sufficiently insulating as such; on the other hand, log buildings have been traditionally clad for aesthetical reasons, especially in cities, and to improve durability, especially in coast areas with humid climate. As a topic of future research, it would be interesting to study how important it is for consumers and professionals that a log building discloses its log-ness both inside and outside.

Luusua et al. (2018) suggested that in order to be accepted in the urban environment among architectural and building industry professionals, log and log buildings have to undergo some sort of transformation. Based on views presented in the study at hand, the lamella log itself, as well as novel detailing of logs, could be considered as such transformations. Among our participants, important attributes for the definition of a log building was material composition, shape as a longitudinal piece of timber and characteristics of the construction method. Very many positive qualities are associated with log building, not least because of its nature as a time-honoured construction technique. Based on our participants' views, certain qualities, such as durability, elegance and traditionality are connected especially with log, and not necessarily with timber building in general. Transformation is needed, but how much can log architecture be transformed while still being perceived as log building and thus associated with its perceived benefits? A tangible architectural answer to this question remains an interesting subject of further studies, for which the views presented in this study are hopefully beneficial.

Future development for logs is needed

The most obvious transformation of log has been the introduction of adhesives. The existence of adhesive was perceived as somewhat problematic; glue was feared to prevent breathability or to cause harmful

emissions into indoor air. However, making logs by gluing is necessary if log buildings are to be manufactured on a large industrial scale. There are not enough large trees for all houses to be log, but also other benefits exist; kiln drying of smaller pieces of timber is more efficient, and glued logs become more stable and accurate products. The possible adverse effects, or the lack of them, along with the benefits of this necessary development should be communicated very openly because the potential issues concern consumers, as well as professionals as was found by Luusua et al. (2018).

In the views of participants, the preferences for detail-level qualities of logs were varied. For example, some wished logs to be more natural, very traditional round logs or at least the surface texture to be rougher instead of planed lamella logs, while others wanted logs to be smoother surfaced. Thus, as the use of logs both increases and diversifies and preferences are very diverse, producers should offer many more options for detailing of logs. For example, alternative cross-section profiles with different bevels and new corner joints should be developed, both for interior and exterior purposes. In addition, alternative quality classes based on, for example, knottiness and natural colour variations of wood, as well as surface textures should be made available. Precise expectations concerning these, from both consumers and professionals, should be examined in the future. The pavilion of this study consists of nontreated and rather nonweathered log walls. The effect of surface weathering or surface finishes, both being important details of building design, which were not examined in this study, should be also considered in future studies related to perception of log walls.

Implications for architectural design

The appreciation and meaning of log building in Finland have shifted from sophisticated primary construction material to outdated and abandoned, from rudimentary, though popular material of summer cottages to current position, where it is considered generally as healthy, trendy and amusing, and its use is increasing. Technical properties too have evolved similarly from handcrafted, very natural to industrial and more processed product. As described in this study, currently, using log as an architectural material can offer positive experiences for building occupants, making it's use very justifiable. On the contrary, designing contemporary urban buildings out of logs is far from straightforward, because of the persisting stereotypes of ruralness and suspicions towards glue for example. However, designing architects are expected to fit together these incoherencies. Log is an emerging material, which architects need to understand and it is crucial that architects are aware of the various associations, presented in this study, that logs currently arouse among laypersons.

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