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Beyond Sleep: Investigating User Needs in Today's Bedrooms

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Abstract: This study investigates the current use of bedrooms to fill a knowledge gap in the existing sleep studies literature by focusing on user preferences and their needs. Despite substantial research into the optimal physical conditions for sleep, there remains a gap in understanding how individuals use their bedrooms today. As an initial step to bridge this gap, we employed a mixed-method research approach, integrating quantitative and qualitative data results. A survey including multiple-choice and open-ended questionnaire items was undertaken in Australia with 304 participants. Our research findings indicate that 'having a separate bedroom in a house' is the most common arrangement. However, other arrangements, such as living in a bedsit or sharing a bedroom, are indicators of diverse bedroom conditions. In total, 70% of respondents stated that they would like to make changes to their bedrooms for physical, functional, comfort-based, and aesthetic reasons, with comfort ranked as the highest. The majority of respondents stating they would not make any modifications in their bedrooms were found to be owner-occupiers. Mattress quality and privacy emerged as the most significant factors impacting the respondents' bedroom experience, and female participants were reported to place higher importance on cleanliness compared to male participants. Additionally, preferences for sleeping alone or with a partner were found to shift with age. Based on our findings, we suggest that survey-based sleep studies should evaluate the bedroom arrangements before the individual's sleep habits. Further studies are needed to understand how privacy needs influence sleep quality. From a built environment viewpoint, this study emphasizes the need to develop bedroom design solutions tailored to optimize bedroom conditions, particularly for rental tenants who often have limited control over the physical conditions of their sleep environment.

Keywords: bedroom; sleep environment; domestic environment; home space; user needs

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1. Introduction

Bedrooms are mostly designated as domestic environments for sleep and the environmental conditions of a bedroom have a direct impact on sleep [1]. However, there is a lack of focus in the sleep literature on the interior characteristics of the sleep environment and users' changing aesthetic and functional preferences. Today, the interplay of various aspects in today's bedrooms has resulted in a highly complicated and multi-layered environment with changing use, ownership, and sharing conditions. The research outcomes reveal a gap in the sleep studies literature concerning bedroom design, with bedrooms noted as environments that lack the controlled conditions found in sleep laboratories [1]. The purpose of this study is to identify and highlight the changing conditions and preferences of bedrooms today, in order to fill a research gap in the current sleep studies literature.

Recent research outcomes provide a thorough understanding of the environmental factors that influence sleep and highlight the optimal physical conditions needed for an ideal sleep environment. Studies indicate that maintaining a temperature between 18 and 28 °C with humidity levels between 40 and 60%, and noise levels below 35 dB are essential. It is also recommended that individuals ensure total darkness and avoid exposure to blue

light [2]. Sleep studies also reveal that demographic factors, including gender, marital status, and educational qualifications, have an influence on sleep quality [3–5]. For example, women were reported as having more sleep problems than men, and socio-economic disadvantages (such as low income or low educational qualifications) were found to have an association with reported sleep problems [3]. Compared to married people, unmarried individuals were found to sleep less with a significant difference, both on weekdays and weekends [5], and the presence of children in the household often increases the frequency of insufficient sleep among the adults residing with them [6].

Changes in physical environmental conditions, such as seasonal temperature shifts or alterations in noise types, have different impacts on sleep quality. Research findings indicate that sleep patterns are affected by seasonal and weather changes and the strongest seasonal effects for wake time and sleep duration were found during the spring season [7]. Road, rail, and air traffic noise have different effects on sleep quality, depending on the sound pressure levels and frequencies of the noise [8]. Other types of noise unrelated to traffic, such as the ringing of church bells, were found to increase the frequency of awakenings in individuals [9]. Out-of-laboratory studies also showed that the range of evening light intensity in the domestic environment can shift the circadian phases of individuals [10]. Thermal comfort is significant for sleep quality, and studies suggest having a sleeping-mode control strategy using air conditioners in bedrooms or making arrangements for the optimal bed micro-environments [4]. Another research finding suggests that opening a window or a door leads to better ventilation, and reducing CO_2 levels during sleep implies better sleep efficiency [11].

Studies on changing environmental factors offer guidance for potential modifications to sleep environments to maintain sleep hygiene. For example, overheating in homes during the summertime has become a growing health concern. In their examination of 750 homes, researchers proposed that living rooms or an alternative bedroom space could provide "a safe haven" for sleep [12]. This suggestion might be a solution when there could be an alternative space to function as a sleep environment. Also, inadequate design of domestic spaces should be considered as another contributing factor to overheating in bedrooms [1]. Additionally, there might not be a distinctive difference in the use of bedrooms and living rooms today, aligned with our previous findings, which confirmed that today's bedrooms are multi-functional spaces [13]. A broader range of activities such as working and eating take place in the bedrooms than before [14]. Evidence for the changing use of furniture, such as the bed overtaking the sofa for the first time as the most used piece of furniture in British homes [15], also shows that there is an ongoing change of preferences in the domestic environment.

The new domestic hierarchies and changing user needs are important aspects to consider in the design of today's bedroom spaces [14]. The sleep literature lacks sufficient focus on the spatial characteristics of the sleep environment [1] and users' changing functional preferences. In fact, it is necessary to question how bedrooms function today and to understand the changing user needs beyond the physical environmental parameters for designing a healthy sleep environment.

2. Use of Bedrooms

Social, economic, and political changes have altered the spatial requirements of city dwellers [14]. Rising urban populations caused people to live in smaller spaces and/or crowded buildings [16], which also brought alternative ways to organize the interior spaces, such as having a bed folding away into the wall [17]. The use of bedroom space has also been affected by various factors throughout history, such as the digital economy, pandemics, or work being carried out from home [18,19]. As a result of its expanded use, the bedroom gained growing importance inside the domestic space [20] with new spatial necessities being formed [14,21].

The home has been evaluated as the core of private life, offering the prospect of family interaction and providing privacy for the individual [22]. Within the home, the

bedroom is often recognized as the "most private space" [17], as a personal, solitary refuge for the individual. Throughout history, the spatial configuration and functional use of bedrooms have varied within the domestic space. An example of this can be seen in the layouts of buildings constructed to host the working class during the early 20th century in North American cities, such as New York. These layouts relegated kitchens and bathrooms as shared spaces between residents on the same floor, while bedrooms were inhabited as the personal living environment. Similar layouts were observed in the Soviet Union, where a bedroom operated as a private space for residents to dwell individually, and two apartments had one shared bathroom [14]. However, bedrooms were not always the "most private" spaces in a domestic environment. In fact, there were times in history when bedrooms and sleeping were a much more communal affair. Sharing beds with strangers was common for travelers sleeping in inns during the 16th and 17th centuries in Europe and North America. As recently as the 20th century, traveling salesmen used to share beds when bed space was in high demand [17]. The examples of 'publicly sleeping together' mostly occurred outside the home and domestic sphere, yet sharing beds at home with family was and still is not uncommon [23,24]. Hence, having a dedicated bedroom to sleep in was not always the norm, as the idea of associating any specialized function with individual rooms had not yet occurred in the 17th century [25].

Given the historical shifts, understanding the changing needs for today's bedrooms has become more complex, as today's bedrooms are more than spaces hosting sleep. The preferences and social norms change over time; for example, in a US-based study from 2005, middle-class parents had a preference for houses with large master suites located at a distance from other bedrooms in the house [26]. Today, there is an emerging bedroom culture with the bed playing an increasing role [27]. The function of the bed has been discoursed beyond its role to host sleep, highlighting the new user needs of the internet and social media [20,28].

At the 15th Venice Architecture Biennale in 2016, the British Pavilion hosted the Home Economics exhibition, with the theme of 'Life is changing, we must design for it'. The exhibition highlighted the housing crisis as 'a crisis of how we live', addressing the ongoing changes happening in the domestic space. One of the examples provided in their exhibition brief was that it was previously common for a married couple to use twin beds, while today, the double bed is the focus of household requirements for UK bedroom standards. In their proposal entitled "Hours", the authors suggested that modular daybeds would provide a flexible solution in a shared home. Another proposal, "Decades", was a design of a room without any functions, with no predetermined spaces or activities [15]. While we cannot foresee what spatial alterations might be solidified in the future, a need for change is evident. Different lifestyles, such as living alone and nomadic living, can result in dwellings being under-occupied or over-occupied. This often leads to a need for new spatial arrangements such as micro-apartments or co-living spaces [14]. Recent studies have also highlighted a noticeable change in the use of domestic spaces, especially for work-related purposes. This shift has introduced different needs for privacy and sociability [19]. As an example, the sleep environments in care homes are now regarded as living spaces, with research confirming the need for personalization to ensure users' privacy and autonomy [29].

The existing literature on bedrooms mainly focuses on the physical environmental factors [2,30–33], and little attention has been given to user needs. Few studies provide guidance for architects or inform sleep researchers about what characteristics and provisions are needed for an optimal bedroom space today. In fact, the currently defined optimal parameters are also subject to further investigation. For example, checking different configurations of window/door openings showed significant correlations between actigraphy data and questionnaire responses for sleep parameters [11]. It is crucial to approach the use of bedrooms with a comprehensive, open-minded viewpoint, rather than relying solely on previously defined parameters and assumptions on how today's bedrooms function. A number of studies have already highlighted that 'other' design-related aspects might influence the use of bedrooms as sleep environments. For example, one study discussed

the significance of "decorations in the bedroom" and the "surrounding environment of the building" as factors affecting bedroom use [34]. These findings are informative in identifying the unconsidered design features that might have an impact on sleep quality. However, these features were constrained by a pre-defined list and disregarded the spatial circumstances of the room. In the study, decoration items were listed as plants, carpet, bookshelf, router, and screen, and the questions about the surrounding environment mainly focused on the view. Additionally, researchers discovered significant disparities in how people utilize their bedrooms, based on their age and gender [35]. Hence, a better understanding is needed of how today's bedrooms function, with whom they are shared, and what factors users believe are important for their bedroom use.

3. Methodology

A survey including multiple-choice and open-ended/text-entry questionnaire items was used to gather data. A mixed-method research approach was applied in this paper, integrating quantitative and qualitative data results. Detailed descriptions of the study design and methodology are provided below.

3.1. Study Design

In preparing our survey, two aspects were defined to have a better understanding of bedroom use in Australia: firstly, functional changes that might be associated with sleep habits, and secondly, user experience and expectations. This forms the second part of the study, following the initial evaluation of its functional use.

To determine the use of bedrooms and user needs, we reviewed the questions in the following sleep studies: the National Sleep Foundation Sleep Survey [36], the Sleep Hygiene Index (SHI) [37], and the Pittsburgh Sleep Quality Index (PSQI) [38]. The National Sleep Foundation Survey included detailed questions about sleep duration and sleep difficulties among key demographic variables including age, gender, education, income, and cultural background. Respondents were queried about their sleep habits, encompassing activities such as watching TV, listening to music, reading, and exercising. There were questions regarding the presence of specific items within the bedroom, such as televisions and computers, which were listed as predefined options. The survey also asked participants about their sleeping arrangements. The PSQI questionnaire mainly focused on sleep duration and sleep quality along with the respondents' health conditions, with one additional question about bed partners or roommates, but made no inquiries regarding the sleep environment. The SHI survey utilized Likert scale questions to assess agreement on bed-related use and habits.

To enhance our understanding beyond the questions from these three surveys, we added a new question about property ownership to better understand potential user needs and possible limitations. We furthermore asked two open-ended questions to assess possible shifts in the current use and perception of bedroom space. This enabled us to explore what adjustments respondents may want, offering insight into current spatial requirements. The survey combined elements from the three surveys above with additional questions, which are structured in two main sections: (1) spatial conditions of bedrooms and (2) user experience and expectations (Appendix A).

At the end of the survey, we asked participants if they would like to provide any photos of their bedroom, along with a disclaimer that no individuals were to be included in these photos. This photo upload option was not mandatory.

3.2. Data Collection and Analysis Method

The data collected for this research were based on the responses from 304 participants about their user experience. The data were non-identifiable as per the negligible risk guidelines and approved by the UNSW Human Ethics Committee. Participants were recruited through an online research panel and the company used weighted randomization based on respondents' demographic data. The online research panel collected data from

qualified individuals (18 years and older, Australian residents), offering real-time anomaly detection. The survey invitations provided basic links and information that was non-leading. Respondents received this invitation without specific project details to avoid self-selection bias, and the project details were disclosed later.

A mixed-method research approach was applied in this paper, integrating quantitative and qualitative data results. IBM SPSS Statistics for Windows, Version 28.0. Armonk, NY: IBM Corp was used to analyze data with a statistical significance level of $p < 0.05$. The categorical variables were examined for any significant differences using Fisher's exact test and Pearson's chi-square test. A Kruskal–Wallis test (the nonparametric version of ANOVA) and a one-way ANOVA test were used to evaluate the relationship between the responses and the sociodemographic variables. The qualitative data were examined using a reflexive thematic analysis method and NVivo 12 software was used for evaluation. A reflexive thematic analysis method was used to identify patterns and/or categories [39].

In response to the optional question of sharing a photograph from their bedrooms, 24 survey participants submitted visuals showing their use of the bedroom space. Of these images, 13 of them were relevant to the bedroom research context, and the others either failed to show a bedroom space or were taken from other online resources. Due to the limited number of image submissions, it was not possible to analyze the visual content; however, a small selection of these images is presented in this article.

4. Results

The demographic characteristics including gender, age, ownership, and household income are shown in Table 1, and the sample was representative of the Australian population with regard to age, gender, and geographic location across states. Among the respondents, 49% identified as male and 51% as female. In total, 38 respondents were aged 18–24 (12.5%), 119 were aged 25–44 (39.1%), 101 were aged 45–64 (33.2%) and 46 were aged 65 and above (15.1%). The majority of the respondents (63.5%, N = 193) were owner-occupiers, while 31.3% were identified as rental tenants. A total of 16 respondents selected the 'other' option for their response to this question, reporting that they were 'living with a parent', were 'dependent', or were 'house-sitting'. Of the 304 respondents, 21 people (6.9%) responded that their annual household income was less than AUD 19,999, which is considered below the poverty line in Australia [40]. Furthermore, 75% of the participants who were 45 years of age and above were owner-occupiers.

Table 1. Demographic characteristics of the respondents.

Demographic Characteristics	Variable	Frequency	Percentage
Gender	Male	146	49%
	Female	158	51%
Age	18 to 24 years	38	12.5%
	25 to 44 years	119	39.1%
	45 to 64 years	101	33.2%
	65 and over	46	15.1%
Ownership	Owner-occupier	193	63.5%
	Rental, tenants	95	31.3%
	Other: dependent	16	5.3%
Household Income	Less than AUD 19,999	21	6.9%
	AUD 20,000–49,999	78	25.7%
	AUD 50,000–79,999	71	23.4%
	AUD 80,000–124,999	71	23.4%
	AUD 125,000–199,999	40	13.2%
	AUD 200,000 and over	23	7.6%

The research findings were grouped into three sections for better readability. In the first section (Section 4.1), we presented the data of the survey findings on the spatial characteristics of bedrooms. This provided us with information regarding the bedroom conditions of the household. The second part (Section 4.2) contains data results about the participants' spatial experience and factors affecting their experience. Following that, a third section of the results (Section 4.3) includes the analysis of the open-ended questions. To provide an analysis of the interconnectedness of these sections, a cross-evaluation, and discussion (Sections 5.1 and 5.2) followed the results.

4.1. Bedroom Conditions

The type of domestic environment (e.g., bedsit/studio, apartment, or house), as well as the conditions of the bedroom within the layout (open floor plan where the bedroom is also a living room, or if the bedroom is a separate area allocated for sleep), might give an indication of the different uses of a bedroom. Our findings showed that 4.3% of the participants lived in bedsits or studio apartments, which indicates that there is not a separate bedroom allocated for sleep. The majority, by a large margin (73%), had their own bedroom in their own apartment/house, followed by those who had their own bedroom in a shared apartment/house (20.4%) (Table 2).

Table 2. Results showing the bedroom conditions.

	Variable	Frequency	Percentage
Bedroom Conditions	I live in a bedsit/studio	13	4.3%
	I have my own bedroom in a shared apartment/house	62	20.4%
	I have a shared bedroom (not partner)	5	1.6%
	I have my own bedroom in my own apartment/house	221	72.7%
	Other	3	1%
Bedroom Sharing Conditions (multiple answers possible)	Sleep alone	134	38.1%
	Sleep with a partner	159	45.2%
	Sleep with children	31	8.8%
	Sleep with a pet	28	8.0%

Fisher's Exact Test results showed that there was a significant difference in bedroom conditions between age groups. Accordingly, 25 to 44-year-olds mainly have a bedroom in a flat/house (64.70%), counting more than the respondents stated living in a bedsit/studio (8.40%); 18–24-year-olds primarily sleep in a shared flat/house (50%), higher than having their own bedrooms (39.50%) (Figure 1). Participants having their own bedroom in a shared flat/house was significantly higher among the 25–44-year-olds (45.2%), followed by the 18–24-year-old group (20.6%). Having their own bedroom in their own flat/house was the highest for 45–64-year-olds (38.0%) followed by 25–44-year-olds (34.8%), and significantly higher than the 18–24-year-olds group (6.8%) ($p < 0.001$). Among respondents aged 45 years and older, two individuals reported residing in a bedsit/studio, while one participant indicated sharing their bedroom with a person other than their partner.

In this section of the data results, we extracted the information to find out whether the respondents were the sole occupiers of the bedroom or not. The goal of this question was to determine if there are other users sharing the same bedroom. Five participants (1.6%) mentioned sharing their bedroom with a person other than their partner. Most respondents stated that they sleep with their partners (45%), followed by sleeping alone (38%). In total, 28 participants (8%) mentioned sleeping with a pet, and a similar percentage was observed for those who sleep with children (31 people, with a percentage of 8.80%). Next, 25 of the respondents slept with their partner and children together, 13 with their partner and pets together, and 2 with their partners, children, and pets. The total number of respondents

who both responded to "sleep alone" and "sleep with pets" was seven. The responses received from the 'other' category revealed that three people (1%) defined their bedrooms as their cars. One of these three respondents mentioned that they were sleeping in a car with a partner, and two of them with their children.

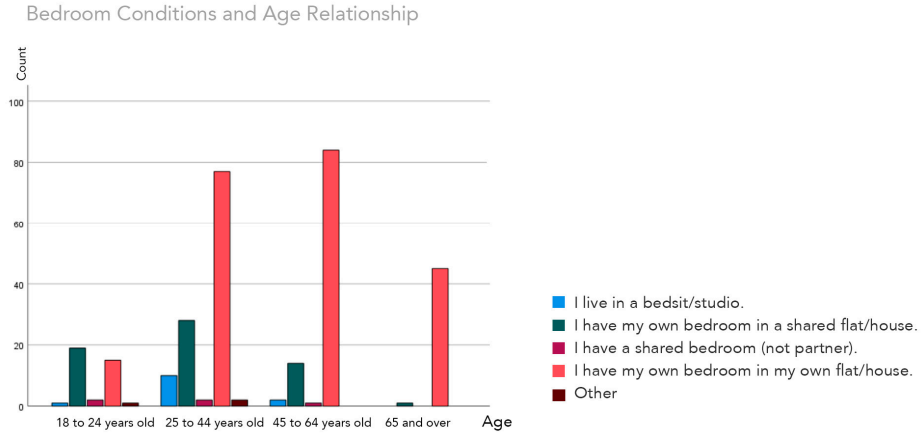

Figure 1. Graph showing the bedroom conditions among different age groups.

Among the 18–24-year-old participants, the majority (68.40%) reported sleeping alone, significantly outnumbering those who preferred sleeping with someone or a pet (31.60%). As age increased to the 25–44-year-old range, the results shifted to 63.00% sleeping with someone or a pet, compared to 37.00% sleeping alone ($p < 0.005$). No significant differences were observed in sleeping preferences beyond the age of 45 (Table 3). Figure 2 illustrates the distribution of bedroom sharing among different age groups.

Table 3. Bedroom sharing conditions and age crosstabulation.

Age–Sleeping Conditions	Sleep with Someone and/or a Pet		Sleeping Alone	
18 to 24 years old	12	31.60%	26	68.40%
25 to 44 years old	75	63.00%	44	37.00%
45 to 64 years old	61	60.40%	40	39.60%
65 and over	22	47.80%	24	52.20%

$p < 0.005$.

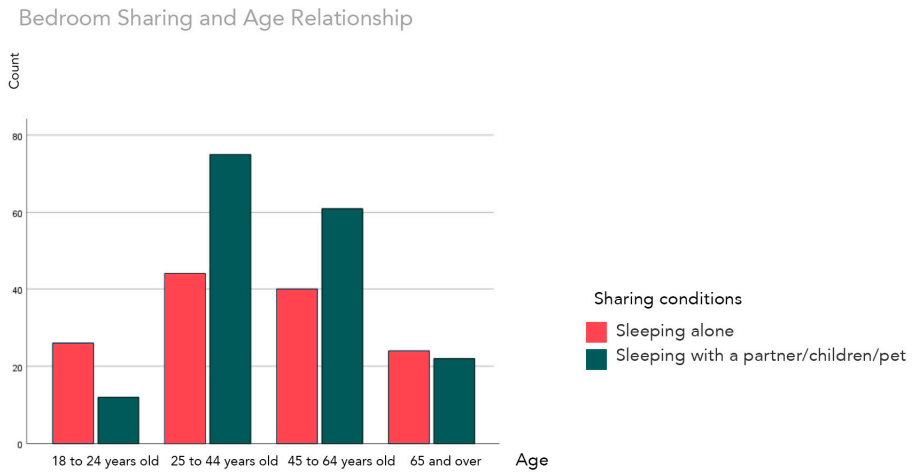

Figure 2. Graph showing the bedroom sharing conditions among different age groups.

There was no significant difference in bedroom sharing conditions between age or gender groups regarding sleeping with children or a pet. According to ownership conditions, owner-occupiers were significantly more likely to report sleeping with another

(partner or children), at 60.60%, compared to participants who mentioned sleeping alone (39.40%) ($p < 0.05$). Participants who responded that they sleep with their partners were mainly owner-occupiers (59.60%) when compared to rental tenants ($p < 0.001$).

4.2. Spatial Experience

We asked participants to rate the significance of the following factors to evaluate what respondents prioritize in a bedroom: comfort of mattress and pillows, noise, light, temperature of the room, scents in the room, fresh air and ventilation, cleanliness, and privacy. Table 4 represents the mean values for the eight factors according to their importance, rated on a scale of 1 to 5 points, with 5 indicating the highest level of importance. The findings suggested that mattress comfort was the most significant factor (4.34), followed by privacy (4.2) and noise (4.11); the least important factor was scents in the room (3.03). In fact, scents were identified as "not important at all" by 49 of the 304 respondents. Privacy was rated as "extremely important" by 133 of 304 respondents (43.8%), while it was rated as "not at all important" by 7 (2.3%).

Table 4. The mean results concerning the importance of various factors.

	Mattress Comfort	Noise	Light	Temperature	Scents	Ventilation	Cleanliness	Privacy
Mean	4.34	4.11	3.94	3.99	3.03	3.79	3.96	4.2
Std. Deviation	0.789	0.948	0.971	0.886	1.282	1.006	0.989	0.895

According to the survey results, 60% of the respondents strongly agreed with the statement that "Bedrooms are private spaces", with an overall agreement ratio of 89%. 28% strongly agreed that their bedrooms reflected them and identified with their room, and 42% agreed that they could personalize/change their bedrooms. Personalization ("I can personalize/change my bedroom the way that I want") had a total agreement ratio of 78% from respondents, whereas the bedroom reflecting themselves ("My bedroom reflects me/is a place that identifies me") had a ratio of 62% (Figure 3).

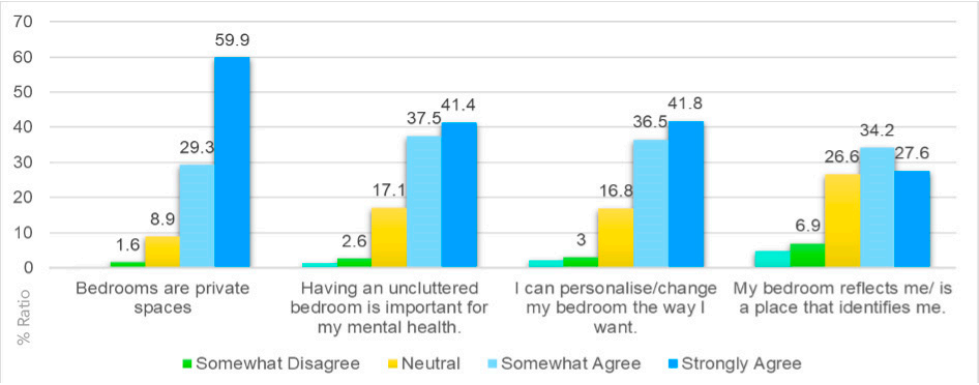

Figure 3. The agreement rankings about bedroom use.

In total, 79% of respondents believed that "Having an uncluttered bedroom is important for (their) mental health", which was not significantly different across age groups. However, a Kruskal–Wallis H Test showed that there was a statistically significant difference in the perception of having an uncluttered bedroom between males and females: $H(1) = 9.957$, $p = 0.002$. While the mean score for males was 3.99 (N = 146), it was 4.30 (N = 158) for females (Figure 4). The importance of cleanliness between genders was also significantly different, as indicated by the Kruskal–Wallis H Test results: $H(1) = 7.736$, $p = 0.005$. Male participants showed much lower agreement with the importance of cleanliness for their sleep environment than female participants (averaging scores of 3.8 and 4.1, respectively, on a 5-point scale assessing the effect of cleanliness on sleep). Regarding

the use of a bedroom, female participants (N = 158, mean score: 3.85) referred to their bedroom as a place that reflects/identifies them more than male respondents (N = 146, mean score: 3.6), which was found statistically significant (H(1) = 4.886, p = 0.027).

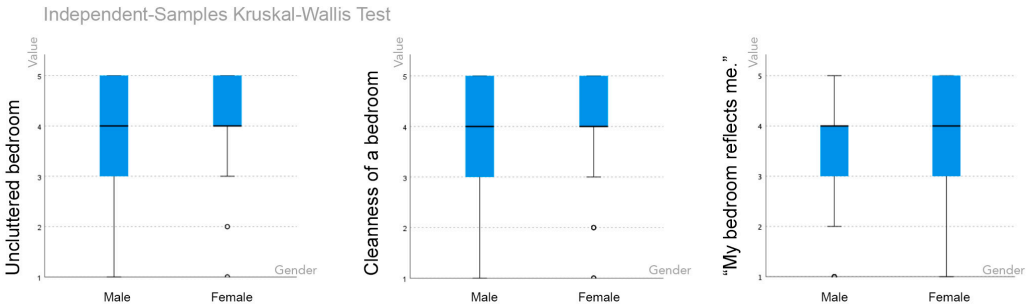

Figure 4. The agreement rankings among different gender groups.

4.3. User Needs and Meaning of the Bedroom

In addition to the multiple-choice questions, we included two open-ended questions to understand different modifications that respondents would like to make in their bedrooms, as well as to examine the current meaning of their bedroom space. The first open-ended question was asking what kind of changes the respondents would like to make in their bedrooms. Firstly, a qualitative analysis software, Nvivo, was employed to examine the word frequencies within the dataset to conduct an initial overview of the data. The words were limited to three letters to exclude articles, synonyms were included, and verbs lacking relevance were excluded (such as make and get). Table 5 represents the results, including the first 20 words.

Table 5. The word frequencies analysis, showing the first 20 words.

Word	Count	Similar Words
bed	43	bed, bedding
bigger	38	bigger, larger
new	28	fresh, modern, new
curtains	21	curtain, curtains, drapes
space	21	space, spaces
better	18	best, better, improved
wardrobe	16	closet, wardrobe, wardrobes
wall	15	wall, walls
room	15	room, suite
bedroom	12	bedroom
light	12	fall, light, lighting, lights
carpet	10	carpet, carpeted, carpets, rugs
blinds	10	blinds, screen, screens
paint	10	paint, painting, pictures
clutter	8	clutter
mattress	1.10	mattress
block	1.00	block, stop, stuff
colour	0.96	colors, colour, colours
different	0.96	different, otherwise
furniture	0.96	furniture

The initial word-frequency analysis results indicate that the participants' responses vary mentioning object-based changes (such as bed, carpet, or mattress) to broader spatial changes (as shown by the descriptive words, such as bigger or better). Therefore, a reflexive thematic analysis method was used to identify patterns and categories, with an aim to achieve a flexible interpretative approach [39]. As a first step, the responses were classified into two categories, which included either "no changes" or a kind of change without any pre-defined classifications. We counted the answers including "none", "nothing", and "no changes" in the categorization of "no changes", as well as statements such as "I have made my bedroom how I want it already", "I am happy with what I have", or "I would not change anything". Among the 304 respondents, 49 mentioned that they were uninterested in making any changes to their bedrooms. This first category resulted in 16% of the respondents indicating that no revisions were needed in their current bedroom spaces (Figure 5).

Figure 5. Photographs by survey participants showing their bedroom environments.

As a second step of the analysis, the responses mentioning a need for change were coded and classified, which resulted in four distinct approaches based on their common characteristics. The first category for the changes was entitled architectural needs, which related to the proportions and physical circumstances of the bedroom space that require a major architectural change. Some examples analyzed in this category were related to the room size, layout, or openings such as windows or doors, or an outside connection. Some of the participant statements classified under this category are as follows: "I wish the room was bigger", "[I prefer having a] door to the bathroom", "more sunlight", "more space, no balcony", "put doors on it", "more space", "have an ensuite", "I'd like to knock out the fireplace", and "I'd remove the inbuilt wardrobe".

The second category focused on "functional needs", encompassing requirements based on objects and other physical improvements in the bedroom space. For example, 15 respondents expressed their need for a "bigger wardrobe" and "more storage space", or a modification to better organize their storage needs as indicated by the following response: "change the clothes storage to be under bed storage to make the room more minimalist". Respondents in this category emphasized activities and practical demands to improve their bedroom space, such as having a bookstand for reading before sleeping or having a dresser for more storage to avoid clutter.

The responses that emphasized "comfort needs", such as "getting a new mattress" or a "humidifier", were classified under a third category. In total, 27 respondents indicated a need for a change in their beds, such as mattress quality, mattress comfort, bed linen, and bed frame as demonstrated by the responses "[I would like to] have the best mattress that provides enough support and comfort". Other answers addressed comfort needs such as having block-out curtains to sleep better, adjustable lighting, or air-conditioning. Noise was also a factor emphasized in responses, with participants reporting needs such as "turn[ing] off exhaust fan noise from the ensuite", "make it more soundproof" and "pad the walls to block all noises", and one respondent mentioned about their bed squeaking. Some of the

other comfort-related needs were stated as the room temperature not being at a comfortable level to fall asleep, or lacking security screens to be able to leave the door open in summer. De-cluttering was also mentioned as a need along with better pillows and bed frames.

The final set of responses fell into the category of "aesthetic needs", which pertained not to changes in room layout or comfort requirements, but rather to visual preferences. Most of these responses conveyed the need for color changes in the room, the addition of visual items such as artwork or pictures, or styling preferences for the bedroom space. In total, 16 respondents stated that they wanted to re-paint or recolor their bedroom space and 10 respondents mentioned adding more artwork or pictures. Some of the other examples that addressed aesthetic needs are as follows: "I would change the wall colors and buy furniture to style the way I want if I could", "everything, need a brand new bedroom style and make it my vibe", "make it more cozy", "more modern", and "get rid of a lot of clutter and make it minimalistic".

Our results of this first open-ended question regarding the changes showed that 58 respondents indicated an interest in making physical improvements to their bedrooms (Table 6). The needs regarding comfort (n = 76), such as bed support, block-out curtains, and a need for a humidifier, were reported in greater frequency compared to physical and architectural changes. Responses such as "I'd like to decorate but I can't because I'm renting" demonstrated that being a rental tenant limited their responses not solely to architectural needs, but also to aesthetic appeal. On the other hand, the majority (n = 41 out of 58) of the respondents mentioning that a possible change is needed were identified as owner-occupants. In terms of aesthetic needs (n = 49), the presence of artwork in the bedroom space was seen as a primarily personal room-enhancing factor. The aesthetic needs expressed by the respondents, such as adding artwork and changing the color of the bedroom, are indicative of a further need for personalization, despite the topic not being specifically investigated in the structure of our questionnaire. The percentage of respondents who claimed they would make an aesthetic improvement to their bedroom was evenly spread across ownership groups, with 46% being owner-occupants and 54% being rental tenants and dependents. Respondents also emphasized the importance of storage and having more space in the bedroom with 5% reporting the desire to have better storage options. Room layout was referred to only in a few instances, with responses such as "my partner doesn't like the bed against the window which limits my options" and "I'd like some art for the walls and comfortable seating, so I didn't have to use my bed" (Figure 6).

Table 6. Categories defined by the respondents' answers regarding bedroom modifications.

Category	No Changes	Physical	Functional	Comfort	Aesthetic
Number of respondents	91	58	56	76	49

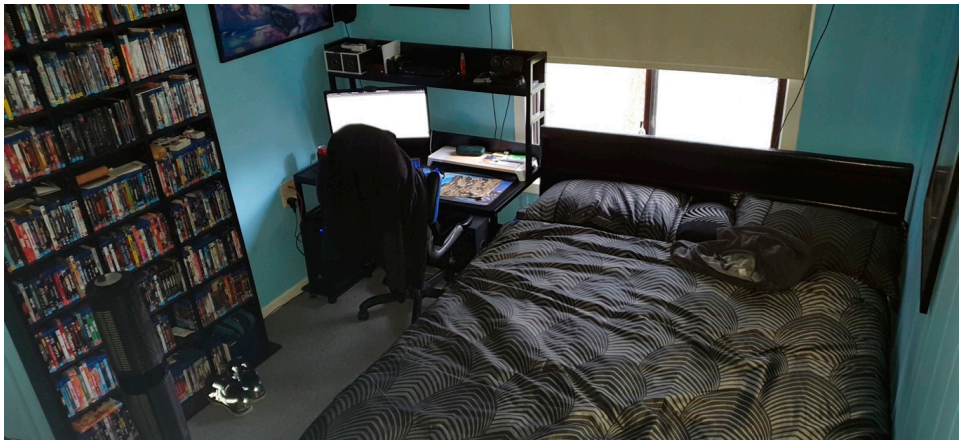

Figure 6. Bedroom photo shared by a survey participant, showing their bedroom, desk, shelves, artwork, and personal items.

The second open-ended question was an inquiry into the meaning of their bedroom space. Most of the respondents defined their bedrooms as a place to sleep (n = 146) and relax (n = 118), with some other related responses such as "a place where I feel comfortable and am able to sleep peacefully", "it's my resting place", and "a place to sleep and rest and refresh for the next day". While sleeping was the main highlighted word, as expected, 39 respondents highlighted the bedroom's privacy aspect. The following are some other examples of how respondents described their bedrooms:

"It's a sanctuary and a safe space to relax"

"[the bedroom is] my identity"

"It's my whole life"

"[the bedroom is] a place to be myself"

"[the bedroom is] my personal space"

"It means a lot. It's my personal quiet space, where I go to relax and feel comfortable".

5. Discussion

This section provides a cross-evaluation of the shared data results and the potential connections between them, followed by a discussion about the implications of this study.

5.1. Cross-Evaluation

Our results showed that sleeping with another or sleeping alone changes with age. As age increases into the range of 25–44, the likelihood of "sleeping with someone or a pet" increases, eventually reaching an equal ratio after 65 years of age. A bedsit/studio arrangement was observed more in the 25–44-year-olds than any other age group, while having a bedroom of their own had the highest value for the 45–64-year-olds. Even though 'having a separate bedroom in a house' remains the most prevalent circumstance (72.7%), other circumstances (27.3%), such as living in a bedsit or sharing a bedroom with others, are important indicators of further possible bedroom-use conditions.

Our findings revealed that mattress comfort was found to be the most significant factor affecting the respondents' bedroom use, followed by privacy and noise. In their responses to open-ended questions, participants mentioned comfort conditions more frequently than practical aspects (such as room size) and aesthetic needs (such as color preferences). Two of the main concerns cited by respondents in relation to comfort conditions were noise and lighting, as indicated by the following respondent comment: "[I would like to] put ceiling fans in, glaze windows to keep noise out, maybe a shutter on the outside noise and light". Based on the findings from other sleep studies about the optimal conditions for a sleep environment, these comfort needs require prompt attention to enhance sleep quality.

In terms of privacy, our study found that respondents regarded privacy in the bedroom as very or extremely important, which is also evidenced by the qualitative results. While there was no significant difference between age groups or gender, respondents sleeping with children reported having less privacy in their bedrooms ($p < 0.005$). Bedrooms were stated as private spaces with a total agreement ratio of 89%, which supported the 83% who conveyed that privacy was a very or extremely important factor. When considered in conjunction with the fact that 62% reported that the bedroom was a place that reflected or identified them, these results further supported that the bedroom was (still) perceived to be a personal and private space.

Most participants in our study were owner-occupiers, sleeping in a separate bedroom space. As anticipated, there was a substantial association between ownership and income ($p < 0.001$), with 73.9% of owner-occupiers reporting an annual income of more than AUD 200,000. There was no significant difference in responses between age groups or ownership statuses regarding the Likert scale agreement question, "My bedroom reflects me". A considerable difference emerged between participants with different ownership statuses regarding the statement "I can personalize/change my bedroom". After these initial results,

we conducted a one-way ANOVA Test which showed a statistically significant difference between groups. Owners were more inclined to agree with the statement compared to rental tenants, as reflected in the mean value of 4.24 for owners and 3.91 for rental tenants ($F = 4.467$, $p = 0.016$). A total of 30% of the respondents (n = 91) stated that they did not want to make any changes to their bedrooms. This ratio can be interpreted as respondents being content with their current bedroom conditions. When combined with the answers to the open-ended question on the need for changes in the bedroom space, the results demonstrated that ownership expands opportunities for optimizing the bedrooms to meet physical and/or psychological needs. The majority (n = 70) of those who stated that they would make no modifications were owner-occupiers, accounting for more than rental tenants or dependents.

The results also showed that the "importance of cleanliness", and the "identification of the bedroom space as a reflection of themselves" were more of a consideration for female participants than male participants. Accordingly, having an uncluttered sleep environment is more significant for female participants. On the other hand, there was no difference between age groups regarding how an uncluttered bedroom affects their mental health, with a high agreement across all ages (79%).

5.2. Limitations

This survey was limited to Australian residents. Although Australia is a multicultural society and the participants represent the wider population, we acknowledge that the responses might vary accordingly within different demographics. A larger sample size would have been preferable; however, this sample size was adequate for gaining an initial understanding of current bedroom use in the Australian community. Also, we anticipate that some of our word choices might have generated a different response if the survey had included the wording 'smell' rather than 'scent'. Our initial questions concerning the types of accommodation and the degree of personalization of the bedroom space were limited. In future studies, it would be beneficial to expand the line of questioning to further address and investigate these aspects.

6. Conclusions

The quality and quantity of sleep are influenced by the environment in which sleep takes place, which refers to any room used for sleeping. Given the extensive knowledge that sleep studies have provided to us regarding temperature, humidity, and lighting, we now know more about the ideal conditions for a bedroom. However, bedrooms are not simply rooms with beds, and they are often not controlled environments in which people can make necessary arrangements to aid in better sleep. The way we use and organize our domestic spaces, especially the bedrooms, has changed in response to social, economic, and political shifts. Regardless of these changes, bedrooms are still considered personal and safe places that people would like to use to express their identity.

Most respondents reported a desire to change their bedrooms, and comfort-related changes were reported more frequently than physical or functional adjustments, such as the requirement for block-out curtains or an air humidifier, both of which are known to have a direct impact on sleep. Previous research indicated that the presence of children in the household often increases the frequency of insufficient sleep [6] and our results showed that respondents sleeping with their children reported having less privacy in their bedrooms. Further research is needed to fully understand the influence of privacy on sleep hygiene. In alignment with the results, our suggestions for future studies are as follows:

- Sleep-focused studies: We propose that survey-based sleep research should, as a first step, evaluate the bedroom conditions before the individual's sleep habits. This evaluation should include the accommodation type, and whether there is a dedicated area for sleeping. Having a partner may not always mean sharing a bedroom, and sleeping with children or pets may influence people's sleeping habits in ways that sleep surveys may not have captured. By gathering more data about the sleep environment and

room-sharing conditions, researchers can obtain a more comprehensive understanding of possible environmental problems before focusing on the individual's sleep habits.

- Design studies: There is a need to further investigate the sleep environment from a design and built environment perspective, including the role of bedroom layout and design preferences. With this knowledge, along with what is already known from previous research about the physiological need for sleep, designers can develop healthy surroundings to improve the quality of our sleep. Some of the key outcomes to consider for future studies on sleep environment are the following: (1) Developing layout solutions to minimize clutter to optimize the bedroom space, especially for female users. (2) Investigating the relationship between privacy and sleep and what kind of design strategies can respond to shared bedroom conditions. (3) Developing design strategies on how to improve the sleep environment in terms of sleep hygiene, especially for rental tenants. Our results showed the need to develop more design solutions with a focus on rental accommodations in which individuals may have limited control over their physical environmental conditions.

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Appendix A

Table A1. Detailed explanations for survey questions.

Demographic Characteristics	**Question**	**Question Type**	**Answer Choice**
Age	Which group are you in?	Multiple choice, allow one answer	• 18–24 years old • 25–44 years old • 45–64 years old • 65 and over
Gender	How do you define your gender?	Multiple choice, allow one answer	• Male • Female • Prefer not to say
Ownership	This question is about housing. Are you a/an	Multiple choice, allow one answer	• Owner-occupier • Rental tenant • Other: please specify
Household Income	What is your total household income considering last year and before tax and other deductions are taken out?	Multiple choice, allow one answer	• Less than AUD 19,999 • AUD 20,000–49,999 • AUD 50,000–79,999 • AUD 80,000–124,000 • AUD 125,000–199,999 • AUD 200,000 and over
Spatial Characteristics and Conditions of Use	**Question**	**Question Type**	**Answer Choice**
Bedroom Conditions	Which of the following categories best describes where your bedroom is?	Multiple choice, allow one answer	• I live in a bedsit/studio • I have my own bedroom in a shared flat/house • I have a shared bedroom (not partner) • I have my own bedroom in my own flat/house • Other (please specify)
Bedroom Sharing	Which of the following apply to you: Most of the nights, I sleep (/with)...	Multiple choice, allow multiple answers	• I sleep alone • I sleep with my partner • I sleep with children • I sleep with a pet

Table A1. *Cont.*

User Experience	Question	Question Type	Answer Choice
Factors Affecting the Experience	The following questions are about your experience in your bedroom. Please indicate how important the following items are in general.	Matrix question, Likert scale	• Comfort of mattress and pillows • Noise • Light • Temperature of the room • Scents in the room • Fresh air and ventilation • Cleanliness of the room • Privacy
User Experience	Please rate the following statements regarding your use of your bedroom in general.	Matrix question, Likert scale	• Bedrooms are private spaces. • Having an uncluttered bedroom is important for my mental health. • I can personalize/change my bedroom the way I want. • My bedroom reflects me/is a place that identifies me.
User Preferences (changes)	If you could change your bedroom, what types of changes would you like to do?	Open-ended question, text entry	
Meaning	What does a bedroom mean to you?	Open-ended question, text entry	

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