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**Submission date:** 27-Oct-2022 12:24AM (UTC+1100)
**Submission ID:** 1935894507
**File name:** Adption_to_Sonic_Territoriality-_A_Domestic_Space_Case_Study.pdf (1.6M)
**Word count:** 7579
**Character count:** 39828

Civil Engineering and Architecture 10(5): 1967-1982, 2022
DOI: 10.13189/cea.2022.100519
http://www.hrpub.org

# The Adaptation to Sonic Territoriality: A Domestic Space Case Study

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*Received April 27, 2022; Revised May 27, 2022; Accepted June 27, 2022*

***Cite This Paper in the following Citation Styles***

***(a):*** *[1] Ivana Agnes Sompie, Coriesta Dian Sulistiani, Tampanatu P. F. Sompie , "The Adaptation to Sonic Territoriality: A Domestic Space Case Study," Civil Engineering and Architecture, Vol. 10, No. 5, pp. 1967-1982, 2022. DOI: 10.13189/cea.2022.100519.*

***(b):*** *Ivana Agnes Sompie, Coriesta Dian Sulistiani, Tampanatu P. F. Sompie (2022). The Adaptation to Sonic Territoriality: A Domestic Space Case Study. Civil Engineering and Architecture, 10(5), 1967-1982. DOI: 10.13189/cea.2022.100519.*



**Abstract** Since the onset of the COVID-19 pandemic, apart from accommodating daily activities, the domestic space also needs to accommodate additional activities, such as studying and working from home, with a longer intensity of time. These activities produce sound and are also influenced by other sounds in the domestic space which then forms the domestic soundscape, thus triggering the sonic territoriality of each occupant to adapt according to their needs for sound. By using the theory of adaptation strategy, as well as the theory of territoriality regarding the mechanism of territorial control and the elements of space, this study aims to identify the adaptation strategies that are being carried out in the domestic space when certain sounds enter the territory that is being occupied. A case study with a qualitative method was conducted in a domestic space with residents who are active for a long time at home, using field observation and interview as the data collection techniques. From the observations, a mapping of the space, activities, and sounds of each occupant of the house was made. Based on the results of the case study, it was found that the adaptation strategies carried out in order to adapt according to their sonic territoriality are: adjustment, in the form of arranging the spatial components and shifting positions and orientations inside a territory, and withdrawal, in the form of moving from one room to another. These adaptations involve elements of space, which are mainly fixed and semifixed features, as well as territorial mechanisms: personalization and defense.

**Keywords** Adaptation, Domestic Space, Sonic Territoriality, Domestic Soundscape, Elements of Space

## 1. Introduction

Since the occurrence of the COVID-19 pandemic, the frequency of face-to-face contact has been reduced to avoid the spread of the Coronavirus. The concept of stay-at-home is increasingly being applied. The teaching and learning process is starting to be carried out online. This results in the intensity of time at home increasing. Activities that are usually done outside the home, such as studying at school and working at the office, are being brought home. Domestic space, which is related to house, home, and household and is a place where humans live their daily activities [1, 2], is no longer just a place to carry out daily domestic activities such as cleaning and cooking, but also needs to accommodate work and study activities that are more intense than usual. Wigglesworth and Till [3] stated that living and working in the same building means that the two lives cannot be easily distinguished, because they actually become inseparable from each other.

Every activity carried out at home since the implementation of stay-at-home, be it domestic activities in general or study and work activities, produces sound which then connects one room to another, either directly

or indirectly. These sounds, together with outside sounds that can be heard even inside the house, such as rain or vehicles passing in front of the road, make up the domestic soundscape [4]. The domestic soundscape can affect the behavior of each person, depending on their activities in a particular space. According to Flügge [5], it is natural for humans to have a desire to fulfill their needs regarding the sound produced and heard in space, so that each individual has sonic territoriality according to their respective preferences and needs. Each individual wants to have control to manage their own territory in their home [6], especially after the intensity of togetherness of family members at home has increased, and several activities carried out by other family members can cause distractions or reduce the individual's territory.

Sonic territoriality in the domestic space implies the exploration of what makes a home by the possibility of rearranging the established order of the home itself [7]. Activities that generate sound will have different acoustic needs, but when the house is not designed from the start to accommodate these needs, changes or adjustments occur from the occupants to the space. The house should adapt to the daily routine of its occupants, especially when the house is where humans hold the highest power and control compared to other places [2, 6]. In the end, adaptation occurs in the domestic space to meet the needs according to the emerging sonic territoriality, especially during stay-at-home. Based on this situation, this research wants to explore the adaptations carried out by the occupants in domestic space as a response of sonic territoriality.

## 2. Theoretical Basis

### 2.1. Domestic Space and Its Adaptation

According to Pink et al. [2], houses are continuously shaped and reshaped through routine processes in daily life, so the domestic space is mentioned as an environment that is constantly adapting. There are three adaptation strategies that humans can do [8], namely 1) adjustment, where there is a desire to achieve harmony between individuals and space; 2) reaction, where there is a desire to make major changes to the space; and 3) withdrawal, where there is a desire for a space that is more in line with needs. By carrying out these adaptation strategies, the expected effect is to create harmony and tolerance in activities that take place at home [9].

### 2.2. Territoriality

Humans, both individually and in groups, need space to carry out their daily activities. According to Lang [10], the space needed makes humans have territorial behavior, where there is a desire for humans to achieve the needs, levels of privacy, and security that they want when they are doing things. Lang [10] defines human territory as space with defined boundaries, which are used and maintained by individuals or groups. Lang states that territory is related to "the psychological identification of a place, symbolized by possessive behavior and the arrangement of objects in that place." The definition put forward by Lang is related to the definition of territory according to Altman [11], where he states that territory is a space or area that is closely related to ownership, accessibility, control, and human involvement as users in it.

Human involvement in the formation of this territory is then referred to as territorial behavior, or territoriality. This behavior is referred to as a self-limiting mechanism involving personalization or marking of a place or object and owned by an individual or group [11]. From this, it can be seen that territoriality is closely related to human claims to a place, even making efforts to defend that space from external interventions.

Nur'aini and Ikaputra [12] defined territoriality as the behavior of individuals or groups to control the formation and arrangement of territories, in which there are fixed, semifixed, and nonfixed elements, with the aim of getting the desired level of comfort and defending themselves from outside intervention. The fixed, semifixed, and nonfixed elements that play a role in forming or managing this territory are described by Rapoport [13] as follows:

1. Fixed-feature elements, namely elements that are always fixed, or that rarely change, such as walls and floors;
2. Semifixed-feature elements, namely elements that are most frequently adjusted, such as furniture or other small objects; and
3. Nonfixed-feature or informal elements, namely elements related to humans living in space, such as the proxemics, distance of interaction between humans, body position and posture, voice and volume. The behavior and arrangement of these nonfixed elements are often reflected in changes made to semifixed elements [14].

Control over territory is important because it leads to the fulfillment of several basic human needs: “the need for identity, the need for stimulation, and the need for security” [6]. Porteous [15] suggested that individuals or groups show control over their territory through two mechanisms, namely 1) Personalization of space, which is related to marking where humans mark space to show their identity and ownership of the space, such as arranging space, arranging furniture, and placing objects in space [10, 15]; and 2) Defense of space, which shows a desire to maintain space that is considered a territory through guarding on territorial boundaries—individuals use clear boundaries to state the space or area that is being used.

### 2.3. Sonic Territoriality

Based on the Oxford Learner's Dictionary [16], sound is a noun that is defined as "something that you can hear."

Activities carried out by humans almost always produce sound, both from individuals and from objects that interact with them. The space formed by sound is a sphere that has no clear boundaries and is dynamic [17]. Sound is associated with its source, but at the same time, sound also becomes something that stands alone, tends to mix with other sounds—sounds are all around us and become something that we respond to unconsciously [18].

It is natural for humans to have a desire for privacy in sonic terms; that there is a limit to what is tolerated and there is a desire to defend their own territory when faced with a sound that has crossed the line of tolerance [5]. Disturbance through sound, where humans feel that it disturbs their comfort, or is intrusive, in space, has the same concept as when there is intervention from external factors on the territory occupied by individuals. This can be perceived as a violation of privacy and is a sign that humans have an auditory sense of ownership of the space they occupy [5].

Just as humans physically control their own territory, each individual can also demonstrate control over sound in space; ownership of the use of space is considered the same as ownership of the sounds in it, thus indicating the existence of sonic territory [5]. Flügge [5] explained that in the territory of physical space, whose ownership can be marked by physical measurements and objects, there is still sonic territoriality, or which is explained as a desire to maintain and defend sonic territory. When doing activities, humans tend to show control over what happens around them: how people will act, how they are arranged in space, and how sounds will be heard inside the space they occupy.

### 2.4. Domestic Space's Adaptation to Sonic Territoriality

"Home is a preferred space, and it provides a fixed point of reference around which the individual may personally structure his or her own spatial reality." [6] The house is a human space that holds the highest power and control compared to other places. However, at home, when living with family, there will still be limitations of space and control. At a smaller territorial level, such as personal space, individual control is more dominant, but the physical space that can be controlled is less, while at a wider territorial level, such as the range of daily activities, more physical space can be controlled, but the control that individuals have is greatly reduced. This is due to the presence of other family members and the need to share sp[illegible] [6].

Oleksik, Frohlich, Brown, and Sellen [4] mentioned the term "domestic soundscape" when trying to understand the role and arrangement of sound in domestic space, which is defined as the acoustic environment of the house. Domestic soundscape consists of all kinds of sounds that appear and are heard in the domestic space, either sounds produced by residents of the house talking to each other, doing activities, or moving places, as well as sounds from media such as televisions, cellphones, and laptops, and also external sounds such as voices from the neighbors, the weather, and vehicles passing in front of the house. It should also be noted that the domestic soundscape is not a permanent phenomenon, but will experience constant changes and variations [4].

The voice in the domestic space is objective and subjective [4]. Objectively, sound intensity level can be measured (decibels or dB) with a sound level meter [19, 20]. All sounds that distract and interfere with daily activities, such as work, rest, entertainment, or study, are considered noise [19]. The criteria for noise in residential houses were not as strict as those in other buildings; this is due to the large difference in the residential area depending on its development, the economic condition of the occupants, and the differences in the activities that take place in it. The recommended noise criteria for residential houses in the city are 30 NC (27 – 60 dB) for bedrooms and 35 NC (32 – 63 dB) for living rooms [19].

Subjectively, sound is said to have a function or purpose, where sound can describe current activities or events that will come and make people anticipate or get ready. Sounds in daily activities have a tendency to be noticed and cause reactions when the sound is felt to be a source of disturbance or annoyance [4]. Everyone has his/her own perception of what sounds are disturbing and sounds that distract or disturb others can cause different reactions for each person depending on his/her comfort level of sonic territoriality [19].

The sound in the domestic space (domestic soundscape) is different from the sounds in other places in terms of the extent to which the sound can be regulated by the occupants; family members have a high level of control over the sound settings in their homes. Those sound management efforts can affect the physical spatial configuration in the house [4]. The components in the house will always adapt in the process of adjusting to the desires or needs of the humans who live in it [2]. This is done in order to create harmony between space and users, so that what happens in space is something that is intended and desired by its users [2, 8, 9].

As discussed in the previous section, Rapoport [13] stated that in space there are three elements that affect territories, namely fixed elements, semifixed elements, and nonfixed elements. Fixed elements, in the form of walls and ceilings; semifixed elements, in the form of furniture, furnishings, or other small objects; and nonfixed elements, which relate to humans in space, such as interaction distance, position, sound and volume, are then reflected in the changes of the semifixed elements. Semifixed elements, which include doors, curtains, furniture, and other furniture or objects, become an important factor in the formation of territory. This element plays a role in the adaptation of space as a response to the territoriality of sound in the domestic space.

Based on the theory of three adaptation strategies, namely through adjustment, reaction, and withdrawal [8, 9], the adaptations carried out by the residents of the house in response to their sonic territoriality are explained as follows:

1. Adjustment, where residents want to reduce the sound conflict that occurs, so they finally make adjustments by adjusting the semifixed elements. The way that can be done with this strategy is by arranging semifixed elements or furniture horizontally to form a closed space with clear but also flexible boundaries, because furniture is easily moved as needed. In this strategy, fixed and non-fixed elements also play a role, where rigid physical barriers such as walls (fixed elements) then block sound more than furniture, so there is also distance between them (non-fixed elements).
2. Reaction, where residents make modifications to the house, which results in major changes to the space. This effort is made to create a new space that suits the users' needs. This method can be done by making extensions of space to other rooms in the house, so that ultimately the house is transformed to meet the needs of certain activities [9].
3. Withdrawal, where residents move to another room to find a place that is more in line with their desires or needs, because the space occupied at the beginning cannot meet their activity needs anymore. This strategy is carried out when the conditions in the space occupied cannot be adjusted to suit what is desired and whatever is done in the space does not provide significant changes, for example when the sound that invades the territory has exceeded the limits of comfort and individual needs.

## 3. Materials and Methods

Based on the theoretical basis above, a case study with a qualitative method was conducted in a domestic space: a residential house with residents who are active for a long time at home. Data collection techniques were carried out through observation and interviews. The adaptations in the domestic space as a response of sonic territoriality was observed using the indicators stated in the theoretical basis, such as activities carried out in the house, sounds that occurred and affected it, and elements of space used and that became factors that affect the changes the users are hoping to gain. The activities are divided by time: morning (09.00-12.00 by hour), noon (12.00-16.00 by hour), and evening (16.00-20.00 by hour) to identify what activities have a specific need for sound that then affects the need to adapt. Sounds are mapped through observations and measured using the Sound Meter application to identify sounds that directly or indirectly become the cause of the adaptation itself. Lastly, elements of space, which are affected by factors of: fixed features such as walls, floors, ceilings; semifixed features such as doors, chairs, tables, windows; and nonfixed features such as the distance, body position and pose. From the observations, a mapping of the space, activities, and sounds of each occupant of the house was made. Interviews were conducted to find out the reasons underlying the act of territoriality and adaptation to certain sounds.

### 3.1. Location


**Figure 1.** House Plan

The house where the case study is conducted is located in a residential area in Manado City, with one floor and a building area of 105 $m^2$. This house is flanked by neighboring houses on the left and right, and is directly opposite a residential street which has a width of 5 meters. This residential road is often passed by cars, motorbikes, and residents of the housing area, ranging from children to adults.

### 3.2. Participants

**Table 1.** Participants and Their Daily Activities

| Participant | Time spent at home since the pandemic | Activities |
|---|---|---|
| A (Father) | >20 hours/day | Working, teaching, attending webinar, exercising, resting, eating, bathing, sleeping |
| B (Mother) | >20 hours/day | Cooking, doing chores, resting, eating, bathing, sleeping |
| C (Child 1) | >22 hours/day | Attending class, doing assignments, resting, eating, bathing, sleeping |
| D (Child 2) | >20 hours/day | Attending class, doing assignments, resting, eating, bathing, sleeping |

The house is occupied by a family consisting of 4 people: Father (male, 49 years old), Mother (female, 49 years old), Child 1 (female, 21 years old), and Child 2 (female, 18 years old), with details of their activities can be seen from Table 1. Figure 1 informs that the house consists of a living room, 2 bedrooms (Father and Mother occupy room 1, Child 1 and Child 2 occupy room 2), a family room and a dining room which are adjacent to the same area, 2 bathrooms, and a kitchen.

## 4. Results

Residents of the house performed activities that play a role in producing sound, thus creating their own sound territory (see Figure 2 where it shows each of the participants's main spots each hours of the day and the sound range of their respective activities). In the morning, initially the sonic territories overlap because activities are carried out at a close distance between one resident and another. Towards noon, the overlapping sound territories then began to separate with distance because each resident carried out his/her activities in a certain space, such as attending online lectures or webinars that produced his/her own sounds, but still influenced each other. In the evening, the sound territory is no longer overlapping because each resident carries out his/her own activities without the need for excessive noise.

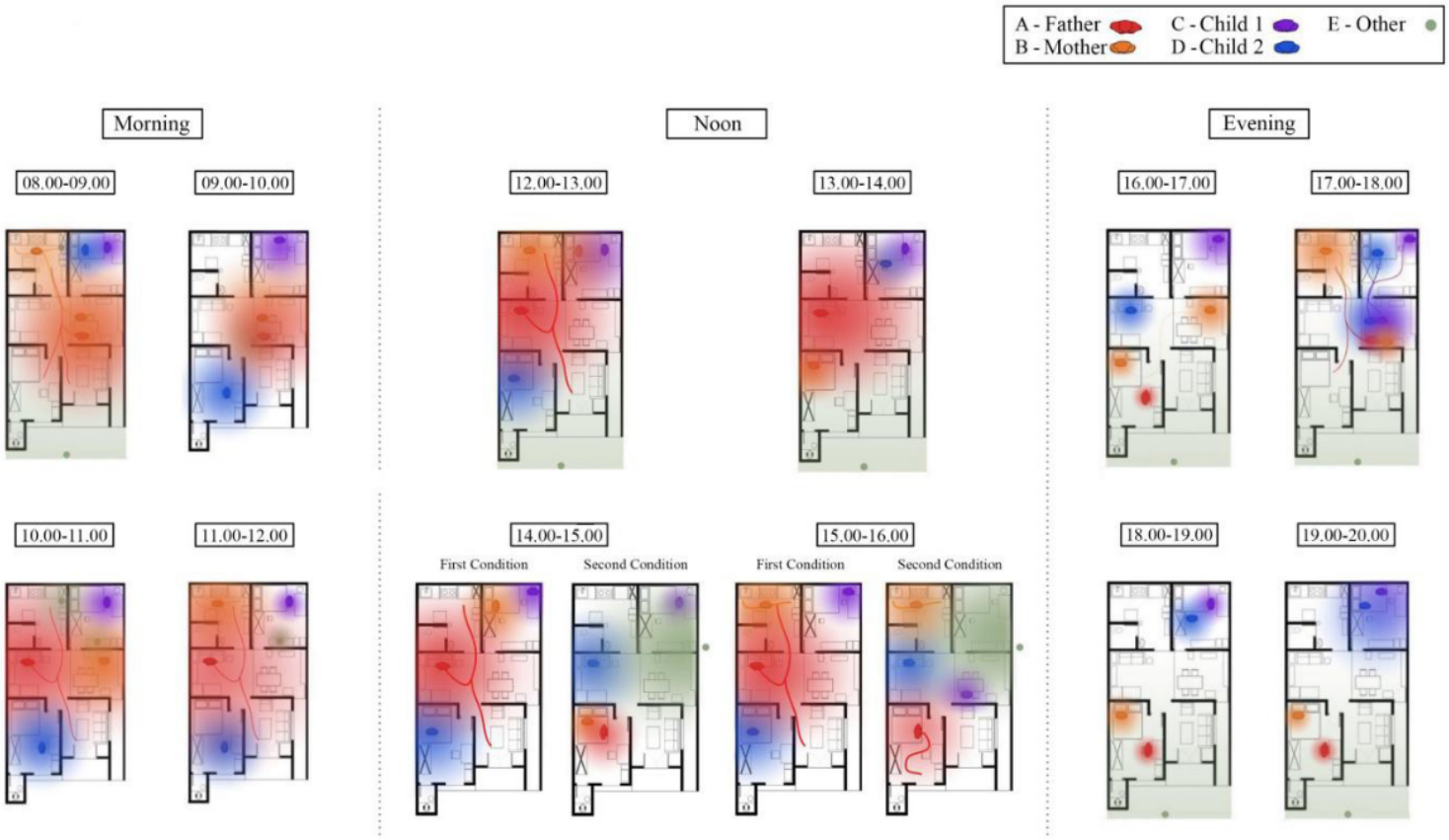



**Figure 2.** Domestic Soundscape Territories

Each person's personal abilities and activity requirements, or what Haas, Stemasov, and Rukzio [21] call causal conditions, triggered the adaptation strategies for the domestic soundscapes, and those adaptations could either result in intended or unintended consequences (i.e. improved focus or limited social interaction) [21]. Based on further observations, the adaptations made by the participants as a response of sonic territoriality to the domestic soundscape are shown and described in more detail as follows.

**Table 2.** The adaptation forms to sonic territoriality in the domestic space

| No. | Adaptations | |
|---|---|---|
| 1 | Closing the door (not completely, leaving 5-10 degrees open) | [Morning]<br>  |
| | | In this condition, participant A (marked in red) is the dominant one who produces sounds (which triggered adaptation), while participant D and C who are in room 2 are the sound receivers who then adapted. |
| 2 | Moving from one room to another and closing the door completely | [Morning]<br>  |
| | | In this condition, participant D (marked in blue) is the one who will be the source of sound (and thus adapted); participant C (marked in purple) is the one who influenced the adaptation of participant D (because in the initial condition they occupy the same space, thus making participant D, who needed a more enclosed room, left and search for a room where they can be alone); and participant A (marked in red) is the one who was influenced by the adaptation of participant D (also adapting by moving from one room to another). |

**Table 2. Continued**

| | | |
|---|---|---|
| 3 | Moving from one room to another | [Morning]<br>  <br> |
| | | In this condition, participant A is the one who will produce sound (by attending a webinar and putting it on speaker), so they are looking for a bigger space that can fulfill their need for sound to spread widely, where they can hear the speakers while also doing exercises around the house at the same time. |
| 4 | Changing positions and orientations | [Noon]<br>  <br> |
| | | In this condition, participant D is the one who produced sound through their activities (i.e. taking online lectures, where they need a space where they can hear the professors clearly) and is also the one who is influenced by external sound sources from outside the house, namely the sound of a motorcycle noise that sometimes passes in front of the house. |

**Table 2. Continued**

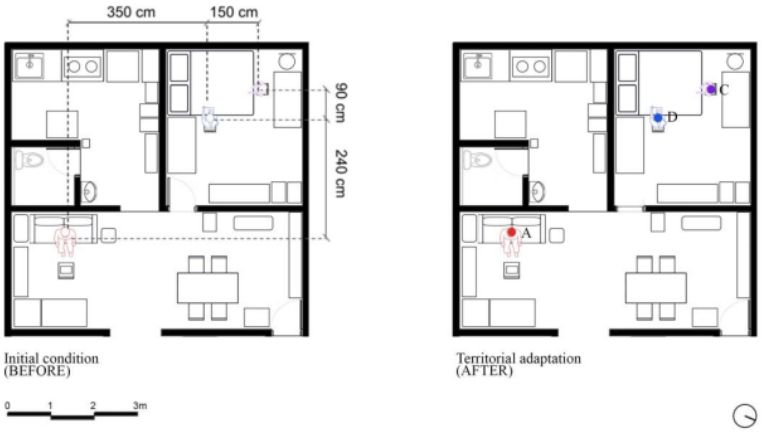
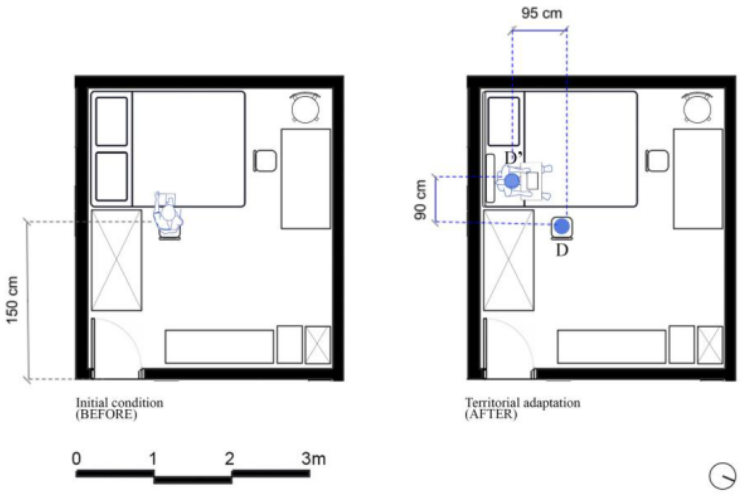
| | | |
|---|---|---|
| 5 | Closing the door completely | [Noon]<br>  <br>Participant A (who is in the family room, marked in red) and participant B (who is in room 2, marked in orange) are both the ones producing sound. In this condition, both of them, with the sound produced through their respective activities, influenced each other to adapt. |
| 6 | Closing the door completely | [Noon]<br>  <br>In this condition, participant A who sits in the family room is the dominant one whose activities produced sound, while participants C and D who are in room 2 are the recipients of the sound, who then adapted because of it. |

**Table 2. Continued**

| | | |
|---|---|---|
| 7 | Placing boundaries and changing positions | [Noon]<br>  <br>Participants C and D are in the same room, namely room 2. C and D are both producers of sound through their typing activities using their laptops' keyboard. However, participant D is also a dominant one who produce sound, because they often speaks to tell something. In this condition, participant C becomes the recipient of the sound,who then adapted when the sound became too much in their initial position. |
| 8 | Changing positions and orientations | [Noon]<br>  <br>In this condition, participant D (marked in blue) is the dominant one in terms of producing sound by sometimes speaking out their thoughts, while participant C is the recipient of the sound and is the one who adapted because of the sound from participant D. |

**Table 2. Continued**

| | | |
|---|---|---|
| 9 | Moving from one room to another room | [Noon]<br>  |
| | | In this condition, the dominant sound source came from the neighbor's house, while participants C and D are the recipients of the noise and are the ones who adapted because their original territories were affected by the neighbor's construction noises. |
| 10 | Changing positions and orientations | [Evening]<br>  |
| | | In this condition, participant D is the possible recipient of sound who then adapted in the space because of the possibility of any sound to come through the door behind them and catching them off guard. |

### 4.1. Adaptation (Morning)

As seen from Table 2 (number 1, 2 3), in the morning, three adaptations were found. The first adaptation is when Participant A carried out his/her activities, namely walking around the house while listening to an audiobook, and Participants C and D adapted by closing the door, but not closing it completely. The second adaptation is when Participant D was going to take an online lecture and needed his/her own space to be able to focus on listening to lecture material, so he/she moved to room 1 and closed the door, while also using headphone to be able to listen to the lecture with more clarity. The third adaptation is when Participant A wanted to take part in a webinar and

needed a position where the sound from the laptop can spread more throughout the house, so Participant A moved from one room to another.

### 4.2. Adaptation (Noon)

During noon, six adaptations were found (Table 2 number 4, 5, 6, 7, 8, 9). The first adaptation (number 4) was carried out when Participant D was attending an online lecture in room 1 which was at the front of the house and heard the sound of a motorbike with a noisy exhaust passing on the road in front of the house. Participant D then adapted by changing positions and adjusting their sitting orientation. The second adaptation (number 5) is when the voice of Participant A's activity, who was attending a webinar, and the voice of Participant B, who was on the phone, overlapped with each other, so the door was adjusted to close completely to isolate them from one another. The third adaptation (number 6) is when Participant A taught online lectures and spoke with a loud volume, thus affecting Participant C and D, who were in room 2, to close the door completely to reduce the intensity of sound entering their own territory. The fourth (number 7) adaptation is when Participant C and D were in room 2 and were both typing using laptops at a close distance. They then put pillows as boundaries and shifted positions to provide distance between the two in order to reduce the intensity of the sound heard. The fifth adaptation (number 8) is still in room 2, where Participant C, who was working and initially sat with their back to Participant D, who became the source of sound, then felt uncomfortable and sought comfort because Participant D often spoke suddenly, which made Participant C change positions of sitting and orientations to be able to monitor the conditions in their territory more broadly. The sixth (number 9) adaptation occurred when a loud noise was heard from the activities of a handyman in a neighbor's house who was doing house construction. The sound came from right next to room 2, on the walls of which were adjacent to the neighboring house. Participants C and D, who occupied room 2, then left their territory to move to the dining room and family room which were slightly further away from the sound source, because the construction sound was considered to be highly disturbing their focus.

### 4.3. Adaptation (Evening)

Table 2 (number 10) shows that the adaptations found were changing positions and sitting orientation. Participant D, who occupied room 2 and initially sat with their back to the bedroom door, felt uneasy when an unexpected and sudden sound came from behind them, so they made position adjustments to make themselves feel more secure.

## 5. Discussion

**Table 3.** The relationship between the adaptations, sound, and activities

| Time | | Morning (08.00–12.00) | | | Noon (12.00–16.00) | | | | | | Evening (16.00–20.00) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Adaptations (based on Table 2) | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| SOUND | Main source | Nonverbal (footsteps), media (phone), external (motorbike) | Media (online class), external (motorbike), machine (water pump) | Media (webinar – laptop), machine (water pump) | External (motorbike), media (online class) | Media (webinar - laptop), verbal (calling) | Verbal (speaking), external (motorbike) | Nonverbal (typing), verbal (speaking), machine (AC) | Verbal (speaking), machine (AC, water pump) | External (neighbor's construction noise) | Verbal (other people possible shouts), media (television), external (motorbike) |
| | Before (dB) | 39.7 | 44.2 | 50.7 | 45.2 | 43.3 | 38.2 | 39.5 | 39.7 | 44.6 | 39.5 |
| | After (dB) | 33.4 | 40.4 | 51.6 | 42.6 | 42.3 | 34.5 | 37.4 | 35.2 | 39.5 | 36.4 |
| ADAPTATION | Adjustment | v | v | v | v | v | v | v | v | x | v |
| | Reaction | x | x | x | x | x | x | x | x | x | x |
| | Withdrawal | x | v | v | x | x | x | x | x | v | x |
| | Action | Closing the door (not completely) | Moving from one room to another and closing the door | Moving from one room to another | Changing positions and orientations | Closing the door completely | Closing the door completely | Placing boundaries and changing positions | Changing positions and orientations | Moving from one room to another | Changing positions and orientations |
| | Territorial control mechanism | Defense | Defense | Personalization | Defense, personalization | Defense | Defense | Defense, personalization | Defense, personalization | Personalization | Defense, personalization |
| | Elements of space | *Semifixed feature:* door *Fixed feature:* wall *Nonfixed feature:* proxemics | *Fixed feature:* wall *Semifixed feature:* door *Nonfixed feature:* proxemics | *Fixed feature:* wall *Nonfixed feature:* proxemics *Semifixed feature:* chair, laptop | *Nonfixed feature:* proxemics *Semifixed feature:* folding table *Fixed feature:* wall | *Fixed feature:* wall *Semifixed feature:* door *Nonfixed feature:* proxemics | *Fixed feature:* wall *Semifixed feature:* door | *Semifixed feature:* pillow *Nonfixed feature:* proxemics | *Semifixed feature:* chair *Nonfixed feature:* proxemics | *Fixed feature:* wall *Nonfixed feature:* proxemics | *Semifixed feature:* folding table, wardrobe *Nonfixed feature:* proxemics |

Based on the observations made, it was found that the sounds that make up the domestic soundscape in the case study of a domestic space can be grouped as follows:

1. Verbal (talking, shouting, calling)
2. Nonverbal (typing, footsteps when walking, running, ironing)
3. Appliances/machines (water pumps, washing machines, stoves, sinks, air conditioners)
4. Media (sound from television, cellphone, laptop)
5. External sounds from outside the house (exhaust sounds of motorcycles, cars, planes, passers-by on the road in front of the house, rain, the sound of a neighbor's pet dog, construction noise from a neighbor's house).

In the morning, most of the adaptations are in the form of moving from one room to another, thus occupying another room. This is because initially the occupants of the house were still in their original territory, namely their respective rooms (Participants A and B in room 1, Participants C and D in room 2). When daily activities such as eating, studying, and working begin to be carried out, there is an adaptation in the form of transferring from one room to another, because the activities to be carried out usually require a room with a certain ability to spread sound (Participant A needs a more open space with less barriers so that the sound of the webinar can be heard at a longer distance, while Participant C needs a more closed room with clear physical barriers to attend online lectures so that they can focus on listening as the sound is trapped in that enclosed room only). After moving and occupying a new space, the participant then makes further efforts in the form of adjustments to the defense or personalization mechanism to control the sound that enters and leaves the territory, as well as to create comfortable space conditions for their respective activities.

During the day, because participants tend to have occupied their respective territories already, the adaptations carried out are no longer in the form of moving spaces, but shifting positions and orientations that occur within the occupied territory, as well as making adjustments to the door as a semifixed element to limit or defend the territory from sound conflicts. This happens because participants tend to continue their activities since the morning, in which the duration of online lectures and webinars that they joined since the morning usually lasts until noon. Therefore, they still occupy the same territory, and during the day, they have occupied that territory for a long time. Furthermore, participants also made further adjustments, namely by doing personalization by arranging the semifixed elements in the room to meet the needs of those who want to feel more comfortable doing activities in the territory.

In some cases, other than rearranging the spatial components, the participants also put on a headphone to get themselves into more focus in building their sonic privacy in their territory. According to Downs [22], the engagement with headphone brings security and comfort in terms of sound—headphone listening acts as a sensory "shelter" that negotiates with external sound, allowing the individual to have sense of control of what they hear in the midst of all the potentially unpleasant and other distracting sound in the home.

In the evening, each participant returns to his/her original territories and begins to carry out his/her respective activities (in room 1, Participant A works by sitting in front of the desk and Participant B rests by lying on the bed, while in room 2, Participant C occupies his/her territory on the right side of the room and Participant D also occupies his/her territory on the left side of the room). With the sound intensity starting to decrease towards the evening, there was no sound that triggered the participants to adapt by changing rooms. The adaptation made in the evening is only in the form of changing positions and orientations as well as slight adjustments to semifixed elements in space as a form of defense and personalization. The adaptation is made to make the participant feel more comfortable and safe in carrying out his/her individual activities.

Based on Table 3, it can be seen that the adaptations made by the occupants of the house as a territorial response to sound in this case study are:

1) changing positions and orientations;
2) arrangement of space components;
3) moving from one room to another.

The fixed feature space element that plays the most role in the territory's adaptation to sound is the wall, where the wall forms a territory with clear physical boundaries and helps reduce incoming and outgoing sounds. Furthermore, the semifixed feature elements that play a role in the adaptation are doors, chairs, folding tables, pillows, and cupboards, which are the furniture and objects used by participants to control the intensity of sound that reaches the position they are in, as well as to mark and emphasize the territory they occupy. Finally, the non-fixed feature space element that plays a role is distance and proximity, where the participant changes position and gives distance with consideration of the sound heard from their territorial spot.

Johansen and Nielsen [23] mentioned that there needs to be more than just labelling discrete sounds to explore the dynamics of sound phenomenon in order to get a more contextualized point of view of the adaptation strategies for the domestic soundscape [21, 23]. There are some factors that can be included in categorizing the types of sound to the kind that is desired, considered noise, or trivial, such as the area type the participants are living in at the moment and how the sound is perceived to give them signals that they have to take action and make rearrangement to the spatial elements [24, 25]. It was found that the sounds that influence the residents to adapt are usually sounds that come from other people's activities (such as online lectures, webinars, exercises, and telephone calls) and not from sounds that are routinely

heard at home such as the sound of a water pump being installed or the sound of frying pan which comes from the kitchen when someone is cooking. It was also found that external noise also influenced the participant's decision to adapt, namely the sound coming from the construction of a neighbor's house and the sound of a passing motorbike with a noisy exhaust sound. The reason the participants made adaptations such as changing positions and orientations was because they felt that these sounds interfered with their activities. In addition, participants also feel uncomfortable or unsafe when the sound source has the potential to come from their back, which is an unknown and can be unexpected territory, so that they end up changing positions and orientations to be able to monitor their surroundings broadly.

There are two types of the relationship between activity and adaptation carried out as a response to sonic territoriality. First, the participants realize that the activity they want to do will make noise or require a new room to focus on hearing the sound according to their needs, so they adapt first. For example, when someone is going to take part in online lecture activities or participating in webinars, they have the awareness to seek comfort and adapt first by changing rooms. Second, the sound produced by other people's activities becomes the thing that influences the participants to adapt. In this case, it occurred when one participant was lecturing an online class, in which they spoke using a loud volume and disturbed the other occupants in the house because of the close proximity between those occupants, thus making the other occupants adjust using closest element of space to reduce the sound.

All adaptations made by participants by moving places and adjusting the semifixed feature elements have an effect on adjusting the intensity of the sound, making it suit their needs. This can be seen from the results of measurements of sound intensity (dB) in conditions before and after adaptation. Sounds with a big intensity that disturbed the participants were found to decrease when adaptation was carried out in the form of moving rooms to provide distance between oneself and the sound source, and also when the adaptation was in the form of controlling how much a door was opened.

## 6. Conclusions

Based on the theoretical basis and case study that have been carried out, three main points were found as the final conclusion. First, humans have a desire to control the sound that enters their territory, which is called sonic territoriality, so they adapt especially in their domestic space. Objectively, the adaptation carried out is proven to be effective, because the sound intensity (in dB) at the point before and after adaptation changes according to their needs. The sound that makes the participant adapt is usually the sound that is close to them (1 to 5 meters) and affect their activities. In addition, subjectively, with humans having their own awareness and perception of sound, it was found that adaptation to territory was carried out with two considerations:

1) Adaptation of the territory to sound from the inside-out, where the occupants realize that the activity they're going to do will produce sound, so they adapt to control the sound that will be heard in accordance to their own activity's need, and;
2) Adaptation of the territory to sounds from outside-in, where it is the activities that are carried out by other occupants that produce sounds which are considered disturbing and invading other's territory, so these disturbed occupants make adaptations to try to control the incoming sound.

Second, adaptation of occupants in response to sonic territoriality is carried out by withdrawal and adjustment. Withdrawal, namely adaptation through moving from one space to another, results in a temporary change in the function of space. On the other hand, adjustment is an adaptation by adjusting the position or arrangement of space components, where the changes made by occupants in the house are not too large; mostly only on semifixed elements (such as doors, chairs, pillows, and cabinets). Other elements, such as fixed features (walls) also play a role in adaptation to sound, but the behavior and arrangement of these elements are reflected in changes made to semifixed elements.

Third, this study gives an implication for design practice in regards of users' activities in the domestic space, especially in the time where a pandemic has made an impact of how people occupy, use, and move within their domestic space. Those implications mean that distance from one activity to another and how to place elements of space between them (the fixed, semifixed, and nonfixed) need to be considered further in designing a domestic space, especially when sound has no clear boundaries and is dynamic. There is a need for design approaches to pay attention to the use of fixed, semifixed, and nonfixed elements of space, to make it more adaptable and easier to align with the residents of the domestic space' needs regarding sound in their territory.

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