Exploring the Design Preferences of Neurodivergent Populations for Quiet Spaces

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Abstract

Quiet spaces warrant scrupulous design consideration as they offer a sensitive restorative environment to the experience of sensory overload. Currently there is a lack of guidance on how to design inclusive quiet spaces and ambiguity regarding the factors which influence design preferences. Neurodivergent populations provide valuable perspectives on how to design for sensory needs, especially considering their susceptible to sensory overload.

An online survey was administered globally to neurodivergent populations to elicit their design preferences for quiet spaces, and semi-structured interviews were conducted to enrich the study with professional perspectives. 312 survey responses and six interviews were analyzed to draw inferences.

There was consensus on sound and lighting as the most important design considerations for quiet spaces, on education as the most critical place to implement them, and on nature as a favorable guiding principle in their design. However, there was a diversity of perspectives, often contradictory, regarding most design preferences. Many of these preferences are correlated with the frequency at which the person experiences sensory overload and thus people's sensory profile may be an underlying mechanism which guides design preferences.

In light of these findings it is recommended to design quiet spaces as neutral environments for the most sensitive users, with optional stimulating design features for the least sensitive, while ensuring that the experience of one does not compromise the experience of the other. Moreover, variety, flexibility and control emerged as critical themes for facilitating inclusive design and empowering users by providing them with autonomy over their environment. Given the positive association between the frequency in which sensory overload is experienced and the person's desire for quiet spaces, it is advisable to consider additional populations which may be susceptible to sensory overload in future research on quiet spaces.

Keywords: Neurodiversity, sensory overload, sensory processing, quiet spaces, design preferences.

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1. Introduction

Over the last couple of decades there has been an increase in awareness and policy to eliminate barriers which may prevent people from having full and equivalent access to buildings or amenities (e.g. Disability Discrimination Act 1995; Equality Act 2010). These barriers have been addressed by implementing accessible design, for example by providing a ramp or an elevator for people with limited mobility. However, not all design barriers are as visible as the need for a ramp or an elevator.

Neurodiversity is a perspective by which neurological differences are considered natural human variations (Singer, 2017). People with neurological differences are regarded as neurodivergent (ND) whereas people with typical neurological development and state are regarded as neurotypical (Disabled World, 2020). Neurodivergent conditions include attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD), learning disabilities/differences (LD) such as dyscalculia, dysgraphia and dyslexia, dyspraxia, epilepsy, hyperlexia, obsessive compulsive disorder (OCD) and Tourette syndrome (TS) (Disabled World, 2020).

Studies have shown an association between several neurodivergent conditions and sensory responses that are either heightened or diminished from what are considered typical (Cohen and Leckman, 1992; Lane and Reynolds, 2019; Tavassoli et al., 2014; Van Hulle et al., 2019). A heighted or diminished sensory response is also regarded as having sensory over-responsivity or under-responsivity, or as having hypersensitivity or hyposensitivity. The visual, auditory, tactile, gustatory, olfactory, proprioceptive and vestibular systems are responsible for discerning sensory stimuli (Lestrud, 2013). The composition of one's sensory profile may incorporate a mix of hypersensitivities and hyposensitivities, such as having auditory hypersensitivity and tactile hyposensitivity (National Autistic Society, 2020). This is especially characteristic of people with ASD (Ben-Sasson et al., 2007; Liss et al., 2006; Tavassoli et al., 2014).

People with hypersensitivities may be more prone to experiencing sensory overload which is "a condition in which sensory stimuli are received at an excessive rate or intensity" (Farlex and Partners, 2009). Sensory overload can trigger a physical, mental or behavioral response such as an increase in heart rate, blood pressure, breathing, anxiety, mental distress and/or erratic behavior (Farlex and Partners, 2009). Spatial design may help to mitigate sensory overload by offering calm low-stimulus spaces such as quiet spaces (Kinnaer et al., 2016). This may be especially beneficial in high-stimulus environments where sensory overload may be more likely to occur, such as loud and echoic spaces.

Most existing literature on design for specific sensory needs comes from research about ASD. The design needs of other ND conditions remain primarily under or unreported. Although there is research on the outcomes of using sensory rooms that are designed to provide stimulation (e.g. Snoezelen multi-sensory environments), even amongst ASD research there is only limited literature on the design of quiet spaces. This may result in poorly designed and unsuitable quiet spaces.

The following research aims to:

1) Find out which design features of existing spaces are appreciated by neurodivergent populations and which are considered bothersome.
2) Identify which design features are preferred by neurodivergent populations for the ideal quiet space.
3) Compare the preferred design features of quiet spaces between people with different neurodivergent conditions.
4) Determine whether the frequency in which a neurodivergent person experiences sensory overload may influence their design preferences for quiet spaces.

Many of the findings in existing literature are based on small sample sizes, and participants' perspectives are often not considered. A global survey addressed to ND populations responds to these shortcomings by creating an opportunity for a large sample size and for the consideration of the perspectives of potential quiet space users, who may provide valuable information about their design needs.

In order to enhance the focus and clarity of the research, the survey focused on the role and significance of six design features in the quiet space: sound, lighting, space layout, color, furniture and decoration. Some other design features such as olfactory and thermal comfort, did not fit well with the methodology. Considering these limitations and each respondent's restricted ability to elaborate on their perspectives within the survey, the study also incorporated interviews with professionals for increased breadth and depth.

2. Literature Review

The literature review focuses on studies investigating the influence of design features on ND populations using a variety of study methods including experiments, interventions, surveys, interviews and case studies. Studies were mainly sourced online from scientific, medical and design journals using keyword search and citation tracing. UK and international design standards and guidelines are referenced for evaluation purposes.

2.1. Background

The use of spatial design to address varying sensory needs has been implemented in the context of design for ASD (Houghton et al., 1998). This includes two major types of spaces: high-stimulus sensory spaces for those experiencing a lack of sensory stimuli, and low-stimulus quiet spaces for those experiencing sensory overload (Kinnaer et al., 2016). These two concepts were not always separated in their definition or design; however, they were both used for the purpose of encouraging sensory restoration after an event of sensory imbalance (Lancioni et al., 2002; Mostafa, 2008).

There has been a rising interest in design for ASD due to increasing rates of diagnosis (Elsabbagh et al., 2012). Consequentially, most guidelines regarding design for sensory needs come from literature on design for ASD. In the absence of robust research on design for other neurodivergent conditions, research on design for ASD has been examined to investigate the design of quiet spaces for people with neurodivergent conditions.

Critical evaluation of the literature has informed the selection of six design features which are the focus of this research: sound, lighting, space layout, color, furniture and decoration (fig.1). These design features were found to be the most applicable to the research subject and method upon review of the ASPECTSS Design Index (Mostafa, 2014), design criteria in the literature review ‘Exploring the impact of the design of classrooms on ASD’ (Martin, 2016), design criteria of M07 Restorative Spaces in the WELL Building Standard v2 (International WELL Building Institute, 2018), and design themes which emerged from open questions in a related dissertation (Gregorians, 2018).

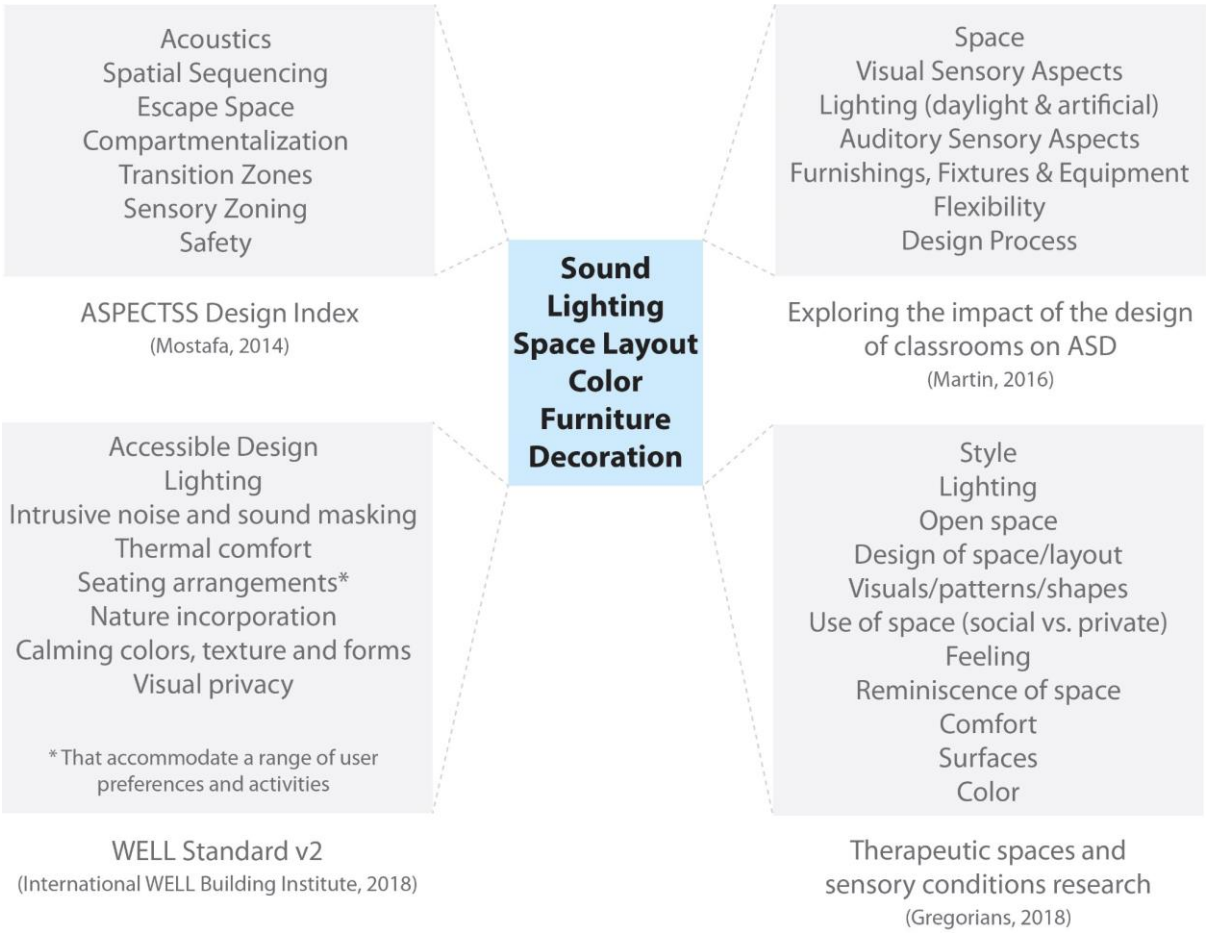


Figure 1: Design Features Diagram

2.2. Design Features

2.2.1. **Sound**

For people with ASD, one sense (e.g. auditory) may occupy the person's full attention making it difficult to respond to signals from other senses (Wood, 2016). There may also be interferences within one sense, such as distinguishing between background and foreground sounds, making it difficult to filter unwanted sounds (Bogdashina, 2003; Kinnaer et al., 2016; Stiegler and Davis, 2010). People with ASD may experience an extreme amplification of sound (Bogdashina, 2003), and intolerance of particular sounds or frequencies, and high intensity noise (Robertson and David, 2015). It is thus no surprise that acoustics have been found to be a leading concern in designing for ASD (Kinnealey et al., 2012; Mostafa, 2008; Shabha and Gaines, 2013).

Studies without interventions found background noise, sound infiltration, echoes and reverberation to have a negative impact on the concentration and behavior of students with ASD and/or ADHD (McAllister and Sloan, 2016; Shabha and Gaines, 2013; Tufvesson and Tufvesson, 2009). Experimental studies have shown an improvement in the behavioral temperament, mood, comfort, attention, performance, attendance and engagement of students with ASD or dyspraxia as a result of echo and

external noise reduction (Kinnealey et al., 2012; Mostafa, 2008). While these findings are valuable, the studies were conducted on small sample sizes.

Design recommendations for noise reduction include using acoustical tiles, draperies and carpets (Doctoroff, 2001; Scott, 2009), physically separating quiet spaces from noisy spaces and using buffer spaces to reduce noise penetration (McAllister, 2010; McAllister and Sloan, 2016; McAllister and Maguire, 2012; Tufvesson and Tufvesson, 2009). Exposure to noise can also be reduced by selecting light fixtures which do not hum (Friedlander, 2009) and in-floor heating (diminishing noise from mechanical fans) (McAllister, 2010).

2.2.2. **Lighting**

Lighting is one of the major design concerns for ASD. People with ASD who are sensitive to lighting conditions may find it difficult to cope with higher intensity bright lights (Shabha and Gaines, 2013), at times exhibiting a preference to being in darker spaces (Robertson and David, 2015; Stickney, 2018). They may be particularly reactive to surface glare and light contrast (Shabha and Gaines, 2013), and to the hum and flicker of fluorescent lighting, which may result in stress (Friedlander, 2009; Kuller and Laike, 1998), distraction (Robertson and David, 2015), headaches and migraines (Robertson and David, 2015; Wilkins, 1986), and trigger ASD symptoms such as repetitive behavior (Kuller and Laike, 1998; Long, 2010).

In two experimental studies changing fluorescent lighting to incandescent or halogen resulted in reduced negative behavior and improved attention, engagement and performance of students (Kinnealey et al., 2012; Stickney, 2018). These outcomes may be a result of reduced exposure to flicker and hum, as well as improved spectral distribution and color rendering index which are characteristic of incandescent lights.

Studies have shown that daylight can help to reduce hyperactivity and eye fatigue, and improve concentration (Kenneth, 1993) and performance (Lyons, 2002; Rittner-Heir, 2002). Daylight that is too bright or creates sharp contrasts, however, may irritate one's visual perception (Shabha and Gaines, 2013). The use of high-level clerestory windows for introducing daylight while avoiding visual distractions has been deemed beneficial (McAllister, 2010; McAllister and Sloan, 2016; Mostafa, 2014).

BSI Standards Publication BS 8300-2:2018 provides guidance on designing accessible and inclusive environments with recommendations on designing for people with sensory/neurological processing difficulties. Recommendations for lighting design include minimizing glare by avoiding shiny, polished surface materials, avoiding pools of bright light and strong shadows, and eliminating fixtures which hum or flicker such as fluorescent (British Standards Institution, 2018). Additional recommendations from literature include using dimming controls, multiple circuits, a range of task lights and providing overall flexibility due to the diversity in requirements for achieving personal comfort level (Long, 2010; McAllister, 2010; McAllister and Sloan, 2016; Scott, 2009).

2.2.3. **Space Layout**

Mostafa's 'Sensory Design Matrix' provides guidance on how to design for specific sensory needs (2008). An "intimate scale", which may be smaller and more private, may facilitate a reduction in echoes and a sense of control and manageability of a space, while an "open scale", which may be larger and more communal, may provide relief from over stimulation from spatial boundaries (Mostafa, 2008). A space which is visually harmonious without much contrast or discord may provide calm neutrality (Mostafa, 2008). Based on Mostafa's design matrix, it may be most suitable to design quiet spaces at an intimate scale with visual harmony.

In order to support the concepts of routine and predictability which are highly valued by people with ASD, research recommends to maintain defined areas and design with logical organization (Mostafa, 2014; Williams, 1996). Clutter and undefined spaces in educational settings have been reported to have a negative influence on students' general behavior (Shabha and Gaines, 2013).

2.2.4. **Color**

Certain color groups such as bright colors (Shabha and Gaines, 2013) and vibrant colors (e.g. red), may cause stress or confusion in people with visual hypersensitivity (Kinnaer et al., 2016; Robertson and David, 2015). One study demonstrated that windowless brightly colored school buildings have increased occurrences of stereotypical behavior, such as self-stimulating or ritualistic behavior, and hyperactivity in children with ASD (Shabha and Gaines, 2013). In contrast, people with visual hyposensitivity may be highly drawn to bright and vibrant colors, finding them highly fascinating (Kinnaer et al., 2016). In the 'Sensory Design Matrix' Mostafa suggests that bright colors may be more stimulating while neutral colors may be more serene (2008), which implies that neutral colors may be more suitable for quiet spaces.

2.2.5. **Furniture**

Durability and ease of maintenance of furniture is regarded as important for the purpose of design for ASD (Khare and Mullick, 2009). Brand (2010) recommends selecting furniture that is nontoxic, does not off-gas and does not hold much dust. Access to loose interior furniture such as pillow seats is regarded as having a positive influence on children's concentration (Tufvesson and Tufvesson, 2009).

2.2.6. **Decoration**

Studies have found decoration to be enhancing outcomes when it was perceived as meaningful in its context, while superfluous decoration and detailing were observed as overstimulating and having a negative influence on general behavior (Kinnaer et al., 2016; Shabha and Gaines, 2013). Certain patterns which are very different than patterns encountered in nature, such as stripes, may cause visual stress and in the case of photosensitive epilepsy, even seizures (Penacchio and Wilkins, 2015; Wilkins et al., 1984; Wilkins, 1995). According to BS 8300-2:2018 large and repeating patterns with bold,

contrasting colors should not be used on wall surfaces where stress reduction is critical (2018), such as in quiet spaces.

2.3. Flexibility and Control

Flexibility and control help to create a sense of safety and wellbeing (Kinnaer et al., 2016) as well as promote independence and choice (Vogel, 2008). This may be achieved by installing lighting (Long, 2010) and sound controls which are accessible to the users of the space. Flexibility may also be useful in the case of conflicting research evidence. For instance, having a view outside a window has been shown to trigger both positive and negative outcomes (Kinnaer et al., 2016; Shabha and Gaines, 2013; Tufvesson and Tufvesson, 2009). Implementing adjustable design makes it possible to accommodate the diverse and specific needs of each person in the space.

2.4. Quiet Spaces

A quiet space provides a calm environment with lower stimulation where people can find relief from stress and sensory overload. The space does not necessarily have to be silent but rather create a mentally 'quiet' environment promoting relaxation. A quiet space may also be called a restorative, retreat, contemplation, meditation, silence, refuge, escape or calming space. Sometimes just knowing that there is an available quiet space to retreat to may be sufficient for the attainment of mental calm (Mostafa, 2008).

In order to facilitate both types of sensory needs, it has been suggested to design the quiet space as a baseline neutral sensory environment for hypersensitive needs while incorporating the option to add temporary stimulating elements for hyposensitive needs (Mostafa, 2008). Low stimulation items may include soft furniture such as cushions, bean bags and blankets (Kravetz, 2017). High stimulation items may include fiber optic lights (Mostafa, 2014), weighted belts (Grandin, 2006; Kravetz, 2017), and ‘fidget toys’ (Friedlander, 2009). Sarrett (2018) suggests for the quiet space to have low lighting, low noise, and be devoid of strong smells. Patterns and color variations should be kept to a minimum (Khare and Mullick, 2009; McAllister, 2010).

Recorded sounds may play an important role in facilitating relaxation and as a way to remove stress from the environment (Robertson and David, 2015). Nature sounds and music have been incorporated into the design of Snoezelen rooms for those purposes (Singh et al., 2004). For these reasons it may be beneficial to create opportunities to access optional sound in the quiet space.

Building bulletin 104 sets the guideline to include one quiet room or sensory room in educational facilities with students who have ASD (2015). According to BS 8300-2:2018 quiet spaces should be designed as visually and acoustically neutral spaces and be incorporated where possible within workplace environments and public buildings (2018). The BS 8300-2:2018 recommendations are

relatively new and nonobligatory, and thus quiet spaces remain an uncommon feature in the built environment.

2.5. Research Gaps

Implementing quiet spaces will provide the necessary inclusive accommodation certain populations may require in order to be able to engage in both public and private sectors. These may include ND conditions additional to ASD for which quiet spaces have so far been primarily designed. Studies focused specifically on the design of quiet spaces for broader ND populations were currently not found. While some standards have acknowledged the need for quiet spaces, there is little guidance on how to design them.

Many of the findings discussed in this literature review are derived from methodologies which did not include interventions or measures in situ and data were often presented as observations from professional or personal carers (Martin, 2016). Experimental studies with interventions are limited, often based on small sample sizes, and do not always include measures of within-session, post-session and long-term results of the study (Martin, 2016).

Design preferences of potential quiet space users and whether an underlying mechanism is guiding their preferences has not been sufficiently explored, especially in cases of conflicting evidence. While distinct research on specific elements exists and provides valuable information, small sample sizes proves to be a key limitation. This research attempts to address these research gaps by exploring the design preferences of ND populations for quiet spaces with an online survey administered globally which may generate a sufficiently large sample size, supplemented by interviews with professionals. Comparisons made between the responses of different ND populations and responses from people who experience sensory overload at various frequencies are expected to provide important insights and inform guidelines for the design of quiet spaces.

3. Methodology

An online survey and semi-structured interviews conducted remotely were found to be the most appropriate qualitative methods for primary data collection. These methods enabled having a large sample size without geographical bounds which facilitated in providing robust evidence across conditions and cultures. These methods have been previously used in similar research (Gregorians, 2018; Long, 2010; Mostafa, 2008; Nikoloudaki, 2019; Sarrett, 2018; Shabha and Gaines, 2013; Slocombe, 2019; Tufvesson and Tufvesson, 2009).

3.1. Survey

Survey Design

The purpose of the online survey was to capture the design preferences of neurodivergent populations for quiet spaces by inquiring directly about the participants' experiences and perspectives on quiet spaces. The online survey was administered anonymously via UCL Opinio 7.12 software, without any identifiable personal data collection. Inclusion criteria was specified as being over 18 years of age, independent and capable of self-care, as well as having a neurodivergent condition. Participants self-selected if they fit the inclusion criteria. Neurotypical participants could complete the survey, however, only responses from neurodivergent respondents were considered for the purposes of analysis. The participant information sheet was included in the introduction of the survey, and consent was recorded at the start of the survey.

Background questions at the beginning of the survey asked about the participants' neurodivergent conditions and the frequency in which they experience sensory overload (SO) (as an indicator of the participants' sensory sensitivity), and at the end of the survey about their gender, age and geographical location. These questions were asked for the purpose of providing context and in order to identify if there is a correlation between the participants' design preferences and their neurodivergent conditions or the frequency in which they experience sensory overload.

The survey consisted of three main sections:

1) Experience in a Quiet Space – participants were asked to identify design features which they appreciated and ones which bothered them from past experiences in dedicated quiet spaces (this section was conditional on the participant having previously experienced a quiet space)
2) Ideal Quiet Space – participants were asked to choose the preferred design features for their ideal quiet space
3) Perception of Quiet Spaces – participants were asked to provide insight on three sample quiet spaces shown as images in the survey (fig.2-4)

The selected design features discussed in the literature review were used as the framework for the survey: sound, lighting, space layout, color, furniture and decoration (fig.1). This specific set of design features was intended for enhancing the focus and clarity of the survey while reducing survey fatigue.

(Unknown, 2017)

Figure 2: Quiet Space A

(Unknown, 2013)

Figure 3: Quiet Space B

(Linebox Studio, 2014)

Figure 4: Quiet Space C

To understand the perception of sample quiet spaces, three images of quiet spaces were sourced online (fig.2-4). The design qualities of an assortment of images was assessed and three images were selected by virtue of their variability and relation to the survey questions. The images were regarded as compatible due to their comparability in size, camera angle and being devoid of people.

Types of questions varied between multiple choice, ranking and matrices. In addition to prescribed response formats, the survey offered opportunities to provide further explanations or additional information in the form of comments. Some of the questions were required, and several were conditional. This can be seen in a copy of the survey which can be found in Appendix F.

The survey was translated to Hebrew and Spanish by the researcher, and each translation was evaluated by two native speakers. Before publishing, the survey went through a validation process in all three languages. The validation was carried out by ten participants, three of which self-identified as neurodivergent. Feedback from the participants was used to revise the survey to its final version.

Recruitment

Data collection lasted for five and a half weeks (9/7/2020-16/8/2020) during which 336 participants responded to the survey. The survey was advertised on 32 Facebook personal accounts, within 129 Facebook groups and on 75 Facebook pages. It was posted on Twitter and retweeted five times and posted on two LinkedIn accounts and shared six times. Four organizations posted the survey on their own platforms.

Data Analysis

Analysis of survey responses was conducted in Microsoft Excel (365 ProPlus) with PHStat2 3.5 add-in used for statistical inference. All responses were grouped in two manners: by neurodivergent conditions of the respondents (ND groups), and by the frequency in which respondents experience sensory overload (SO groups). If a respondent had more than one neurodivergent condition they were included in all relevant ND groups.

Frequency distribution graphs were created for all survey questions, and descriptive statistics (Appendix C) were carried out for all rating questions. Results within ND and SO groups were normalized to 100% to facilitate a comparison of the prevalence of each response within each group.

Spearman's correlation coefficients were calculated for all questions in the 'Ideal Quiet Space' and 'Perception of Quiet Spaces' sections of the survey to identify correlations between the percentage of respondents within an SO group who chose a particular answer and the SO frequency of the group (Appendix A). Chi-square goodness-of-fit tests were conducted on all survey questions to test the null hypothesis that responses to the survey were uniformly distributed. Chi-square tests of homogeneity were performed on all survey questions in the 'Ideal Quiet Space' and 'Perception of Quiet Spaces' sections of the survey in order to test the null hypothesis that two groups had no significant differences in the way they responded to a particular question (Appendix B). The tests were conducted amongst all ND and SO groups.

3.2. Interviews

Interview Design

Semi-structured interviews were conducted with professionals in the field of design for neurodivergent conditions in order to inform and enrich the survey results and research discussion. The structure of the interviews followed a similar outline to the survey (experience in a quiet space, ideal quiet space and perception of quiet spaces) with open ended questions and the inclusion of industry-specific questions. A crossover between the survey and the interviews was the inclusion of the same three images of sample quiet spaces in both methods (fig.2-4).

Invitations to participate in the interviews were sent by email along with the participant information sheet, informing potential participants of the research's purpose. Participants were asked whether they would agree to have their interview audio-recorded, and whether they would like to be identified in the research. Consent was recorded via email.

Recruitment

Potential interviewees were identified through an online search and by means of UCL industry links. Six interviews were conducted in total: three in English and three in Hebrew. The interviews were conducted at the convenience of the interviewees via WhatsApp, Zoom or phone calls. Recordings of the interviews were stored on Filestore@UCL. All interviewees agreed to be audio-recorded and requested to be identified. Audio recordings will be securely destroyed within three months after the interviews.

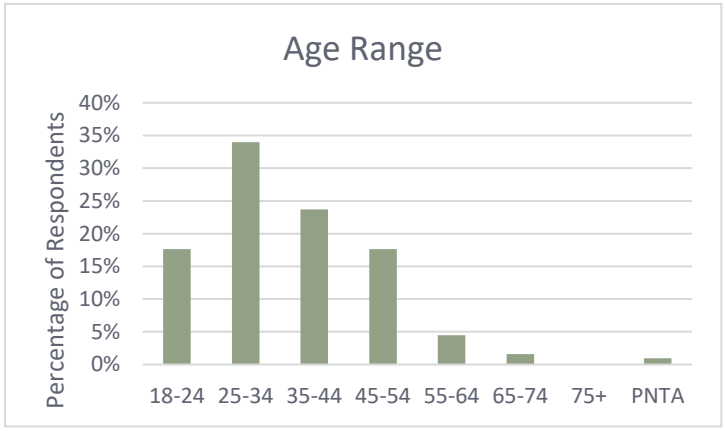
Research Ethics Approval

The research was classified as low risk and was approved by IEDE MSc Research Ethics Team. Research Ethics approval can be found in Appendix E.

4. Results

4.1. Background

336 responses were recorded out of which 24 did not meet the inclusion criteria, leaving 312 responses for analysis. Out of 312 responses 230 were in English, 62 in Hebrew and 20 in Spanish. The largest age group was 25-34 years old (34%), followed by 35-44 years old (23.7%) and both age groups of 18-24 and 45-54 years old (17.6% each) (fig.5). Most of the respondents were female (73.4%), followed by male (15.7%) and non-binary/third gender (9%) (fig.6). Responses came from 17 out of 19 global regions, with 97 responses from Northern Europe, 80 from Northern America and 55 from Western Asia (fig.7).



PNTA = Prefer not to answer

Figure 5: Age Range of Respondents

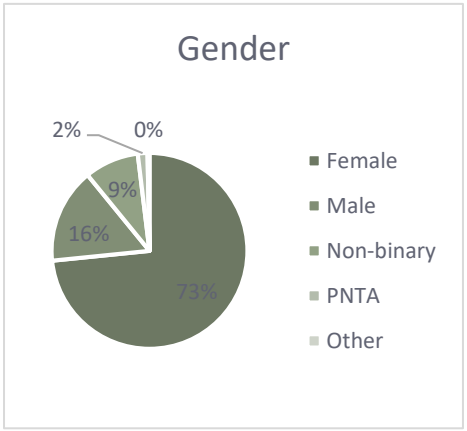


Figure 6: Gender of Respondents

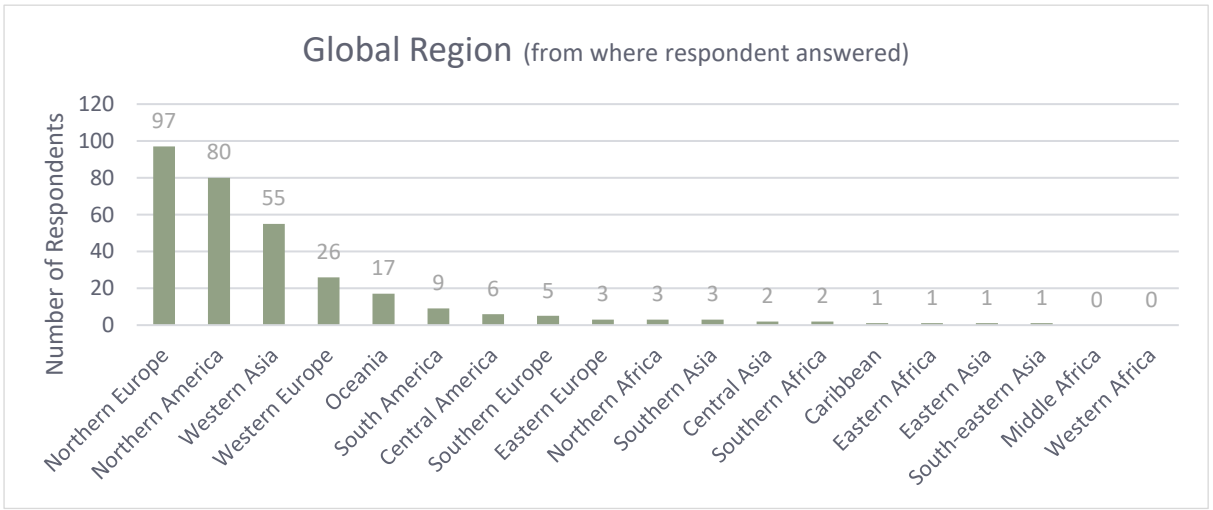


Figure 7: Global Region of Respondents

298 respondents indicated that they have neurodivergent conditions, and 14 wrote that they are not sure ('maybe') but specified which ND condition they suspect to have (fig.8). Analyses pertaining to ND groups exclude respondents who did not specify their ND conditions.

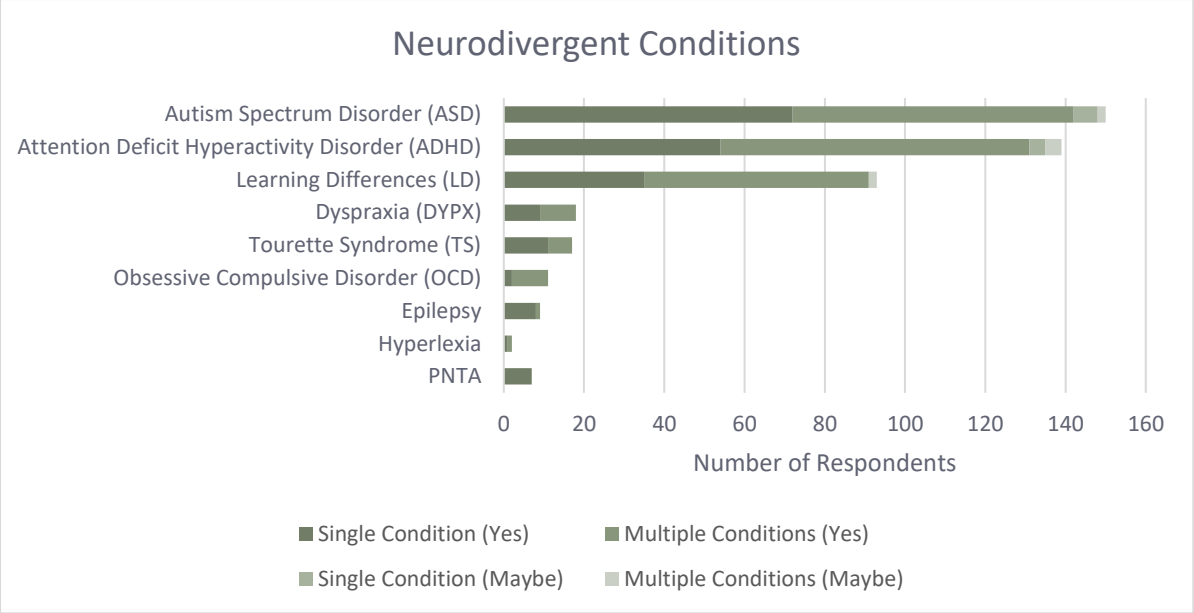


Figure 8: Neurodivergent Conditions of Respondents

ND groups which are above 5% of the total ND population size are considered individually, and the rest are grouped into the other (OTH) group, which includes OCD, epilepsy and hyperlexia. Large ND groups are defined as ASD, ADHD and LD and small ND groups are defined as DYPX (dyspraxia), TS (Tourette syndrome) and OTH. The results of large ND groups and small ND groups will be considered separately and compared amongst themselves.

The largest SO group is WK where SO was experienced once to a few times a week (fig.9). Less than 2% of the respondents indicated experiencing SO once every couple of years. For the purpose of statistical analysis, a wider category, YR, has been created to encompass groups where SO was experienced at a frequency of a few times a year or less.

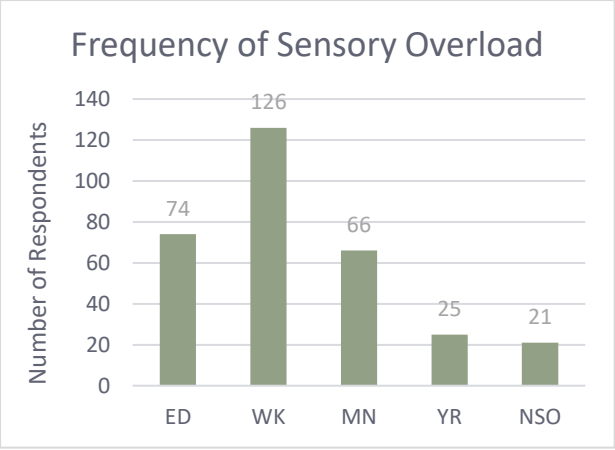


Figure 9: Sensory Overload Frequency of Respondents

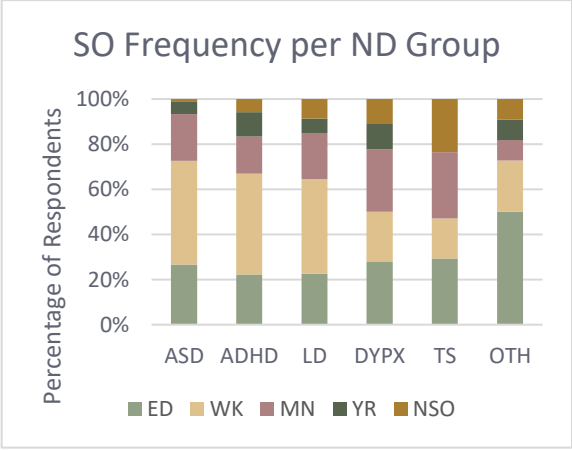


Figure 10: Sensory Overload Frequency per Neurodivergent Group

ED = Everyday; WK = Once to a few times a week; MN = Once to a few times a month; YR = A few times a year to once every couple of years; NSO = No experience of sensory overload

If a SO frequency of at least once a week is considered high and a SO frequency of a few times a month or less is considered low, than OTH group has the highest SO frequency, followed by ASD, ADHD, LD, DYPX and TS (fig.10). Thus, the order of SO frequency within large ND groups is ASD, ADHD and LD and within small ND groups is OTH, DYPX and TS, from highest to lowest.

Interviews

Six interviews were conducted through WhatsApp, Zoom and phone calls. Three of the interviews were conducted with people in the UK and three were conducted with people in Israel (in Hebrew). Five out of the six interviewees identified as ND. Details about the interviewees can be found in Table 1. Perspectives from interviews are included in several of the result sections and in the discussion.

Reference in Text	Name	Role
Dark	Jessica Dark	Founding Director of Hygge Me Global and Supporting and Celebrating Neurodiversity
Farhi	Shmuel Farhi	Interior Designer
Maslin	Steve Maslin	Chartered Architect and NRAC Registered Access Consultant
Mond	Peter Mond	Social Worker and Director of In the Quiet Space Center
Morris	Becki Morris	Director of Disability Collaborative Network and Associate Consultant for EMBED
Stern-Ellran	Keren Stern-Ellran	Founding Director of Senso-Made Rooms and Senior UX Architect & Project Manager at UI – Human Factors

Table 1: Details of Interviewees

4.2. General Perspectives

Access to Quiet Spaces

91.7% of the respondents indicated that yes, having access to quiet spaces (QS) would be beneficial to them, 7.7% selected ‘maybe’, and 0.6% selected ‘no’ (fig.11). ADHD had the largest share of respondents who responded ‘yes’ (97.1%), and LD had the least (87.1%) (fig.12). A chi-square test of homogeneity indicates that the difference in response between ADHD and LD is significant at 95%.

There is a perfect positive correlation (Spearman correlation coefficient: ρ=1) between the percentage of respondents who selected ‘yes’ and their SO frequency, and a strong negative correlation (ρ=-0.9) between the percentage of respondents who selected ‘maybe’ and their SO frequency (fig.13). A table with all moderate to perfect correlations can be found in Appendix A.

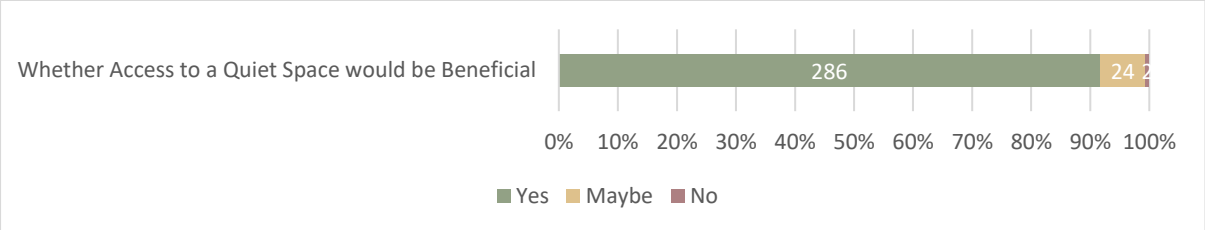


Figure 11: Whether Access to a Quiet Space would be Beneficial

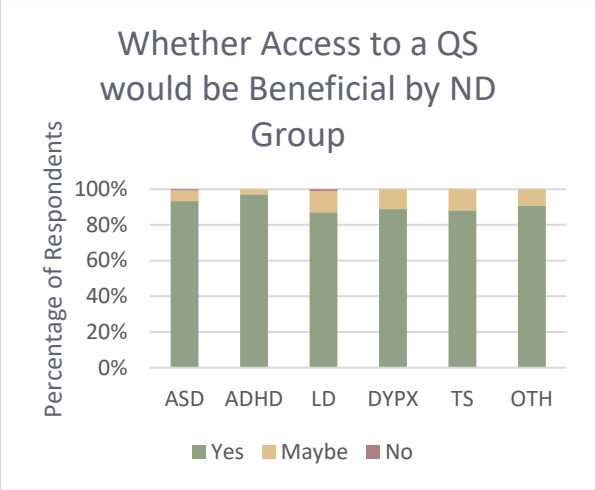


Figure 12: Whether Access to a QS would be Beneficial by ND Group

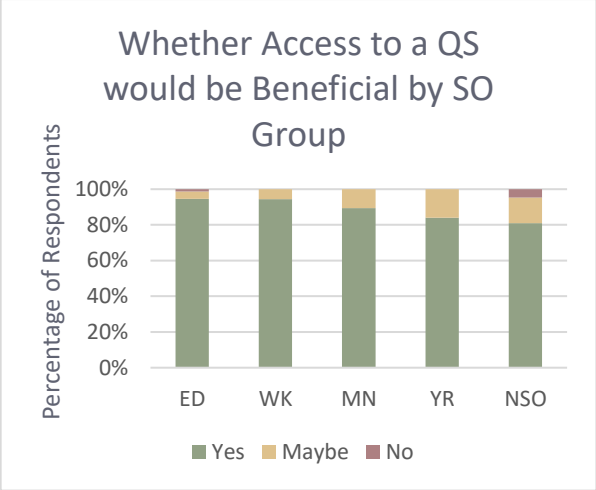


Figure 13: Whether Access to a QS would be Beneficial by SO Group

Importance Ratings

Importance rating of design features (fig.14) mostly followed the same order and magnitude across ND and SO groups, with ASD giving the overall highest percentage of 'very important' ratings relative to their group size (41.9%) and DYPX giving the lowest (29.6%). ED gave the highest percentage of 'very important' ratings relative to their group size (51.6%) while NSO gave the lowest (33.1%).

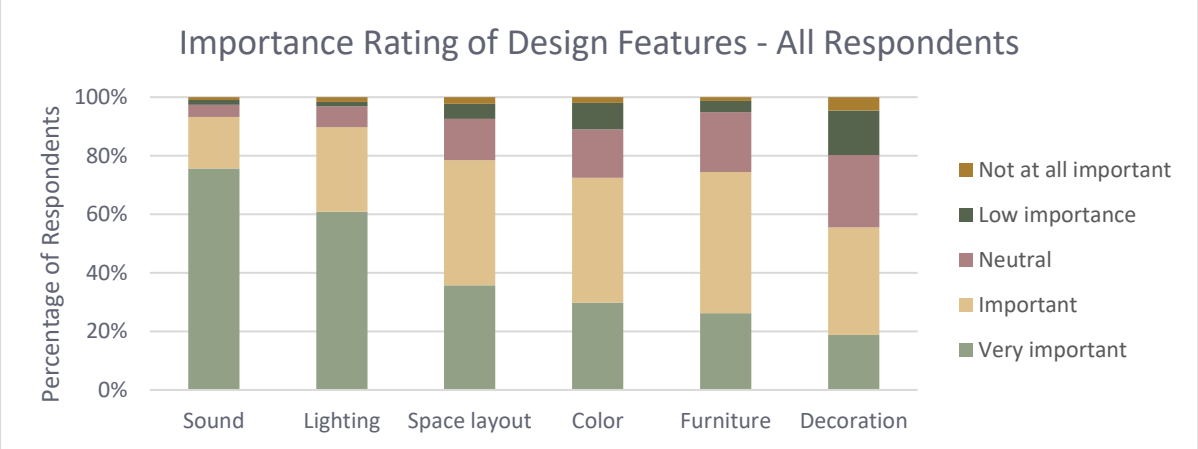


Figure 14: Importance Rating of Design Features - All Respondents

Sound and lighting received the highest importance ratings in all ND and SO groups (fig.15-16). Strong to perfect positive correlations (ρ=0.9-1) are found between the SO frequency of respondents and the percentage of them who rated sound or lighting as 'very important', and moderate to strong negative correlations (ρ=-0.7 to -0.8) with the percentage of them who rated lighting or furniture as 'neutral'.

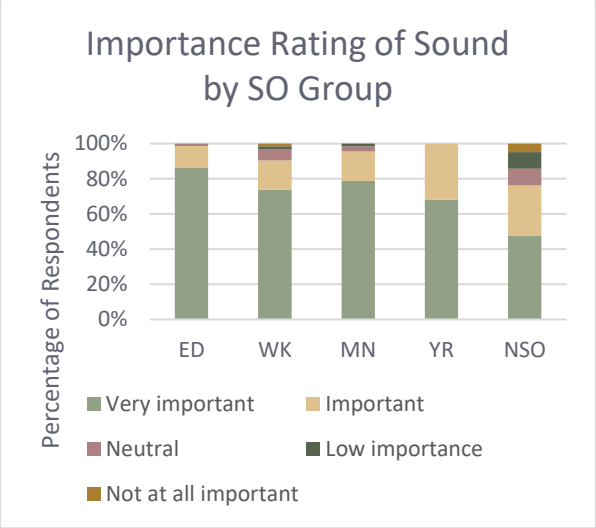


Figure 15: Importance Rating of Sound by SO Group

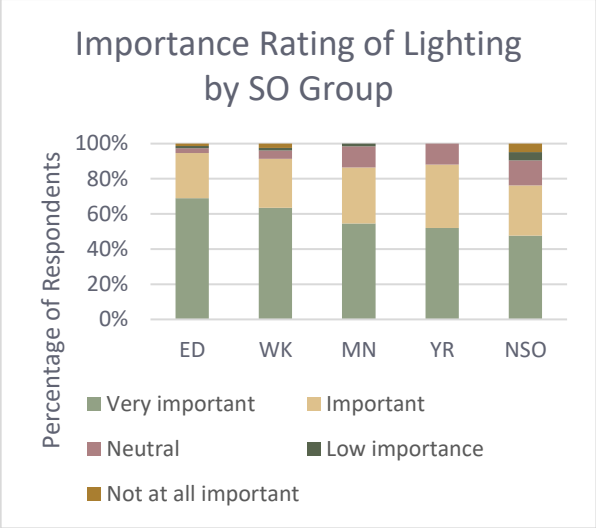


Figure 16: Importance Rating of Lighting by SO Group

The top three locations where respondents reported it is 'important' to 'very important' to have quiet spaces are in education (94.5%), workplaces (92.2%) and healthcare (84.9%) (fig.17). Education was the top choice across all ND and SO groups.

Strong to perfect positive correlations (ρ=0.9-1) are found between the SO frequency of respondents and the percentage of them who rated education, transportation, retail, entertainment or recreation spaces as 'important' to 'very important', and strong to perfect negative correlations (ρ=-0.9 to -1) with the percentage of them who rated these 'not at all important' to 'neutral'.

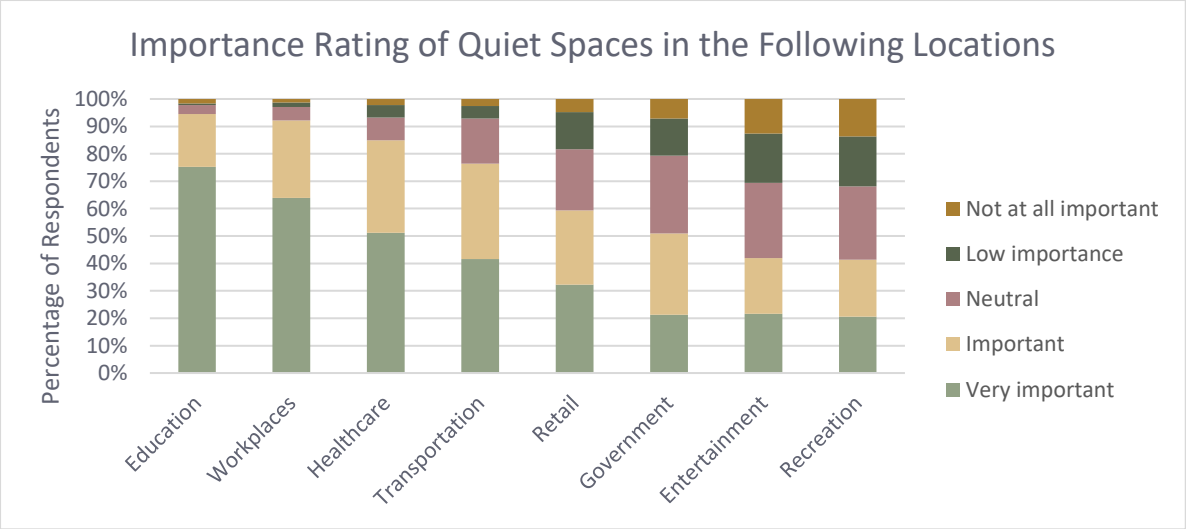


Figure 17: Importance Rating of Quiet Spaces in the Following Locations

ASD importance ratings were proportionately higher than LD in healthcare spaces, higher than ADHD in retail spaces, and higher than both ADHD and LD in government spaces at a significance level of 95%.

Chi-Square Goodness-of-Fit Tests

Chi-square goodness-of-fit tests reject the null hypothesis that the responses to the survey were uniformly distributed in all questions of the 'Ideal Quiet Space' and 'Perception of Quiet Spaces' sections of the survey at a significance of 99%, except one question. In the question inquiring which quiet space from A-C fully met the respondent's sensory needs, the null hypothesis is marginally accepted with p-value=0.056.

Experience in a Quiet Space

119 of the respondents had previously been to a dedicated quiet space and responded to the 'Experience in a Quiet Space' section of the survey. Many of the quiet spaces experienced were shared with other uses (fig.18-19). Lighting (26.3%) and sound (25.1%) are the top design features which the respondents both appreciated and were bothered by (fig.20). Key results of this section are presented below; further information can be found in Appendix C-D.

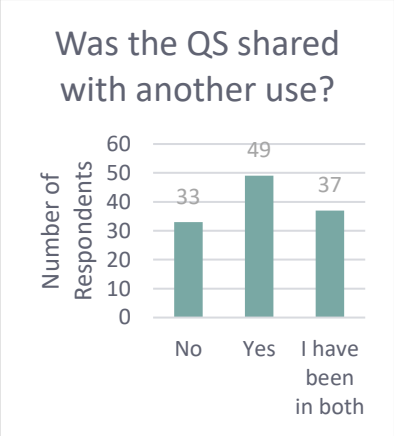


Figure 18: Was the QS shared with another use?

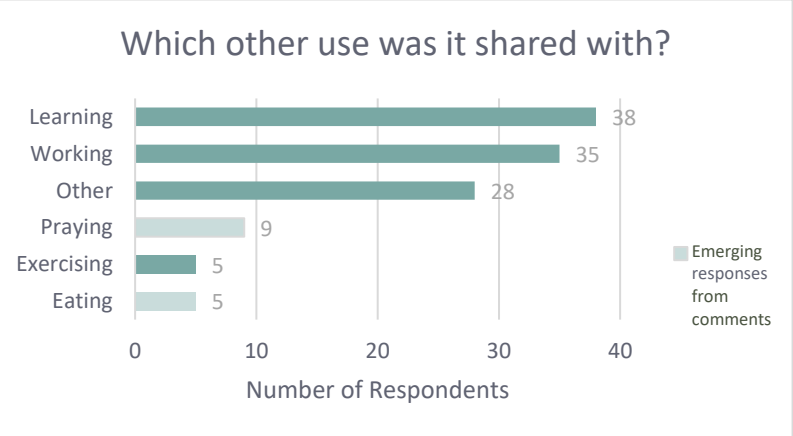


Figure 19: Which other use was it shared with?

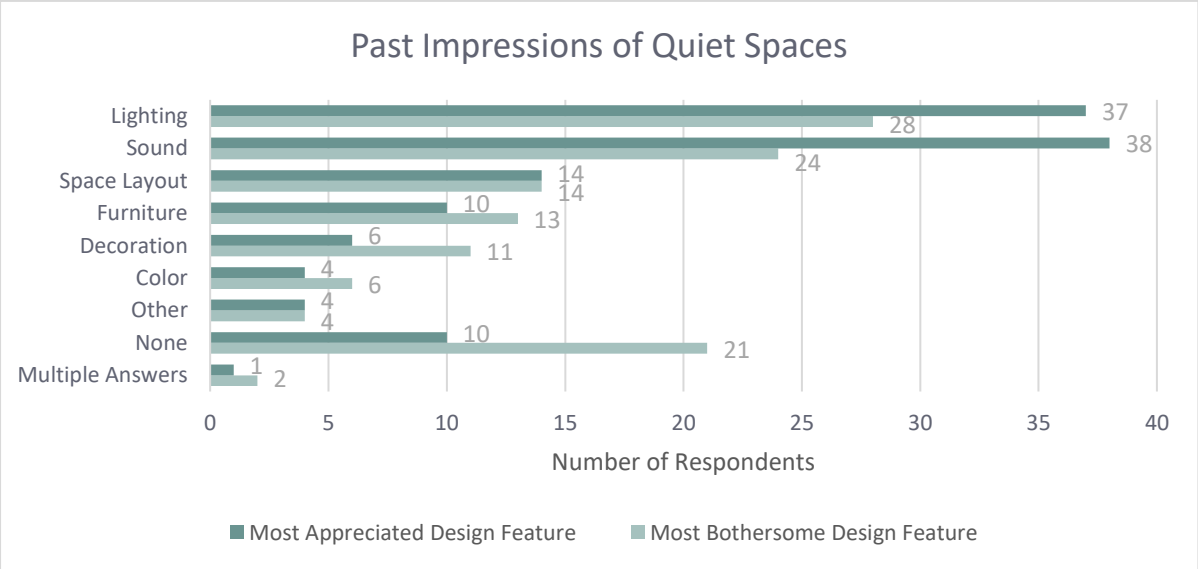


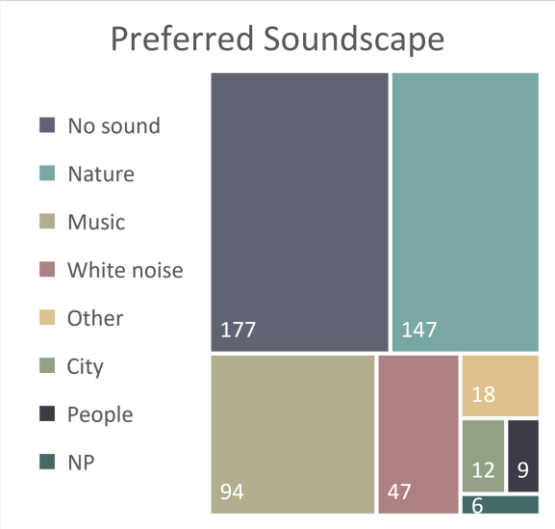
Figure 20: Past Impressions of Quiet Spaces

4.3. Design Features

4.3.1. **Sound**

'No sound' is the most preferred soundscape for a quiet space (34.7%), followed by nature sound (28.8%) and music (18.4%) (fig.21). A perfect positive correlation (ρ=1) is found between the SO frequency of respondents and the percentage of them who chose 'no sound', and a perfect negative correlation (ρ=-1) with the percentage of them who chose 'music' (fig.22).

Differences in the preferred sound choices between ASD and LD are found to be significant at 95%, where ASD chose 'no sound' 7.8% more than LD, and LD chose 'nature sound' 8.4% more than ASD (fig.23). 13 people who chose 'other' expressed the importance of including sound controls.



NP = No preference

Figure 21: Preferred Soundscape

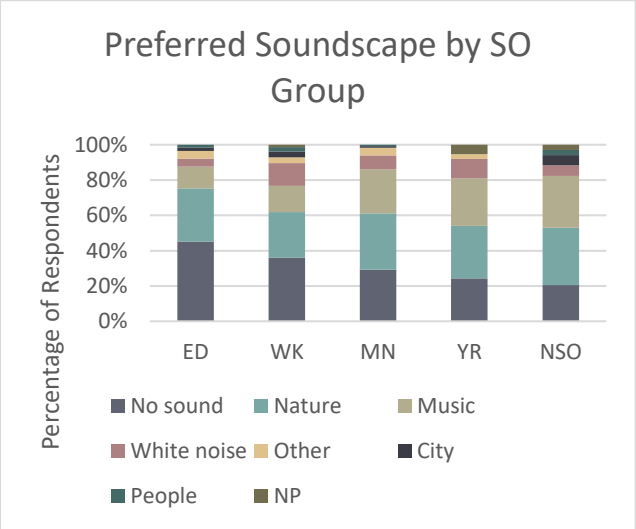


Figure 22: Preferred Soundscape by SO Group

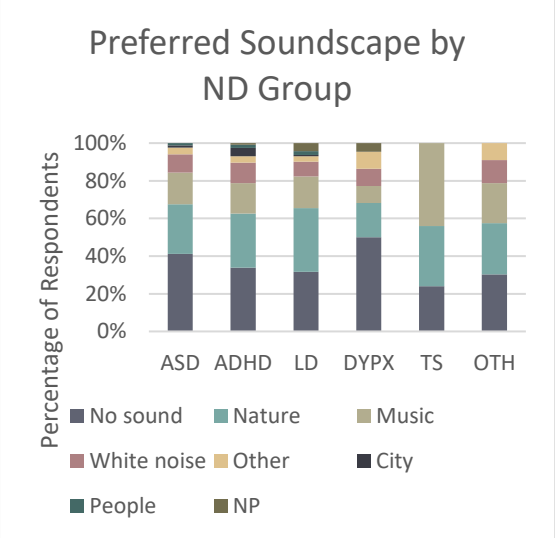


Figure 23: Preferred Soundscape by ND Group

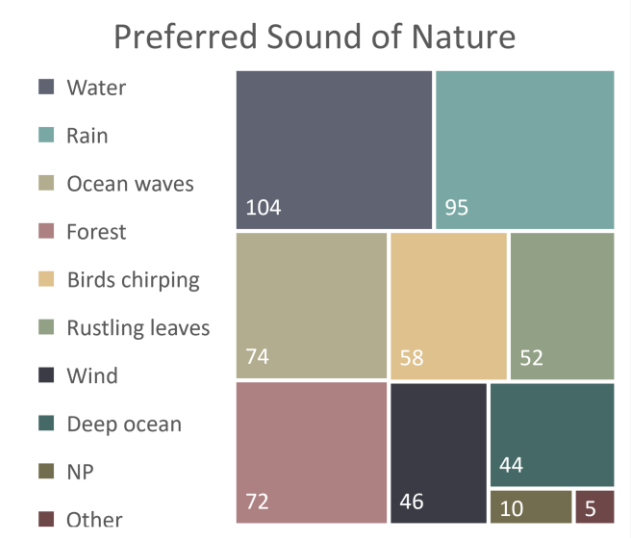


Figure 24: Preferred Sound of Nature

Water is the top choice for nature sounds (18.6%), followed by rain (17%) and ocean waves (13.2%) all of which involve water and comprised 48.8% of the selections (fig.24). There are strong to perfect negative correlations (ρ=-0.9 to -1) between the percentage of respondents who chose water, ocean waves or deep ocean sounds and their SO frequency.

The top preferred music qualities are soft (28.3%), instrumental (26.6%) and slow (15%) (fig.25). A strong positive correlation (ρ=0.8) is found between the SO frequency of respondents and the percentage of them who chose slow, and a strong negative correlation (ρ=-0.8) with the percentage of them who chose vocal (fig.26).

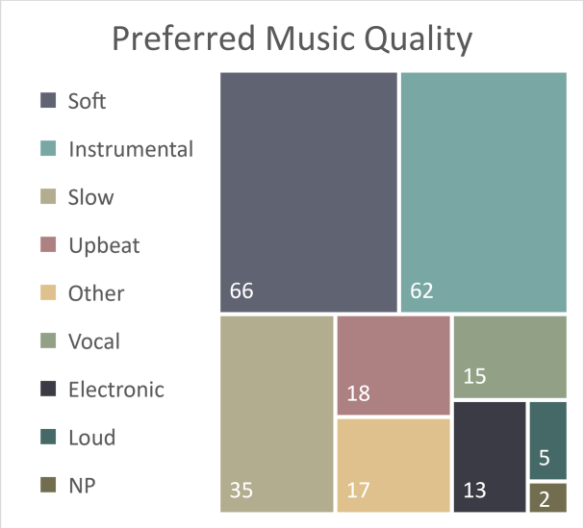


Figure 25: Preferred Music Quality

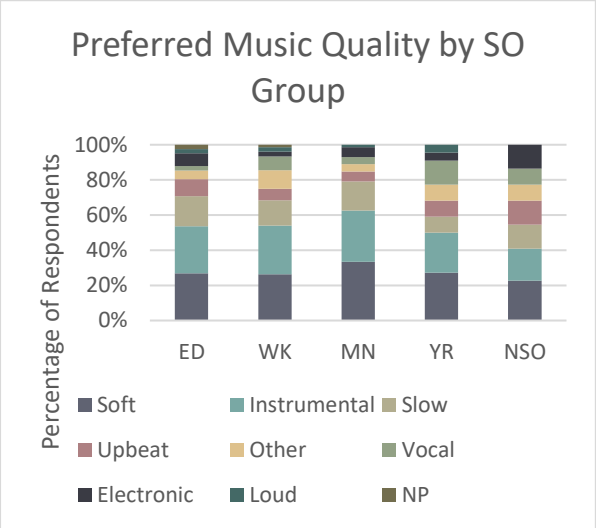


Figure 26: Preferred Music Quality by SO Group

Experience in Quiet Spaces

The estimated sound level mean is 2.1 (where 1 is silent and 5 is very loud) where sound was appreciated, and 2.7 where sound was regarded as bothersome (fig.27). The main sources of sound came from outside (28.1%) or from people (26.3%) (fig.28). Nature sounds were mostly considered bothersome no matter their specific sound.

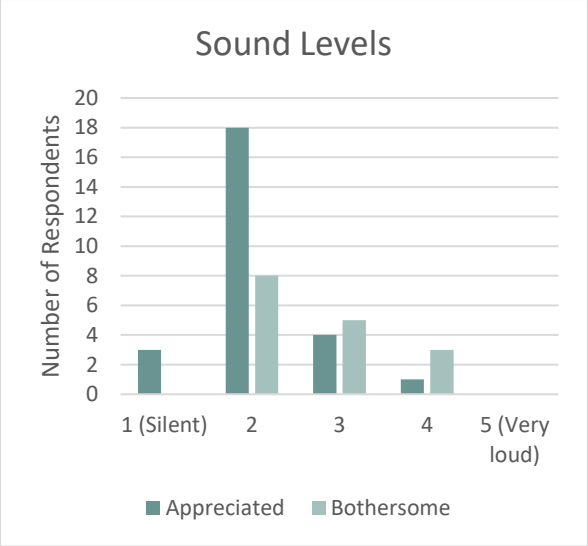


Figure 27: Sound Levels

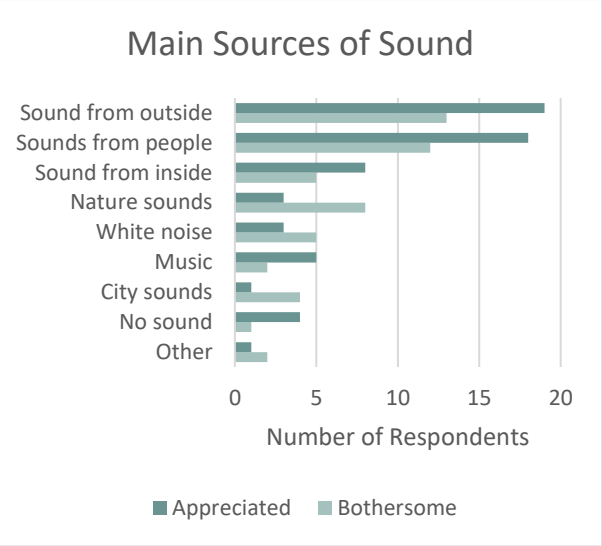
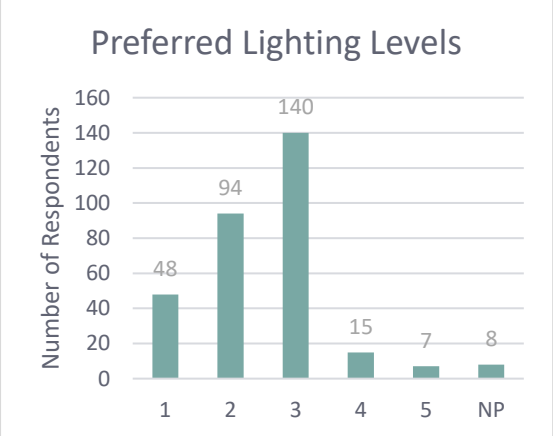


Figure 28: Main Sources of Sound

4.3.2. **Lighting**

The mean preferred lighting level is 2.47 (where 1 is very dim lights and 5 is very bright lights), with a mode of 3 (fig.29). OTH has the lowest mean preferred lighting level at 2.27 and TS has the highest at 2.79. Differences in selections between ASD and ADHD are found to be significant at 95%, where ASD proportionately chose lower lighting levels than ADHD (fig.30).



1 = Very dim lights; 5 = Very bright lights

Figure 29: Preferred Lighting Levels

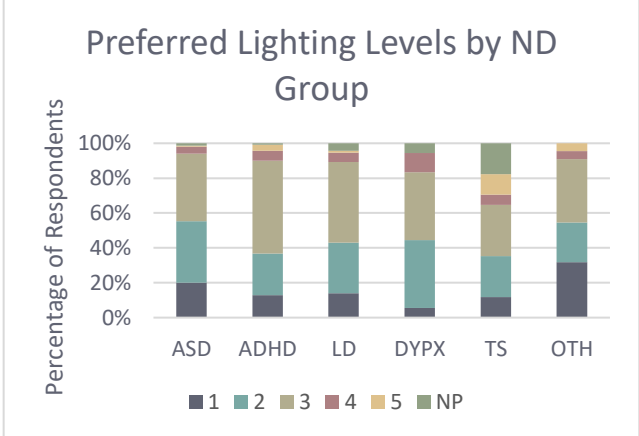


Figure 30: Preferred Lighting Levels by ND Group

1 = 1000K; 2 = 2000K; 3 = 3000K, etc. (Unknown, n.d.)

Figure 31: Image of Correlated Color Temperature Indices

The mode of the selected CCT is 3 (3000K) with a mean of 4.25 and 75th percentile value of 5, showing a preference for orange-yellow light over white-blue light (fig.31-33). This is also evident when considering CCT groups: orange-yellow (1-3) is the top choice (47.5%), followed by white (4-7) (39.6%) and blue (8-10) (12.9%) (fig.34).

A strong positive correlation (ρ=0.9) is found between the SO frequency of respondents and the percentage of them who chose orange-yellow light, and a strong negative correlation (ρ=-0.8) with the percentage of them who chose blue light (fig.35).

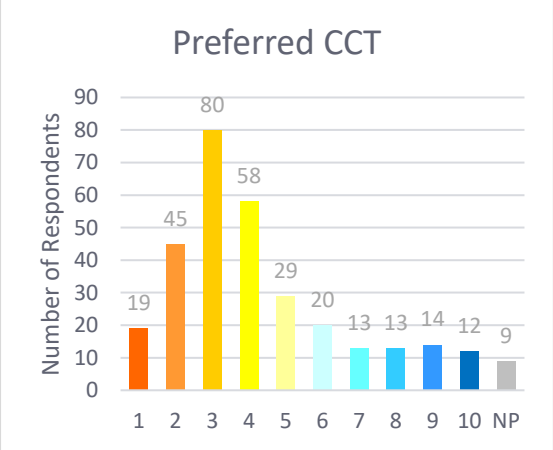


Figure 32: Preferred CCT

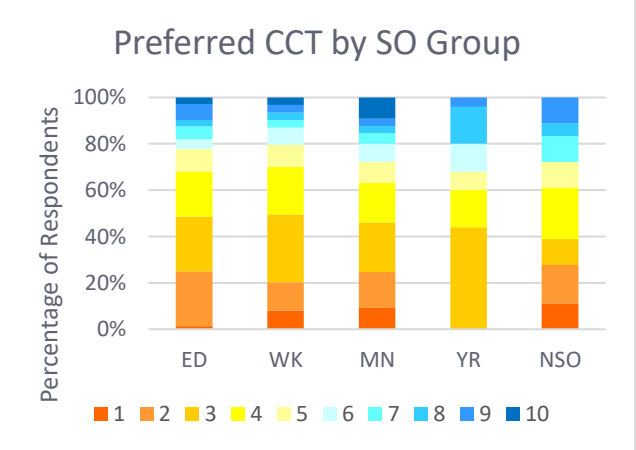


Figure 33: Preferred CCT by SO Group

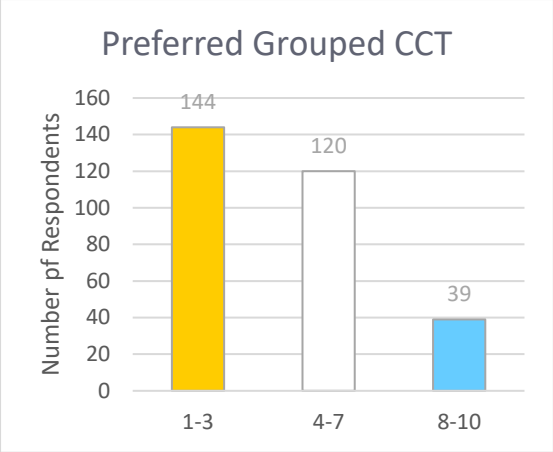


Figure 34: Preferred Grouped CCT

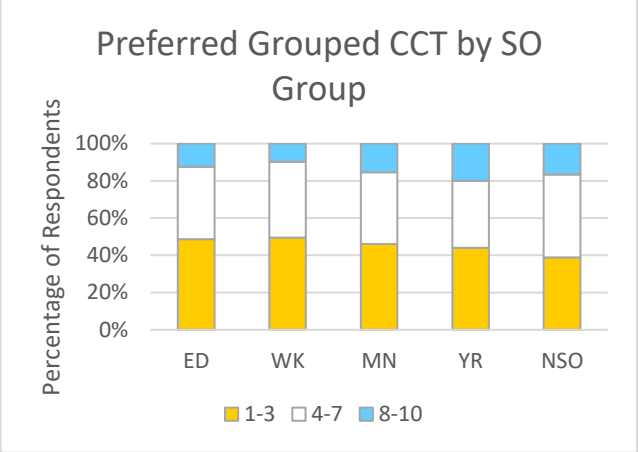


Figure 35: Preferred Grouped CCT by SO Group

Only 32.1% of the respondents preferred to have colored lighting, with 81% of these respondents wanting them as some of the lights rather than all lights (fig.36). Preference for specific colored lighting increase from red to blue, peaking at blue (fig.37-39).

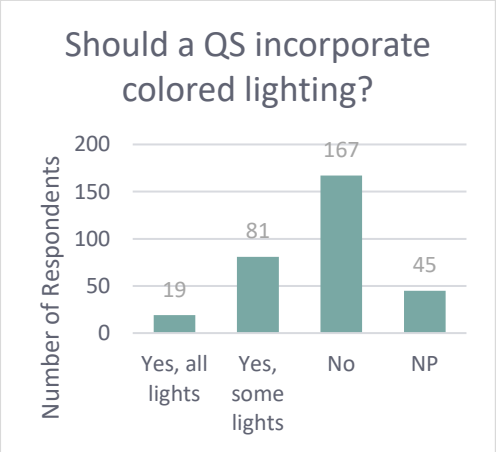


Figure 36: Should a QS Incorporate Colored Lighting?

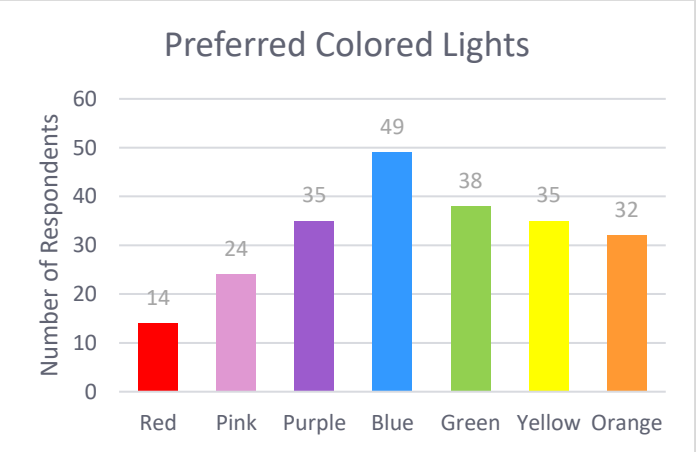


Figure 37: Preferred Colored Lights

A strong positive correlation (ρ=0.9) is found between the SO frequency of respondents and the percentage of them who chose cool colored lights (purple, blue, green), and a strong negative correlation (ρ=-0.8) with the percentage of them who chose warm colored lights (yellow, orange, red) (fig.40-41).

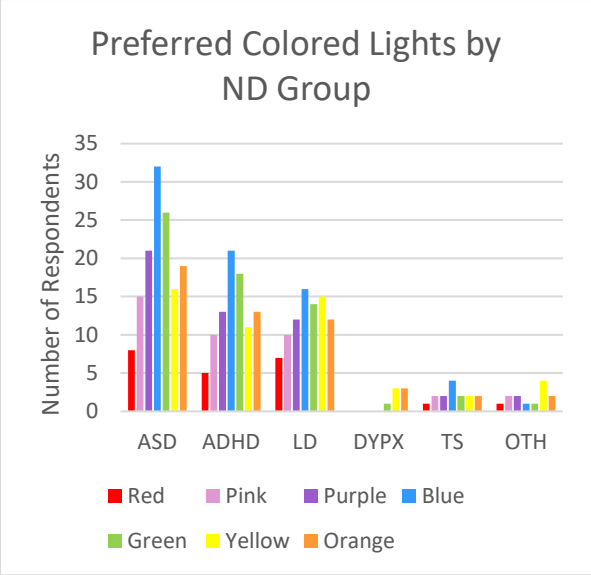


Figure 38: Preferred Colored Lights by ND Group

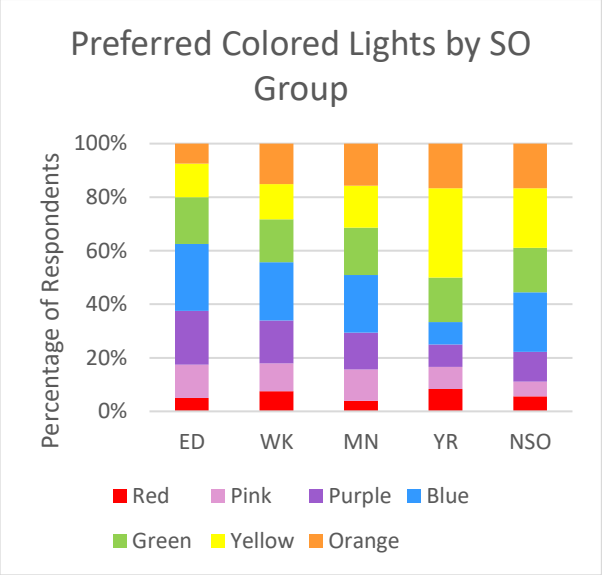


Figure 39: Preferred Colored Lights by SO Group

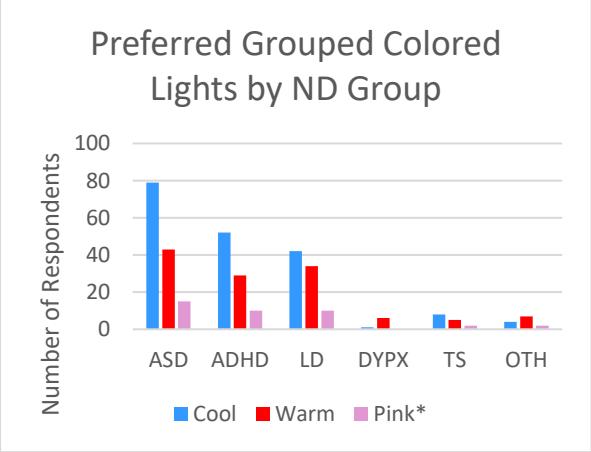


Figure 40: Preferred Grouped Colored Lights by ND Group

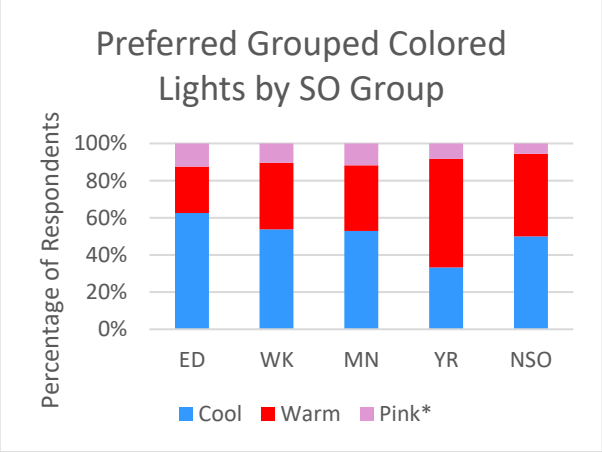


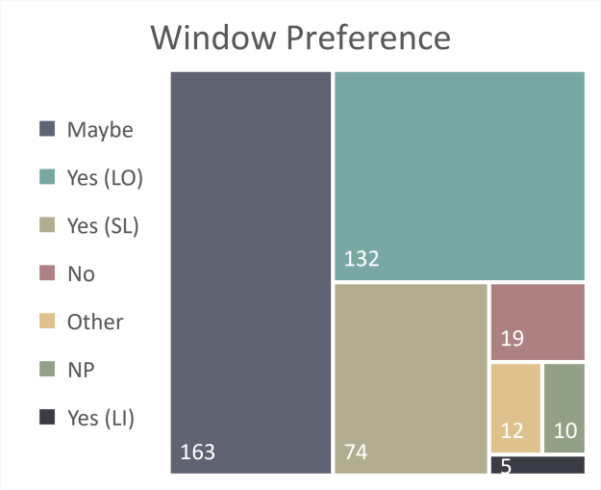
Figure 41: Preferred Grouped Colored Lights by SO Group

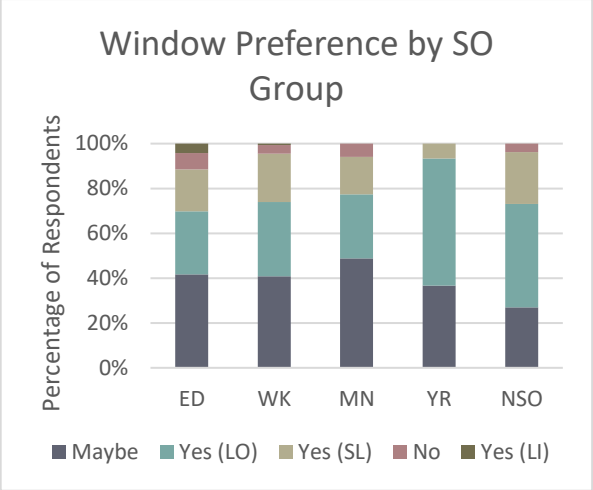
*Pink can be considered as either a cool or a warm color

Windows

The top preference for windows is 'maybe, depending on potential views' (39.3%), followed by windows facing outside (31.8%) and high windows only for sunlight and above eye level for avoidance of distracting views (17.8%) (fig.42). 15 comments expressed the importance of incorporating controllable shades.

There is a strong negative correlation (ρ=-0.8) between the percentage of respondents who chose 'yes, looking outside' and their SO frequency (fig.43). ED has the largest share of answers that includes windows looking into the building and no windows (11.5% total).





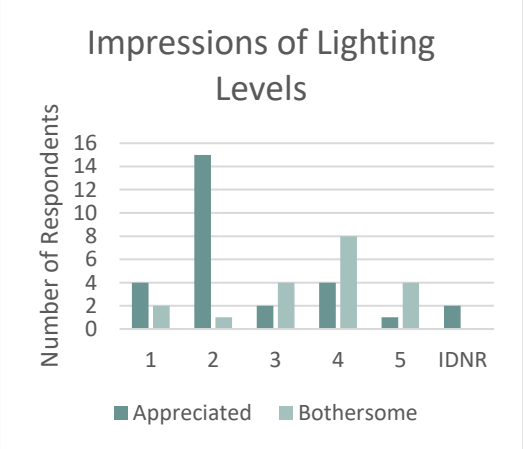
Maybe = Maybe, depending on potential views; Yes (LO) = Yes, looking outside; Yes (SL) = Yes, only for sunlight and above eye level to avoid distracting views; Yes (LI) = Yes, looking into the building

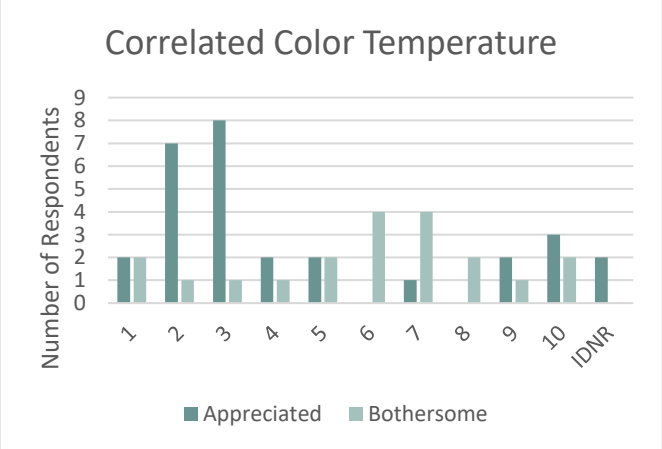
Figure 42: Window Preference

Figure 43: Window Preference by SO Group

Experience in Quiet Spaces

The mean lighting levels is 2.3 (where 1 is very dim lights and 5 is very bright lights) where lighting was appreciated, and 3.6 where lighting was regarded as bothersome (fig.44). The mean CCT is 4.2 (~4200K) where lighting was appreciated and 5.9 (~5900K) where lighting was regarded as bothersome (fig.45). The most bothersome lighting quality is lighting that was too bright, followed by too much glare and too many light sources (fig.46).





1 = Very dim lights; 5 = Very bright lights;
IDNR = I do not remember

1 = 1000K; 2 = 2000K; 3 = 3000K, etc.

Figure 44: Impressions of Lighting Levels

Figure 45: Correlated Color Temperature

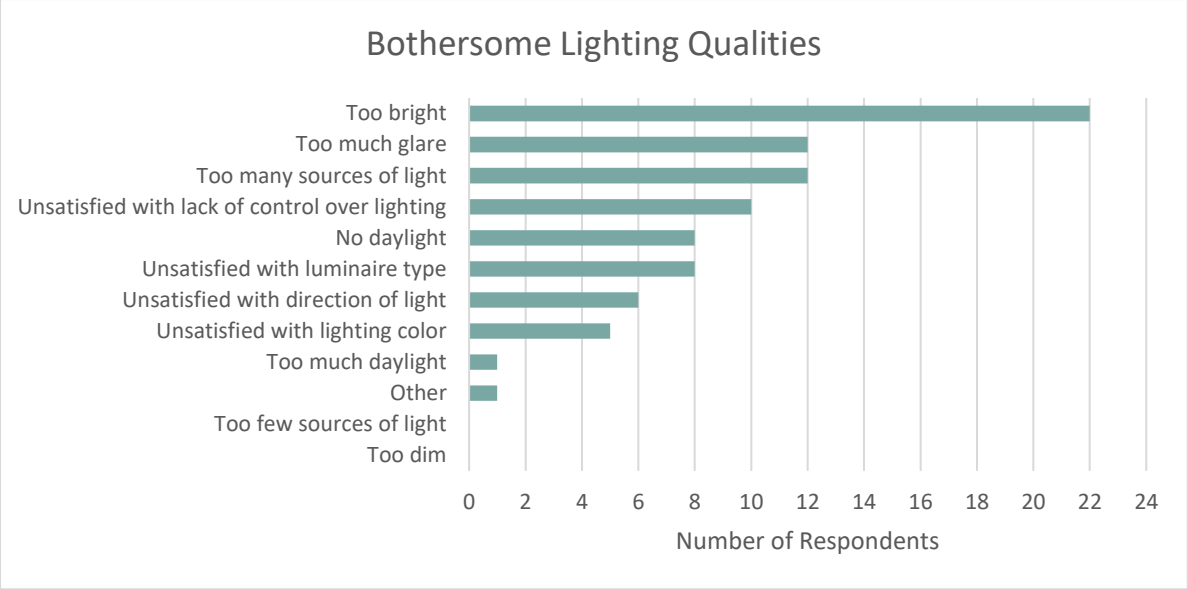


Figure 46: Bothersome Lighting Qualities

Interviews (Perspectives from Stern-Ellran)

Our brains are accustomed to the full spectrum light produced by daylight. The mechanism of heated filament lighting (e.g. incandescent, halogen) gives off light that is most similar to daylight, with a close to continuous black-body radiation spectrum and high color rendering. Once you have luminaires that do not give off a spectrum that is similar to daylight, such as is typical with fluorescent or LED, the brain may notice the differences. This makes such lights especially disturbing for people with high sensory sensitivities.

4.3.3. **Space Layout**

The following qualities were measured against each other: simple vs. intricate, private vs. communal, cozy vs. spacious and informal vs. formal. The preferred space layout qualities are simple (93.8%), private (85.3%), informal (86.9%) and cozy (65.3%) (fig.47). A strong positive correlation (ρ=0.9) is found between the SO frequency of respondents and the percentage of them who chose private (fig.49-50).

The top choice in ASD is ‘private’, and in ADHD and LD it is ‘simple’ (fig.48). ASD preferred private proportionately more than ADHD or LD at a significance level of 95%.

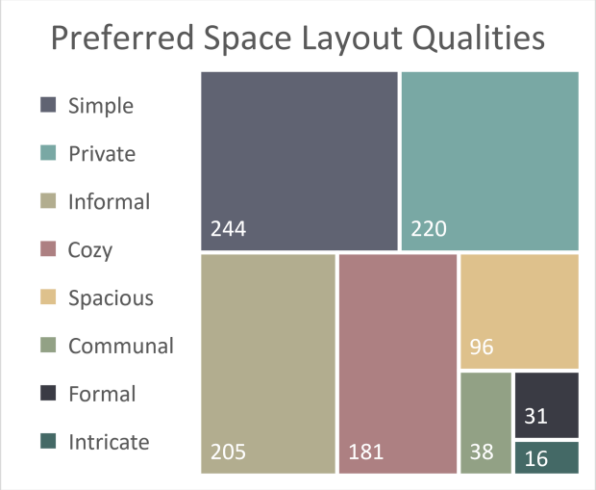


Figure 47: Preferred Space Layout Qualities

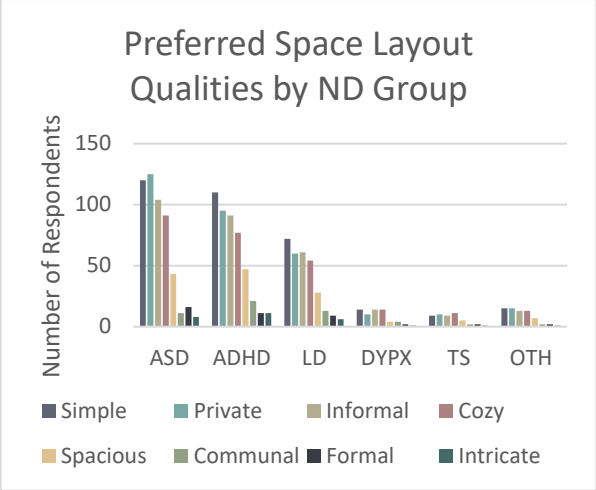


Figure 48: Preferred Space Layout Qualities by ND Group

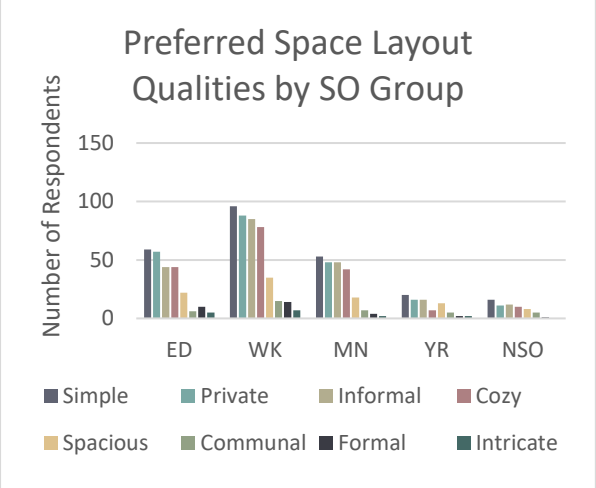


Figure 49: Preferred Space Layout Qualities by SO Group I

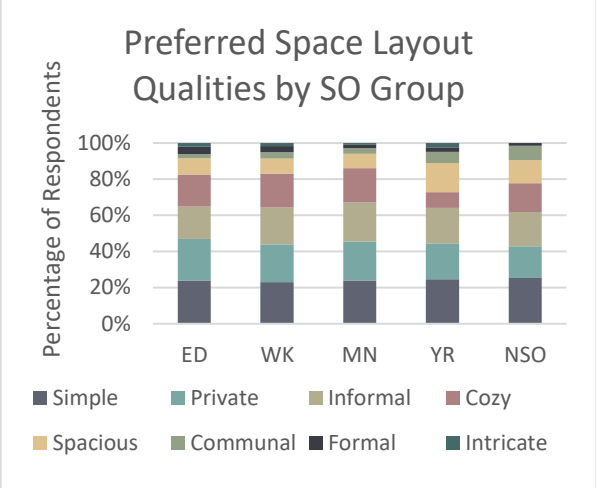


Figure 50: Preferred Space Layout Qualities by SO Group II

4.3.4. **Color**

Colored walls were preferred (33.3%) above textured walls (25%) and white walls (21.7%) (fig.51-52). Natural material (20.9%) is the top choice in the preferred material/color scheme, followed by muted (16.8%), few (16.3%) and light colors (12.7%) (fig.53). Strong positive correlations (ρ=0.8-0.9) are found between the SO frequency of respondents and the percentage of them who chose a dark color scheme or a color scheme on the grey scale, and strong negative correlations (ρ=-0.8 to -0.9) with the percentage of them who chose a light or warm color scheme (fig.54).

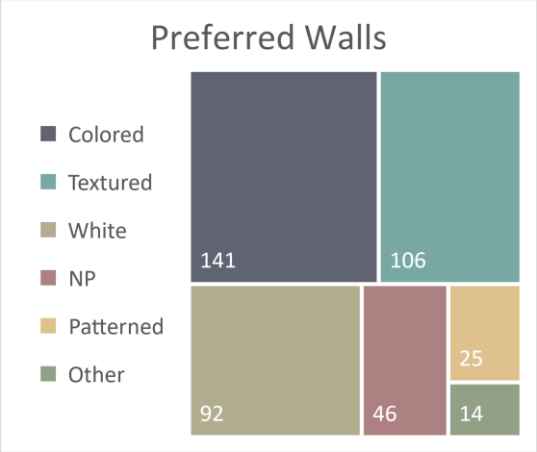


Figure 51: Preferred Walls

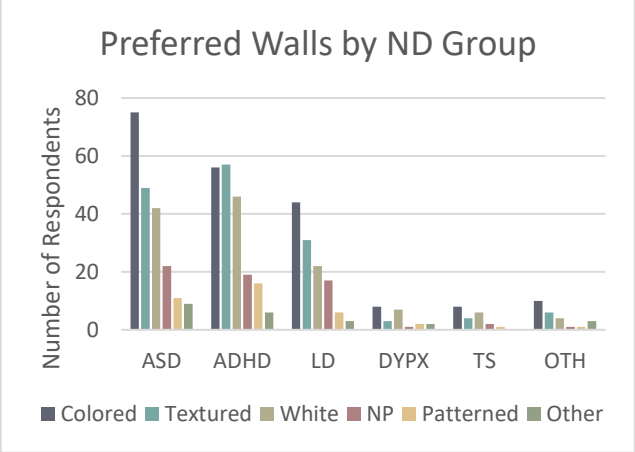


Figure 52: Preferred Walls by ND Group

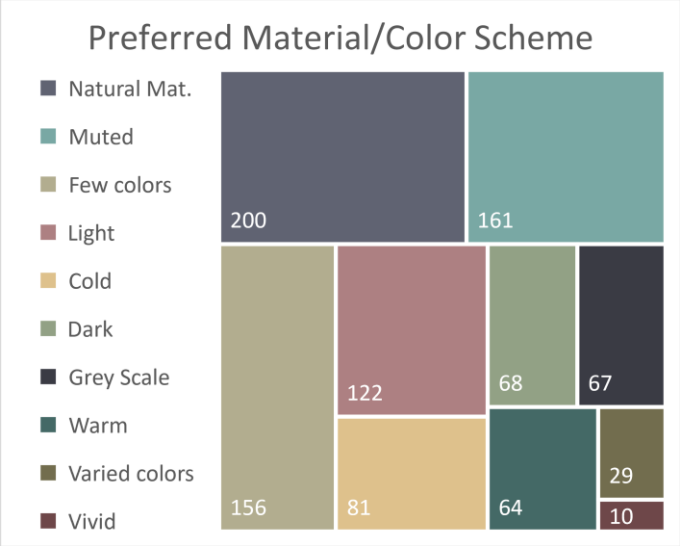


Figure 53: Preferred Material/Color Scheme

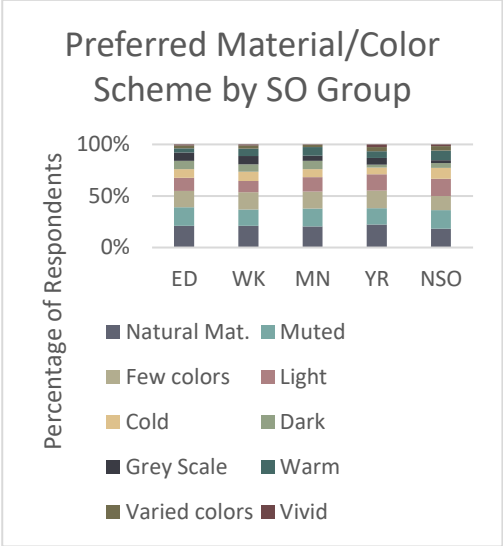


Figure 54: Preferred Material/Color Scheme by SO Group

4.3.5. **Furniture**

The top choices for important furniture qualities are comfort (29.5%), texture (17.7%) and flexible use (15.4%) (fig.55). Comfort is the top choice across all ND and SO groups. Moderate to strong positive correlations (ρ=0.7-0.8) are found between the SO frequency of respondents and the percentage of them who chose texture or material. Fabric (41.8%) and wood (30.3%) are the leading preferred furniture materials across all ND and SO groups (fig.56).

Top five preferred items in the quiet space include chairs (13.3%), pillows (12.6%), beans bags (12.1%), tables (10.6%) and office supplies (10.3%) (fig.57). 15 comments specified an interest in including couches, sofas and armchairs. Strong negative correlations (ρ=-0.8 to -0.9) are found between the SO frequency of respondents and the percentage of them who chose office supplies, books or hammocks (fig.58).

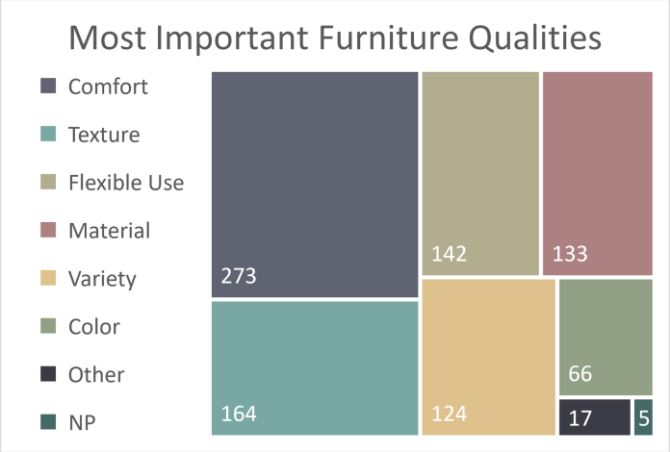


Figure 55: Most Important Furniture Qualities

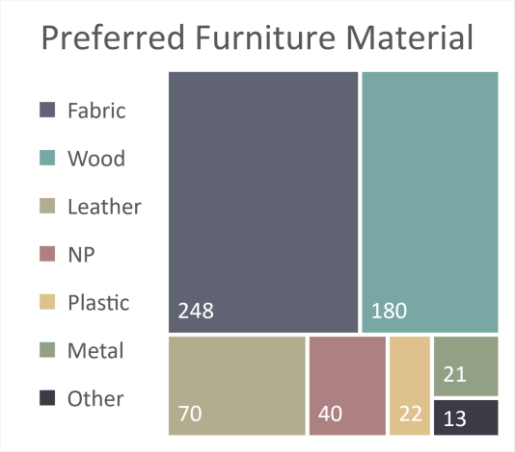


Figure 56: Preferred Furniture Material

Figure 57: Preferred Items in the QS

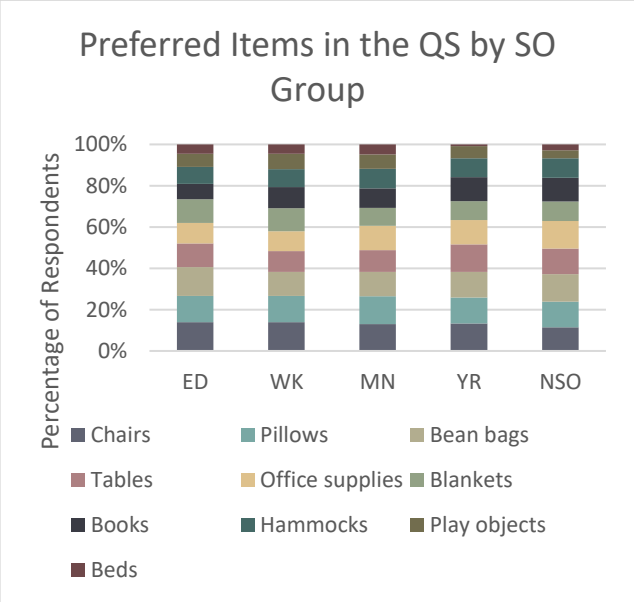
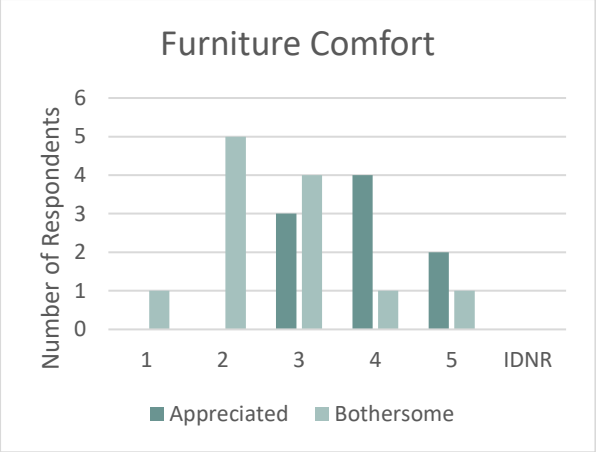


Figure 58: Preferred Items in the QS by SO Group

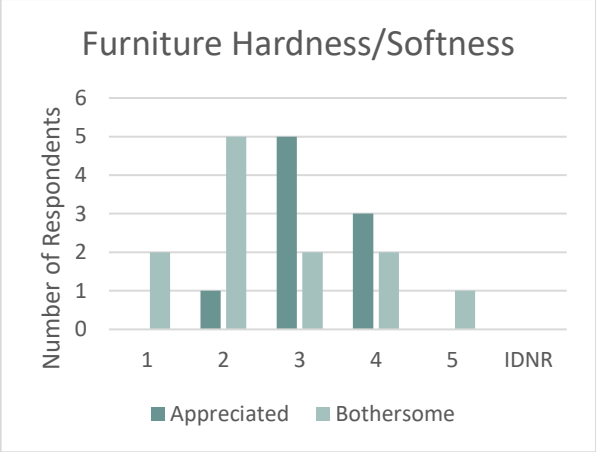
Experience in Quiet Spaces

The mean furniture comfort is 3.9 (where 1 is 'not at all comfortable' and 5 is 'very comfortable') where furniture was appreciated, and 2.7 where furniture was regarded as bothersome (fig.59). The mean furniture hardness/softness is 3.2 (where 1 is 'very hard' and 5 is 'very soft') where furniture was appreciated, and 2.6 where furniture was regarded as bothersome (fig.60). Fabric (37.1%) and wood (31.4%) are the most common furniture materials, and chairs (27.1%), tables (18.6%) and bean bags (14.3%) are the top three common elements (fig.61-62).



1 = Not at all comfortable; 5 = Very comfortable

Figure 59: Furniture Comfort



1 = Very hard; 5 = Very soft

Figure 60: Furniture Hardness/Softness

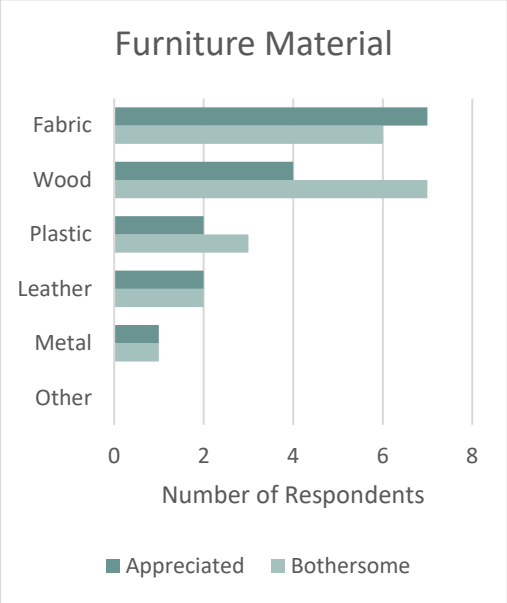


Figure 61: Furniture Material

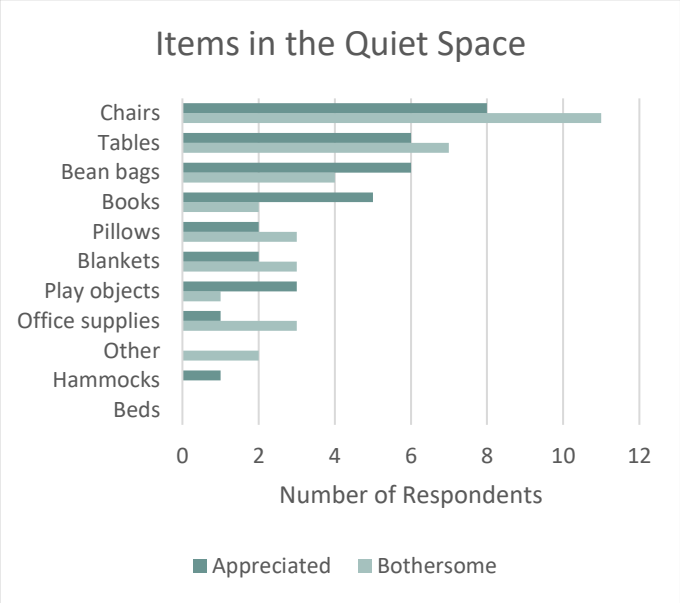


Figure 62: Items in the Quiet Space

4.3.6. **Decoration**

Plants is the top choice (48.5%) for decorative element across all ND and SO groups (fig.63). A moderate positive correlation is found (ρ=0.7) between the SO frequency of respondents and the percentage of them who chose plants, and a moderate negative correlation (ρ=-0.7) with the percentage of them who chose images or decorative objects (fig.64). Eight comments specified not wanting to have any decoration.

From the respondents who expressed interest in having images in the quiet space, nature (43.4%) is the top choice of image within all ND and SO groups, followed by abstract art (21.3%) and patterns (17.4%) (fig.65-68).

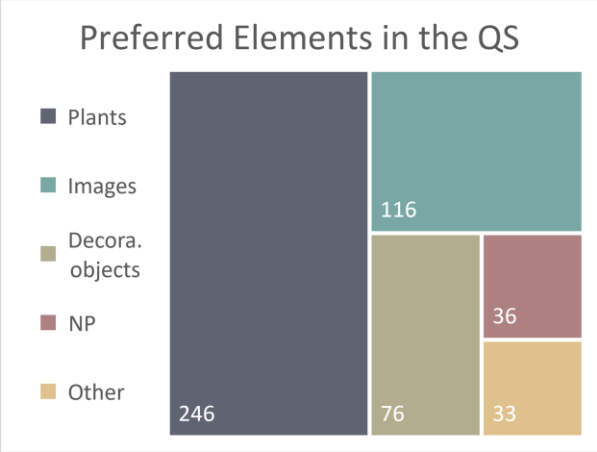


Figure 63: Preferred Elements in the QS

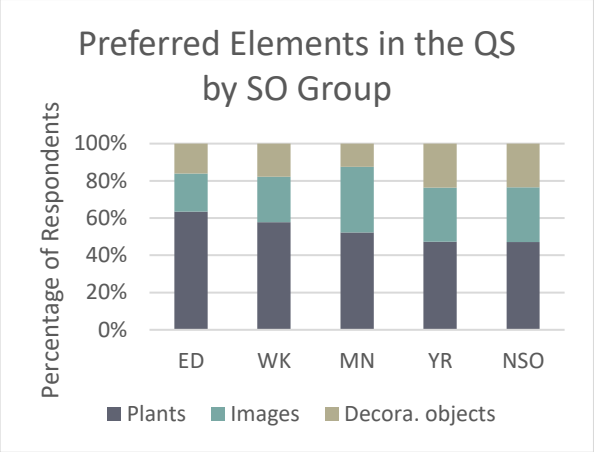


Figure 64: Preferred Elements in the QS by SO Group

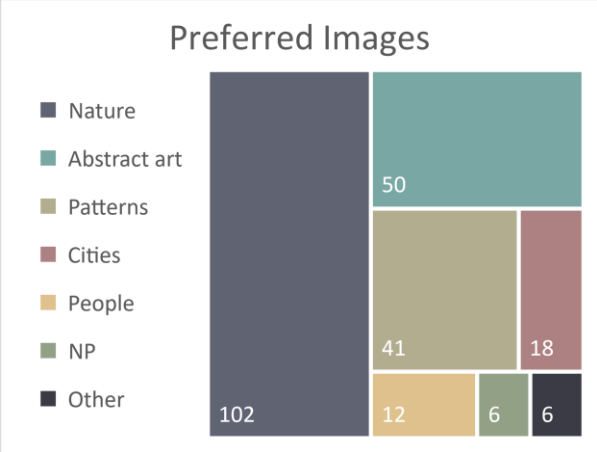


Figure 65: Preferred Images

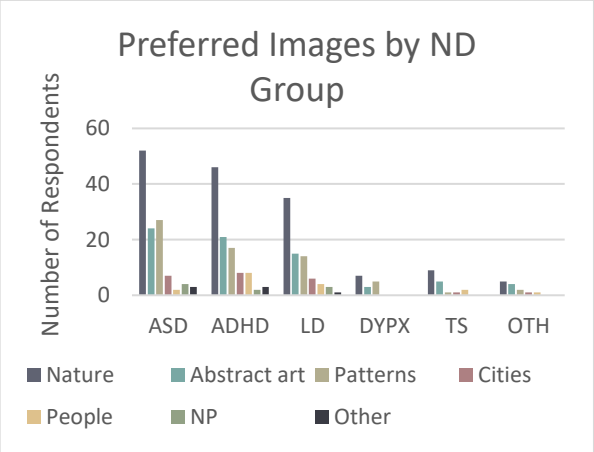


Figure 66: Preferred Images by ND Group

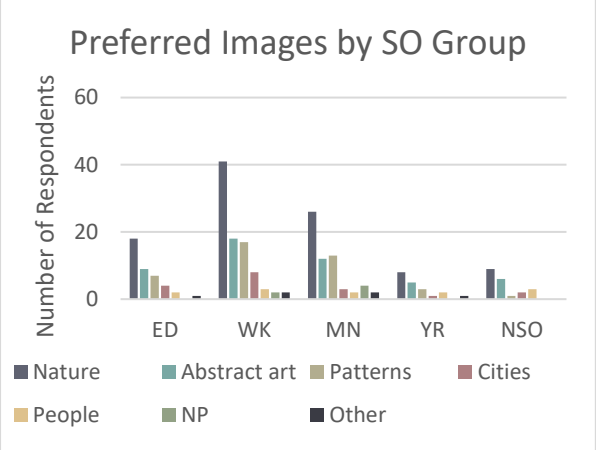


Figure 67: Preferred Images by SO Group I

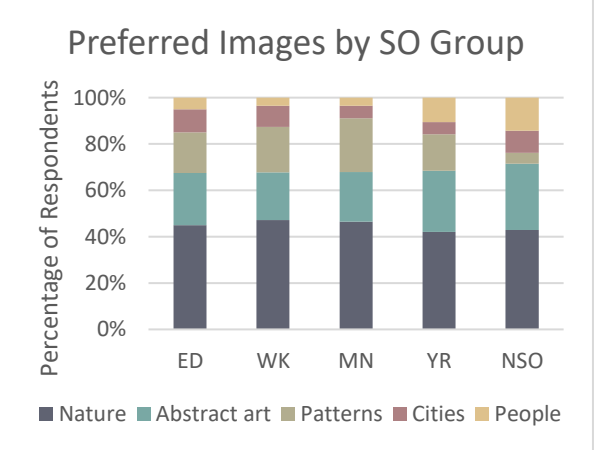


Figure 68: Preferred Images by SO Group II

Experience in Quiet Spaces

The main bothersome quality of the decoration is too much decoration, followed by distracting and unpleasant decoration. Images seem to be commonly found in the decoration of quiet spaces, being

regarded as more bothersome than appreciated, with abstract art and patterns as common images which cause bother (fig.69-70).

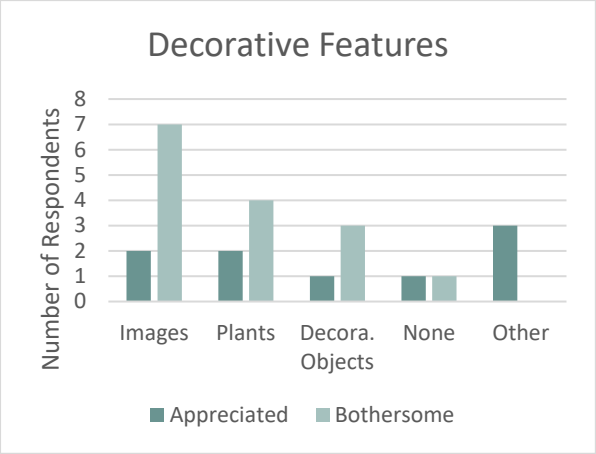


Figure 69: Decorative Features

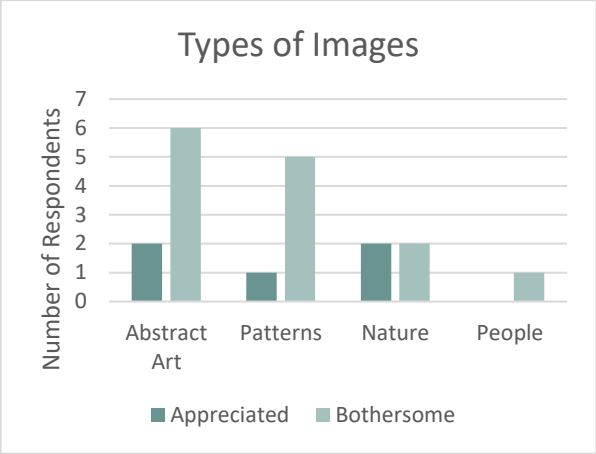
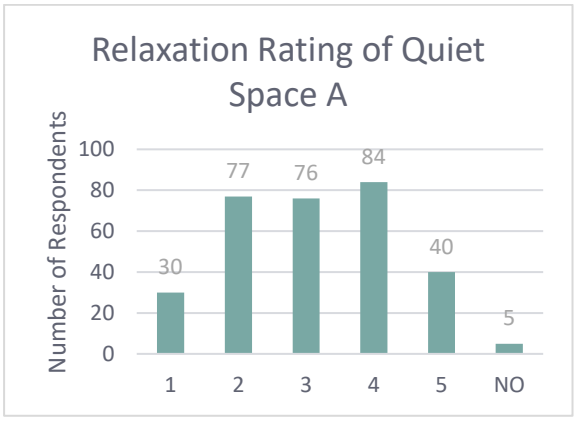


Figure 70: Types of Images

4.4. Assessment of Sample Quiet Spaces

4.4.1. **Quiet Space A**

The mean relaxation rating of Quiet Space A (QS-A) is 3.09 with a median of 3 and mode of 4 (fig.71). OTH rated the room the most relaxing (3.4), followed by ADHD (3.22), with the lowest rating coming from LD (2.9). There is a strong negative correlation (ρ=-0.9) between the percentage of respondents who rated QS-A as 5 and their SO frequency.



1 = Not at all relaxing; 5 = Very relaxing; NO = No Opinion

Figure 71: Relaxation Rating of Quiet Space A

The top three liked design features of QS-A are lighting (20.7%), color (18.8%) and objects (16.3%) (fig.72). 41 emerging answers from comments included the window and the view outside the window as liked features. There is a strong negative correlation (ρ=-0.9) between the percentage of respondents who chose furniture as a liked feature and their SO frequency (fig.73).

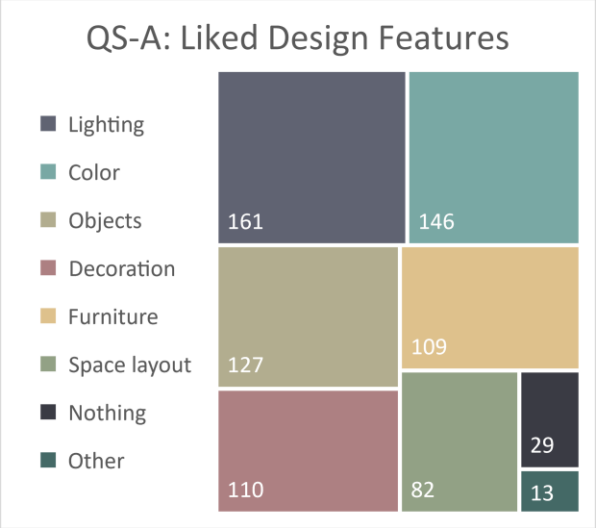


Figure 72: QS-A Liked Design Features

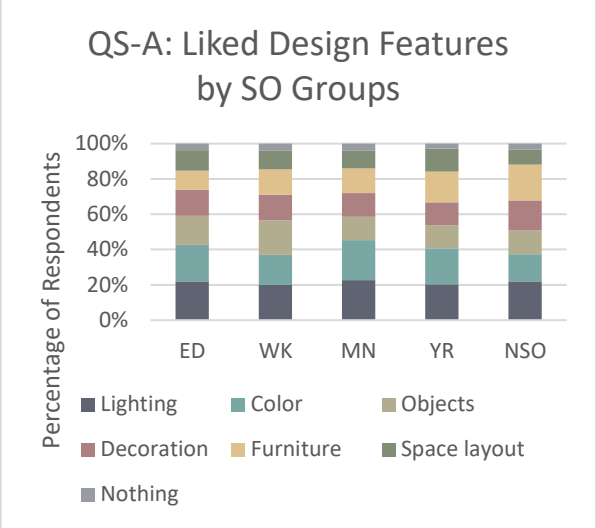


Figure 73: QS-A Liked Design Features by ND Group

The top three disliked design features of QS-A are objects (21.5%), furniture (19.2%) and decoration (17.9%) (fig.74). Eight emerging answers from comments included the window and the view outside the window as disliked features. Many comments highlighted disliking that the space is too busy and cluttered, as well as disliking of the cacti as a chosen plant type. There is a strong negative correlation (ρ=-0.8) between the percentage of respondents who chose 'nothing' for a disliked feature and their SO frequency (fig.75).

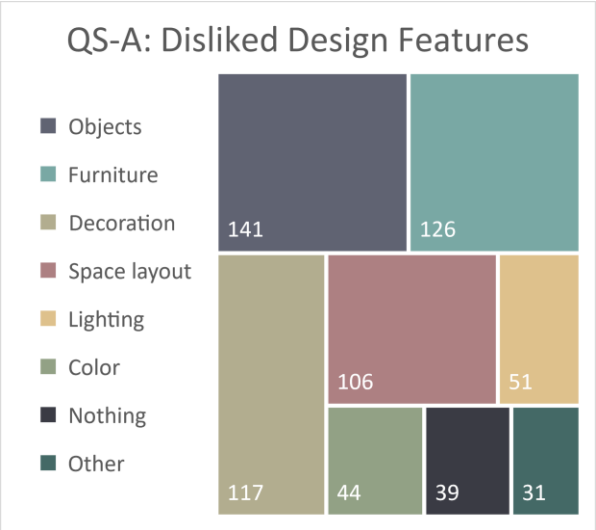


Figure 74: QS-A Disliked Design Features

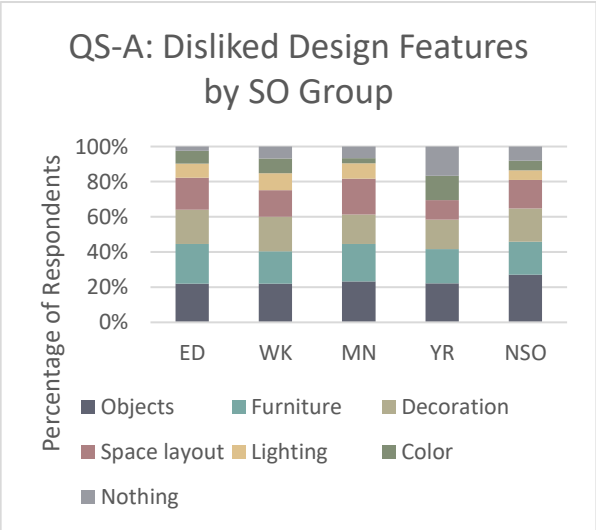
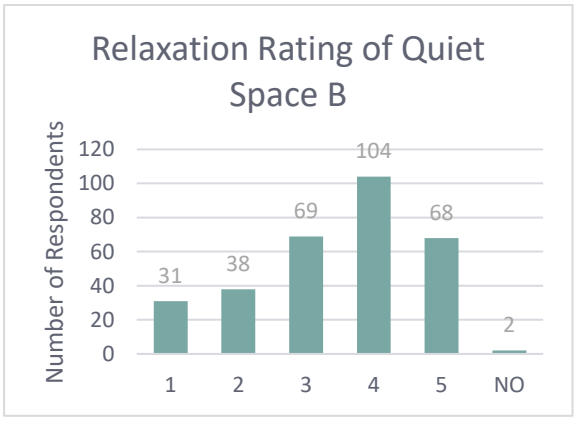


Figure 75: QS-A Disliked Design Features by SO Group

4.4.2. **Quiet Space B**

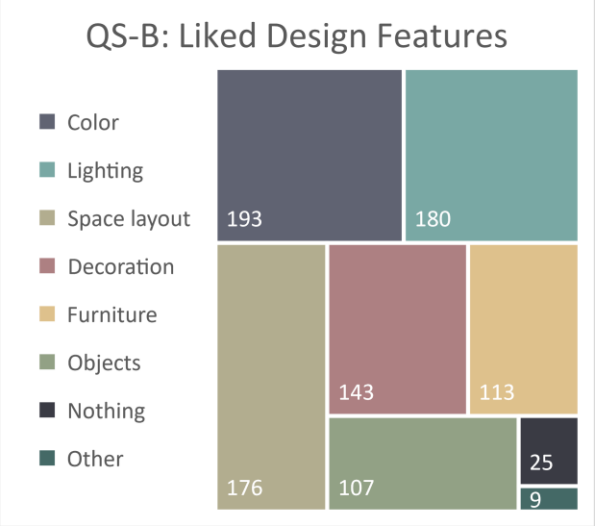
The mean relaxation rating of Quiet Space B (QS-B) is 3.45, 0.36 points higher than Quiet Space A, with a median and mode of 4 (fig.76). OTH rated the room the most relaxing (3.68), followed by ASD (3.55), with the lowest rating coming from TS (3.12). There is a strong negative correlation (ρ=-0.8) between the percentage of respondents who rated QS-B as 1 and their SO frequency.



1 = Not at all relaxing; 5 = Very relaxing; NO = No Opinion

Figure 76: Relaxation Rating of Quiet Space B

The top three liked design features of QS-B are color (20.4%), lighting (19%) and space layout (18.6%) (fig.77). Ten emerging answers from comments mentioned the floor as a liked feature. Space layout is the top design feature choice within ASD and LD (fig.78). A strong positive correlation (ρ=0.9) is found between the SO frequency of respondents and the percentage of them who chose furniture as a liked feature, and a strong negative correlation (ρ=-0.9) with the percentage of them who chose 'nothing' for a liked feature.



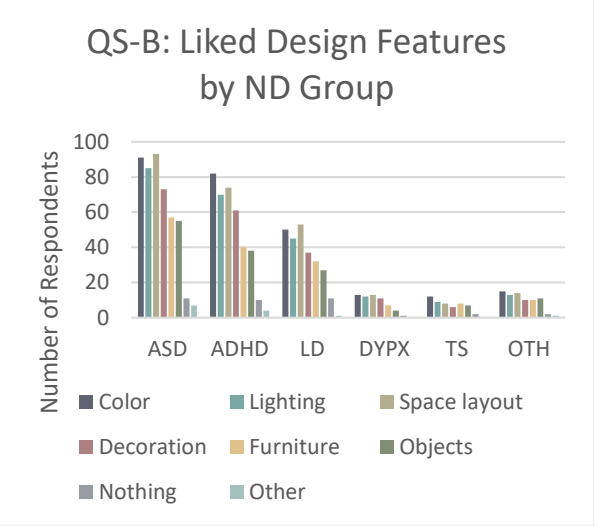


Figure 77: QS-B Liked Design Features

Figure 78: QS-B Liked Design Features by ND Group

The top four disliked design features of QS-B are furniture (27.5%), lighting (14.9%) and both decoration and objects (13.3% each), with furniture as the top choice across all ND and SO groups (fig.79-81). Six emerging answers from comments included the curtains to the window. There is a strong negative correlation (ρ=-0.9) between the percentage of respondents who chose furniture as a disliked feature and their SO frequency (fig.82).

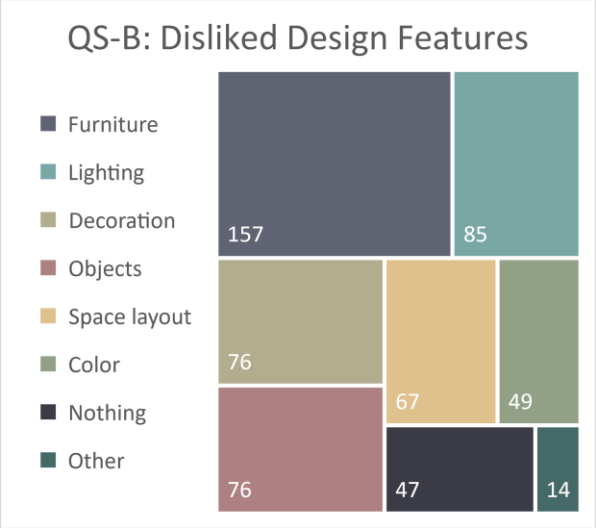


Figure 79: QS-B Disliked Design Features

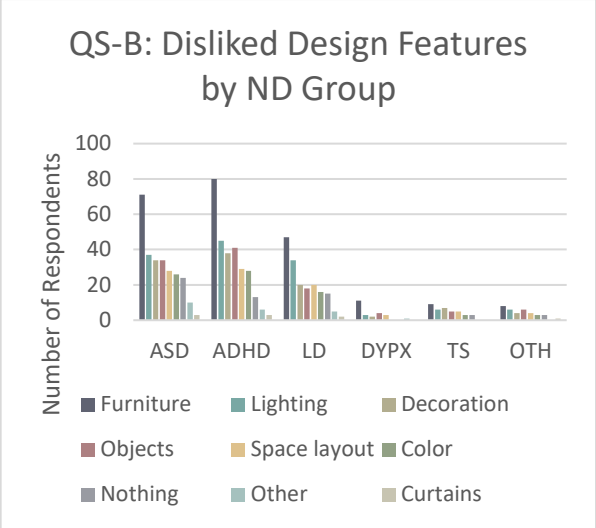


Figure 80: QS-B Disliked Design Features by ND Group

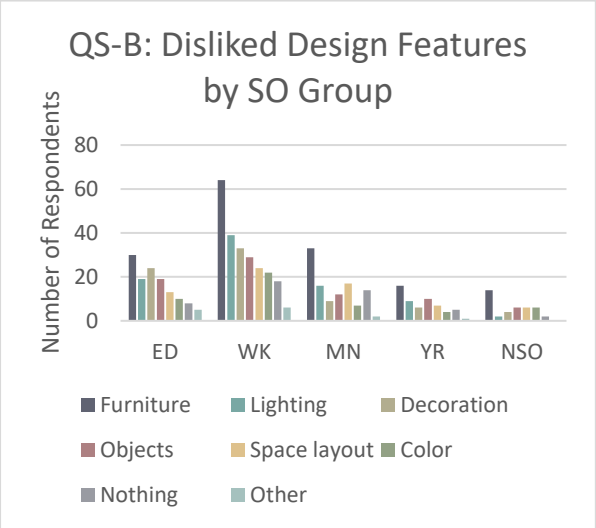


Figure 81: QS-B Disliked Design Features by SO Group I

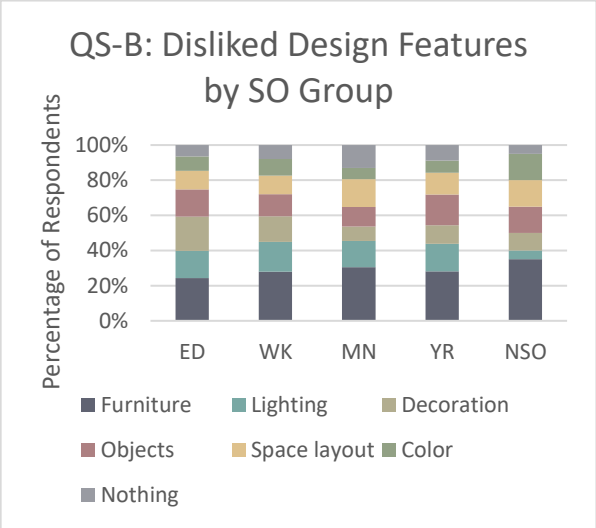
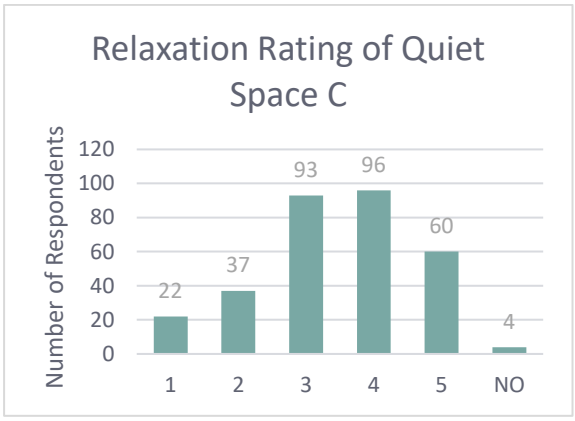


Figure 82: QS-B Disliked Design Features by SO Group II

4.4.3. **Quiet Space C**

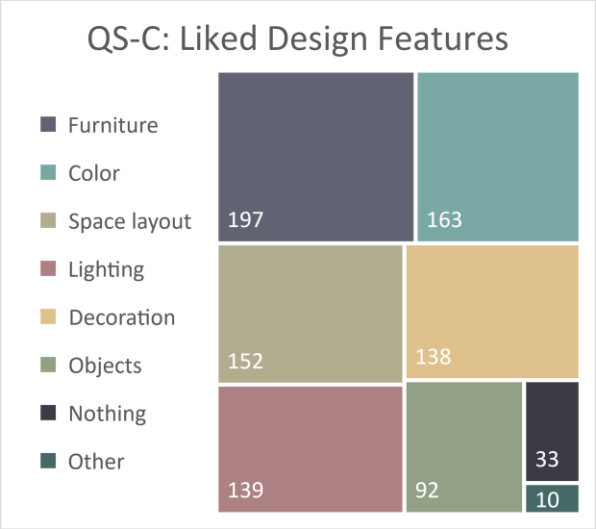
The mean relaxation rating of Quiet Space C (QS-C) is 3.44, which is 0.01 points lower than QS-B and 0.35 higher than QS-A, with a median and mode of 4 (fig.83). OTH rated the room the most relaxing (3.71), followed by DYPX (3.5), with the lowest rating from TS (3.24). There is a moderate negative correlation (ρ=-0.6 to -0.7) between the percentage of respondents who rated QS-C as 1 or 2 and their SO frequency.



1 = Not at all relaxing; 5 = Very relaxing; NO = No Opinion

Figure 83: Relaxation Rating of Quiet Space C

The top three liked design features of QS-C are furniture (21.3%), color (17.6%) and space layout (16.5%) (fig.84). Several comments highlighted liking the separated nook seating. There is a moderate negative correlation (ρ=-0.7) between the percentage of respondents who liked 'nothing' and their SO frequency (fig.85).



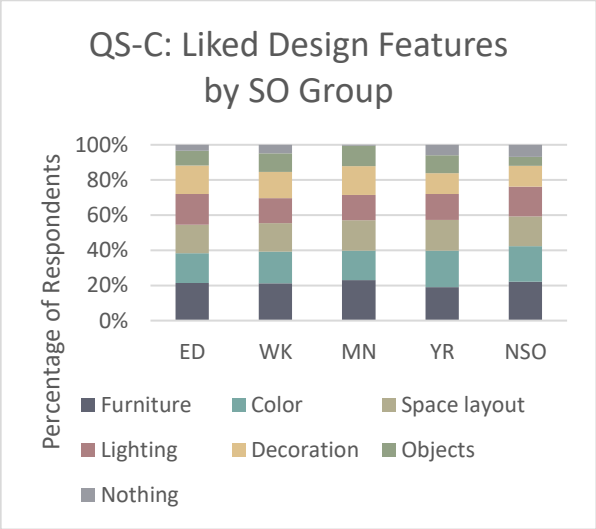


Figure 84: QS-C Liked Design Features

Figure 85: QS-C Liked Design Features by SO Group

The top three disliked design features of QS-C are space layout (22.3%), lighting (17.2%) and furniture (12.9%), with space layout as the top choice across all ND and SO groups (fig.86-89). 20 emerging answers from comments included the window and the view outside the window as disliked features.

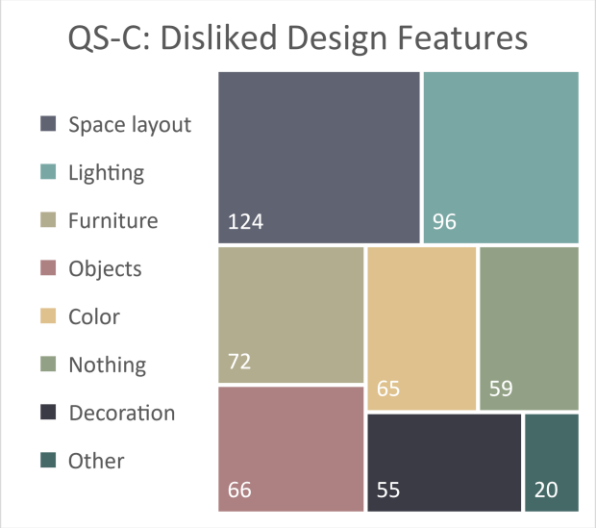


Figure 86: QS-C Disliked Design Features

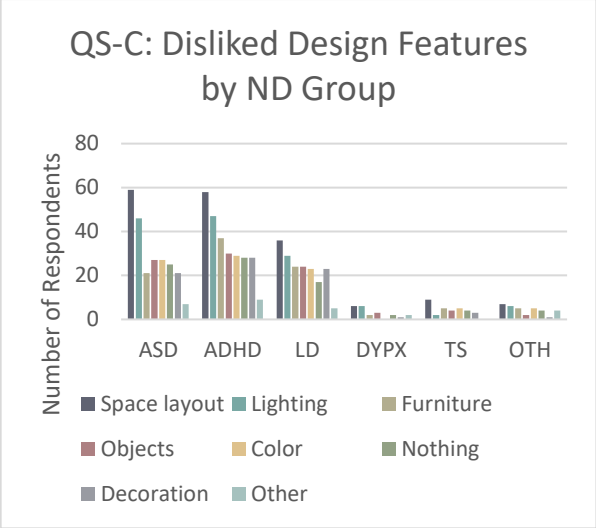


Figure 87: QS-C Disliked Design Features by ND Group

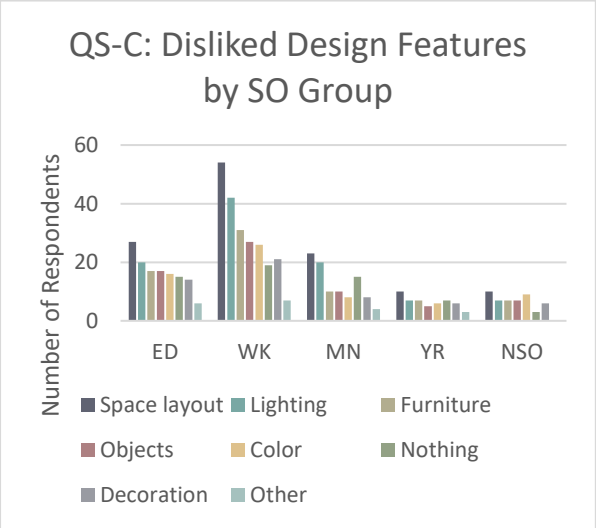


Figure 88: QS-C Disliked Design Features by SO Group I

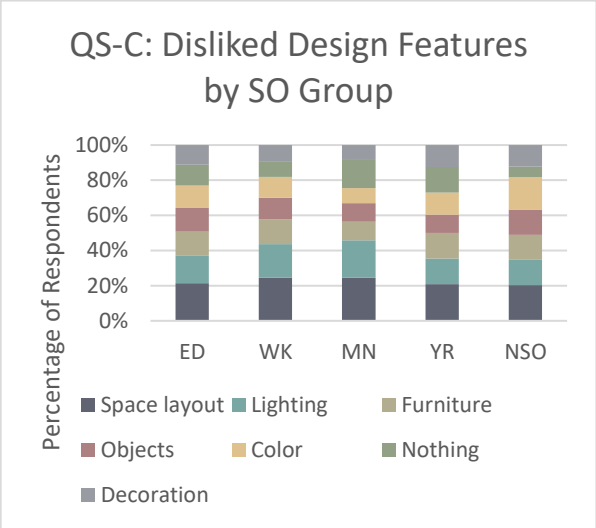


Figure 89: QS-C Disliked Design Features by SO Group II

4.4.4. **Quiet Spaces A-C**

QS-C met the sensory needs of the largest number of people (29.3%), closely followed by QS-B (27.7%) (fig.90). 21.74% of the respondents' needs were not met in any of the three quiet spaces. ASD, ADHD and OTH rated QS-C the highest, while LD, DYPX and TS rated QS-B the highest (fig.91-92). There is a strong negative correlation (ρ=-0.8) between the percentage of respondents who chose QS-A and their SO frequency (fig.93).

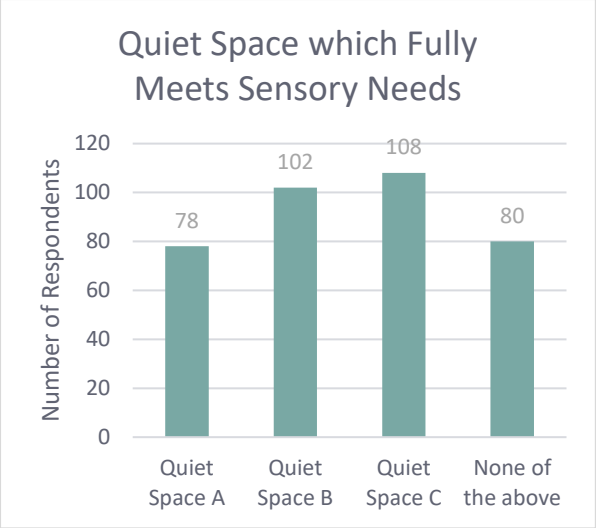


Figure 90: Quiet Space which Fully Meets Sensory Needs

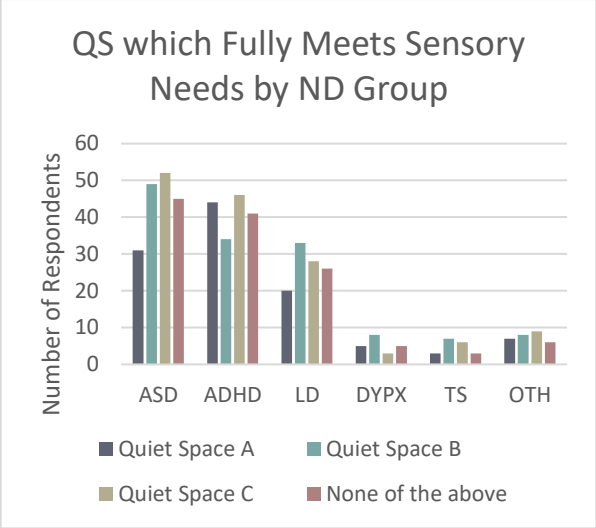


Figure 91: QS which Fully Meets Sensory Needs by ND Group I

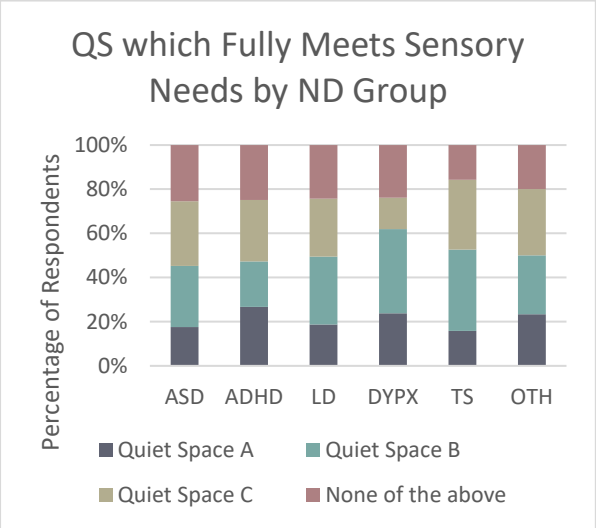


Figure 92: QS which Fully Meets Sensory Needs by ND Group II

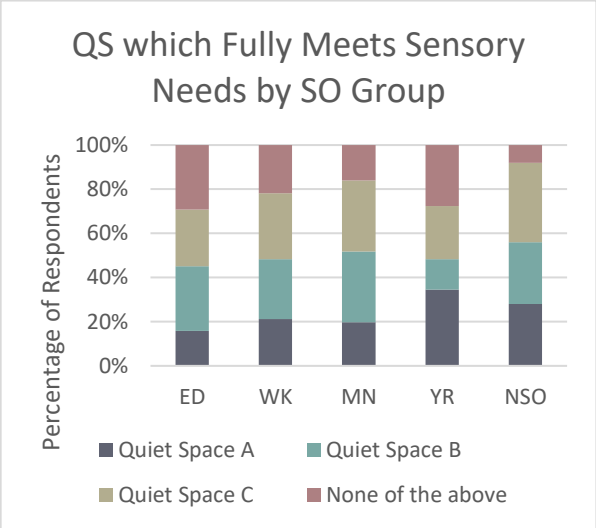


Figure 93: QS which Fully Meets Sensory Needs by SO Group

4.5. Additional Perspectives from Interviews

Interviewees had contrasting perspectives regarding whether quiet spaces should be designed for the general public or exclusively for ND populations. One argument is that the only reason quiet spaces are necessary is due to the shortcoming of design which typically exclude the needs of ND populations, and as such quiet spaces should be offered as an accommodation for those who really need it (Dark, Stern-Ellran). Others suggested refraining from labelling the users of the space and keeping it open for all (Maslin, Mond, Morris).

Several design aspects which were not addressed in the survey were brought up in the interviews. Olfactory was mentioned as the trickiest of senses which requires careful attention (Mond). Room and material temperatures were mentioned with regards to helping regulate the body temperature when in

the heightened arousal state of SO, during which the body temperature rises (Dark). Considering this, it would be advisable to have aspects which are cool (e.g. cool floor), with the ability to access warmth (e.g. blankets) (Dark).

A couple of additional considerations are accessibility, location, signage, and how one may access help in time of need (Dark, Morris). It may also be helpful to consider transitional spaces and signage for 'quieter' spaces (Morris). A preview of the space through a door with a glazed panel may be helpful (Maslin, Morris), however it should not compromise the privacy of the space users.

5. Discussion

5.1. General Perspectives

With almost all the survey respondents indicating that having access to quiet spaces would either definitely or potentially be beneficial to them, it is important to consider implementing quiet spaces in more areas of the built environment. According to the respondents' importance rating this is most desirable in education spaces, followed by workplaces, healthcare and transportation.

Correlation tests show that the perspective by which quiet spaces would be beneficial increased with increased SO frequency (fig.94; Appendix A). As SO frequency increased high importance ratings for implementing quiet spaces increased in most locations while low importance ratings decreased. These findings show an overall increased desire for quiet spaces when SO frequency is increased. In light of these findings it is important to consider additional populations which may be susceptible to sensory overload when researching or implementing quiet spaces.

Sound and lighting are found to be the most important design features across all ND and SO groups, followed by space layout, color, furniture and decoration. Sound and lighting are also the design features which elicited the largest response, both positive and negative, in quiet spaces which people had experienced. This is in line with studies which found sound and/or lighting to be the most critical design elements to investigate in design for ND populations (Kinnealey et al., 2012; Long, 2010; Mostafa, 2008; Shabha and Gaines, 2013; Stickney, 2018).

As SO frequency increased, ratings of sound or lighting as 'very important' increased and ratings of lighting or furniture as 'neutral' decreased. This suggests that people with higher SO frequency may be relatively more sensitive to the sound or lighting design of a space, an observation which is supported by literature (Robertson and David, 2015; Shabha and Gaines, 2013), whereas people with lower SO frequency may be relatively less sensitive to the lighting or furniture design of a space.

Chi-square goodness-of-fit tests show that almost all survey questions were answered nonuniformly, suggesting established opinions of the respondents regarding their design preferences for quiet spaces. This may point to a strong awareness of the respondents regarding which design aspects may influence them positively and which may influence them negatively, thereby strengthening the value of their responses. This idea is supported by literature and perspectives from interviews which stressed the intolerability that some ND individuals may exhibit towards certain design features (Bogdashina, 2003; Kranowitz, 2005). There were, however, several matters which all ND and SO groups agreed upon, which can be found in Table 2.

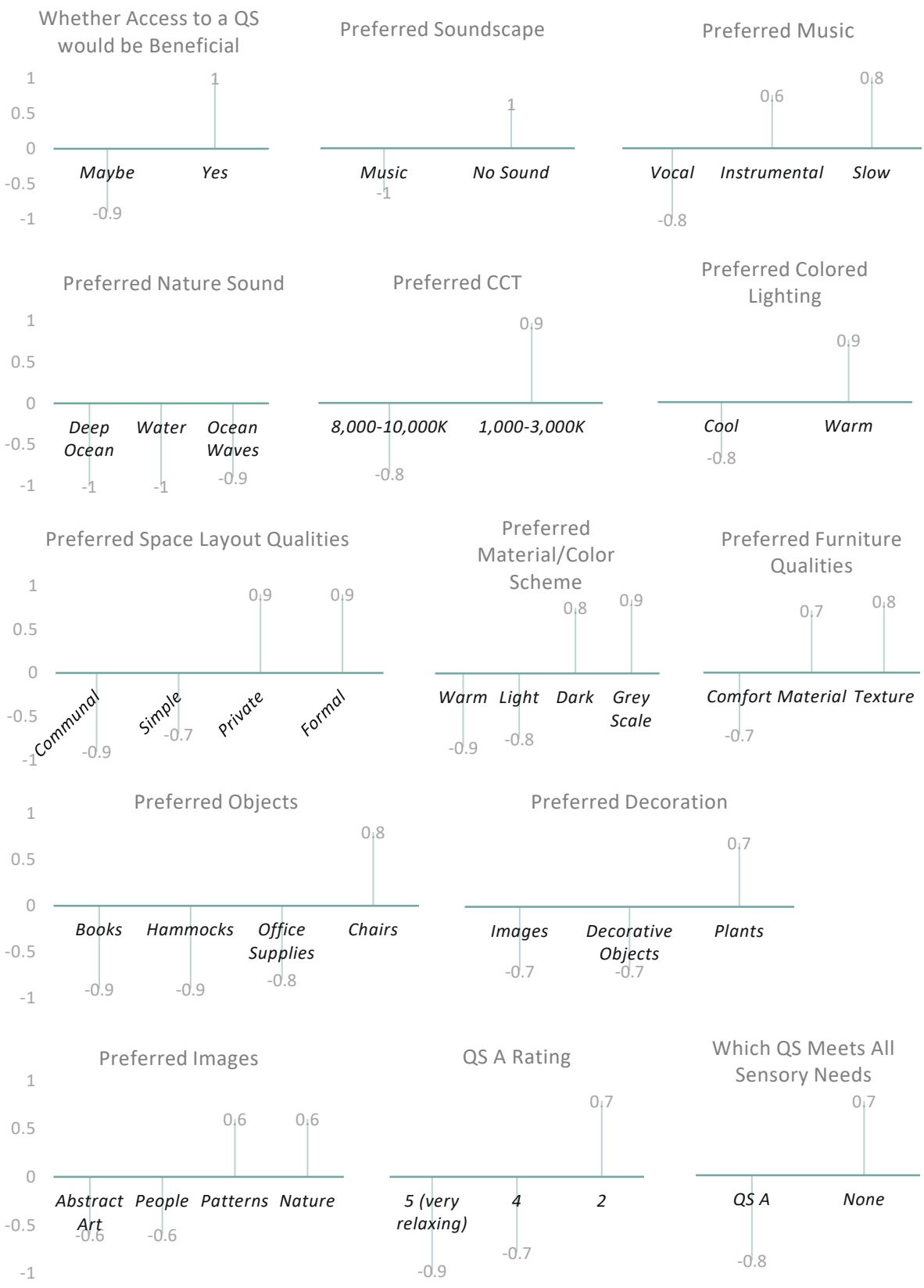


Figure 94: Correlation coefficients between the SO frequency of respondents and the percentage of them who selected a certain response

All neurodivergent and sensory overload frequency groups agreed:
Education is the most important location for implementing quiet spaces
Sound and lighting are the most important design features to consider
Comfort is the most important furniture quality
Fabric and wood are the preferred furniture materials
Plants are the preferred decorative elements
Nature is the preferred image type

Table 2: Consensus Across All ND and SO Groups

5.2. Design Features

5.2.1. **Sound**

While ‘no sound’ was the top preferred soundscape of quiet spaces, ‘nature sound’ and music were also chosen considerably. As SO frequency increased the choice of ‘no sound’ increased and the choice of music decreased. This is aligned with having higher instances of auditory hypersensitivity amongst people with higher SO frequency (Kranowitz, 2005). People with lower SO frequency seem relatively more appreciative of having music.

All top choices for nature sounds include water, however these choices reduced with increased SO frequency. It is advisable to avoid simulated, monotone or repetitive nature sound which may be perceived as unbearable (interviewee: Farhi). People whose preferred soundscape was music selected soft, instrumental and/or slow as their top music qualities. As SO frequency increased slow music choice increased and vocal music choice decreased. Having good acoustics was regarded as crucial, especially considering that some ND people may be more sensitive to hearing echoes; it is therefore important to integrate soft materials for sound absorption (Morris, Shtern-Elran).

All of these choices can be made available by designing the quiet space without sound and introducing sound stations for individual choice, while avoiding sound infiltration into the general soundscape of the quiet space. This design approach also responds to survey and interview comments which stressed the importance of integrating sound controls in order to cater to each individual need without compromising the needs of others.

5.2.2. **Lighting**

Preferred lighting levels tended towards dim rather than bright levels, and warm rather than cool lights (in terms of CCT), findings which are aligned with existing literature (Robertson and David, 2015; Shabha and Gaines, 2013; Stickney, 2018; Long, 2010). As SO frequency increased the relative preference for warm light increased while the relative preference for cool light decreased. Respondents who wanted colored lights (less than half) preferred cool over warm lights; as SO frequency increased the choice of cool colored lights increased and the choice of warm colored lights decreased.

These two findings may appear in contradiction – when it comes to CCT people with higher SO frequency prefer warm lights, and when it comes to colored lights they prefer cool colored lights. These preferences may relate to two different types of reactions: lighting with warm CCT triggers the release of the hormone melatonin which brings about relaxation, whereas cool colored lighting may create a psychological cooling effect which may be favorable during sensory overload. This finding and hypothesis merit further investigation.

Window preferences varied with the top choice being that it would depend on potential views. Preference for windows looking outside decreased with increased SO frequency, and ED had the largest share of answers which included windows looking into the building and 'no windows'. This shows that looking outside is relatively more desirable by people with lower SO frequency, whereas looking into the building or no windows at all, is relatively more desirable by people with higher SO frequency. This may be related to the wish to preview a place which has been mentioned as a desirable design feature in design for ASD (Regnier and Denton, 2009).

Interviewees highlighted the significance of incorporating daylight and installing adjustable shades for lighting control. They discussed their preference for indirect subdued lighting which facilitates a uniform and gentle lighting distribution with reduced glare and advised to provide a variety of light choices with dimmers and color tuning controls.

5.2.3. **Space Layout**

Space layout preferences were for simple, private, informal and cozy quiet spaces. As SO frequency increased the relative choice of private increased and the relative choice of communal decreased. Considering the diversity of opinion, it may be useful to zone the quiet space into a calm passive area and a stimulating active area. Interviews with Maslin and Stern-Ellran supported this perspective and noted that it is especially important to consider visual separation where movement may be expected, and that incorporating personal capsules may benefit those who are especially sensitive and may require a more private respite space.

5.2.4. **Color**

Colored walls are the most preferred walls and natural materials is the preferred choice of material or color scheme. As SO frequency increased the choice of dark or grey scale colors increased and the choice of light or warm colors decreased. Preference for dark colors by people with higher SO frequency may be tied to a desire for lower brightness levels (considering that dark colors absorb light), an observation which is supported by literature (Robertson and David, 2015; Stickney, 2018). Preference for light or warm colors by people with lower SO frequency may be tied to a desire for higher brightness levels and more stimulating colors, an observation which is also supported by literature (Kinnaer et al., 2016).

In the interview with Stern-Ellran it was pointed out that our brains are accustomed to colors which are found in nature, especially ones which cover large areas for long lengths of time such as blues, greens and browns (this observation could not be independently verified and merits further investigation). More vibrant colors which may appear in nature in small quantities for shorter intervals of time tend to attract our attention and may be distracting for quiet spaces. Stark contrasts attract attention and unnatural patterns may be overwhelming, therefore it was advised to consider gradual color changes and natural patterns (if any) which our brains are more familiar with.

5.2.5. **Furniture**

Comfort was chosen as the most important furniture quality within all ND and SO groups. The choice of texture or material as most important increased with increased SO frequency, which is aligned with having tactile hypersensitivity (Kranowitz, 2005). Fabric and wood were the leading preferred furniture materials across all ND and SO groups, possibly pointing to a preference for natural materials.

Fifteen comments indicated a desire to have couches, sofas and armchairs which demonstrate the importance of having a variety of informal and soft furnishings. Research findings show that the choice of having office supplies, books and hammocks, items which involve more active engagement and movement, increased with decreased SO frequency.

In interviews with Dark and Stern-Ellran it was indicated that furniture should facilitate self-regulation. Informal furniture such as bean bags and large pillows was said to provide proprioceptive input for self-regulation and furniture which provides movement, such as bouncing, rocking or swinging, was said to provide vestibular input for self-regulation. Stern-Ellran noted that providing furniture that is easily moveable can provide an empowering sense of control, and Morris noted that it should be ensured that there is accessible furniture with fixed arm rests to facilitate getting in and out of a seat comfortably.

5.2.6. **Decoration**

Preference for plants as decoration represents the top choice within all ND and SO groups. As SO frequency increased preference for plants increased and preference for images or decorative objects decreased. Stern-Ellran noted that it is advised to avoid plants with extreme elements such as spikes, sharp corners or patterns with strong contrasts.

The top choice amongst people who preferred to have images was images of nature, strengthening the notion that nature has a significant role in facilitating calm in quiet spaces. Morris noted that unnatural decorative patterns may be too easy to get wrong and thus it may be advisable to avoid them altogether.

5.3. Assessment of Sample Quiet Spaces

Most of the interviewees regarded QS-A as pleasant but too busy with patterns and decoration, and potentially overstimulating. The natural colors were regarded as positive and the furniture was regarded

as pleasant but with the appearance of being too formal and uncomfortable. The plants were regarded as overall positive but too spiky and overly patterned. Two interviewees indicated the need for lighting controls by means of shades, and one indicated that the space lacks accessibility. The rating of 'very relaxing' (5) for QS-A and the choice of 'nothing' being disliked in the survey both increased with decreased SO frequency, indicating that the design of QS-A may be more favorable for people with lower SO frequency.

QS-B was mostly viewed by interviewees as calming, with an appreciation for the natural earthy colors, the wooden floor and the subdued lighting. One of the interviewees, however, found the design elements to clash, especially in terms of patterns and geometries. The tree and figurine were viewed as unnecessary, and the sand was considered particularly negative in terms of safety and tactile input. Two interviewees brought up the ideas of using the niche to introduce more items for potential use and adding more diverse and accessible furniture. The rating of 'not at all relaxing' (1) for QS-B and the choice of 'nothing being liked both increased with decreased SO frequency, indicating that the design of QS-B may be less favorable for people with lower SO frequency.

Two interviewees mentioned an appreciation for the niche seating in QS-C. The cacti were viewed as negative in terms of safety and texture, and three interviewees pointed out the need to control the lighting and views from the windows. The stairs were noted as inaccessible and unsafe.

The null hypothesis in the chi-square goodness-of-fit test was marginally accepted in the question pertaining to which quiet space fully met the respondent's sensory needs. Responses were fairly uniformly spread amongst all three quiet spaces and the option of 'none'. No single quiet space stands out from the others as more fitting for all respondents. Additionally, responses in the survey showed nonuniformity in the perspective of whether certain design aspects were positive or negative aspects of the quiet spaces. This is true with regards to objects in QS-A, lighting in QS-B and furniture and space layout in QS-C. These findings show that people required different design attributes in order for the quiet space to fully meet their sensory needs, and that none of the quiet space designs were suitable for all.

5.4. Experience in Quiet Spaces

Sound and lighting emerged as the most significant design considerations from respondents' reflections on past experiences in quiet spaces. Criticism about lighting included being too bright, having too much glare, and having too many light sources. Quiet spaces with space layouts that were too small, exposed and/or cluttered were considered bothersome. Images were a common form of decoration, however they were found to be mostly bothersome, with abstract art and patterns causing the most bother. Criticism about decoration included too much decoration and distracting or unpleasant decoration. These perspectives are evidence that the design of quiet spaces is currently not aligned with the needs of ND populations.

5.5. Difference in Preferences between ND Groups

Upon examination of the differences in design preferences between ND groups, it appears that the design preferences of a ND group are mostly aligned with the design preferences of their associated SO frequency level (fig.10). This means that ASD and OTH exhibited design preferences that are aligned with relatively higher SO frequency, and LD and TS exhibited design preference that are aligned with relatively lower SO frequency. This implies that design preferences may be guided more by SO frequency rather than specific ND conditions.

The literature presented in this study has mainly focused on studies regarding design for ASD. Considering that the ASD participants in this study are mostly associated with a higher SO frequency, it is no surprise that the design preferences that were shown to be associated with higher SO frequency resemble the results and recommendations in the literature review.

5.6. Overarching Themes

A reoccurring theme that emerged from answers across design features is the desire to incorporate natural elements into the quiet space. This is shown in the preference for natural materials including fabric and wood furniture, and for plants and images of nature for decoration. This is also supported by perspectives from interviews which highlighted the importance of daylight and colors found in nature. Elements of nature may be found to be soothing (Kaplan and Kaplan, 1989) and thus desirable for quiet spaces.

Variety, flexibility and control emerged as important themes throughout the survey and within all interviews. There are two central virtues in providing variety, flexibility and control: they facilitate creating an adaptable and inclusive environment for diverse needs, and they empower people by letting them have autonomy over their environment. Variety and flexibility are especially important where there may be a huge variety in people's sensory profiles, and control is especially important with ND populations which may be susceptible to sensory overload. Their distress or sensory overload may have already been triggered by lack of control over their environment and thus regaining some control may help them bring themselves back to equilibrium. These ideas are supported by interviews from Dark and Stern-Ellran. A summary table with suggestions on how to implement variety, flexibility and control for each design feature can be found in Table 3.

Design Feature	Variety, Flexibility & Control
Sound	Provide optional sounds on an individual basis Provide earplugs or noise canceling devices Provide individual capsules where people can select their desired soundscape
Lighting	Provide shades to control daylight and outside views Provide a variety of lights which facilitate individual control without the disturbance of others Provide artificial lighting controls including dimmers and color tuning (if available)
Space Layout	Provide individual capsules for increased optional privacy
Color	Create visual separation if introducing colors or textures that may be too bright, too distracting or too rough for the most sensitive
Furniture	Provide a variety of furniture options including furniture with movement for self-regulation Provide furniture which is easy to move Provide access to items such as books and office supplies
Decoration	If providing decoration other than plants, make sure it is not visible from some areas of the quiet space

Table 3: How to Implement Variety, Flexibility and Control by Design Feature

6. Conclusion

In light of the findings, it is advisable to design quiet spaces as neutral-passive environments for the most sensitive users while introducing optional stimulating-active design features for the least sensitive. It is important however, not to optimize the experience of one at the expense of another. For this purpose, and if spatially possible, it may be best to create zones which are designed for different levels of sensitivities to address the diverse sensitivities of the quiet space's users. A summary table with design suggestions based on the research findings can be found in Table 4.

While in some cases there is a clear design preference across all neurodivergent and sensory overload frequency groups, in other cases there are different and sometimes opposing preferences between people with lower frequency of sensory overload and people with higher frequency of sensory overload. Nonuniformity in responses points to strong preferences and awareness of the respondents regarding their design needs. Significant differences in responses between sensory overload frequency groups and strong correlations between the preferences of respondents and their sensory overload frequency, suggest that susceptibility to sensory overload is an underlying mechanism which guides the respondents' design preferences for quiet spaces.

Although the study assumes that neurodivergent populations would be able to recognize which design features would best suit their needs, some people may not be highly aware of how the physical environment is affecting them. Images in the survey are limited in the way they convey the design information of a quiet space, and certain design features, such as olfactory and thermal preferences, were mainly eliminated due to the study method.

In consideration of the above-mentioned limitations, future research may advance knowledge by including additional design features and confirming the study results in a physical experiment with physiological data, such as blood pressure, heart rate and cortisol levels. Furthermore, it is advisable to investigate the design preferences of additional populations which may be susceptible to sensory overload.

Design Feature	Baseline (Neutral-Passive)		Optional Additions by Choice* (Active)	
	Attributes	**Comments**	**Attributes**	**Comments**
Sound	No sound	But not anechoic	Nature sound	Avoid simulated, monotonic or repetitive sound Sounds with water were preferred but should only be optional
	Good acoustics	Low reverberation No audible echoes; use soft absorptive materials	Music	Provide a variety of options If used in the main space: soft, instrumental & slow
Lighting	Artificial lights	Avoid fluorescent lights Provide low level indirect lights Provide warm CCT	Artificial lights	Provide options for brighter lights and cooler CCT
	Daylight & windows	Provide access to daylight and outside views	Colored lights	Cooler colors were preferred
Space Layout	Simple, private, informal & cozy	Use these attributes as guides for the space layout design	Spacious & communal	If possible, create options for more spacious and/or communal areas
Color	Natural	Use natural materials and colors which are abundant in nature such as browns, greens & blues	Light colors (including white)	Which may be too bright for the neutral space
	Few colors / muted colors	Can be for colored walls Avoid glare from walls and make sure that the room is not too bright Maintain low contrast & smooth color transitions	Textures	Which may be too rough for the neutral space
	Dark colors - optional	For a section of the quiet space May assist in providing visual relief	Warm colors	Which may be too distracting for the neutral space
Furniture	Comfort & texture	Most important furniture qualities to consider	Variety	Provide a variety of furniture
	Chairs, pillows, bean bags, tables & blankets	Confirm comfortable & accessible seating options	Books & office supplies	Provide access to these optional items
	Fabric or wood	Preferred furniture materials	Movement in furniture	Provide furniture with movement (e.g. bouncing, rocking or swinging) Confirm that it is not visually disturbing to others
Decoration	Plants	Avoid extreme elements such as spikes, sharp corners & patterns with strong contrast	Images	Provide images of nature Consider images of abstract art
	*Optional additions by choice should either be available in a space that is visually and if possible, acoustically separate from the main space or upon individual request or choice. It should be ensured that their use does not disturb other users of the space.			

Table 4: Summary Table of Design Features

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8. Appendices

8.1. Appendix A

Legend	Positive Correlation Ranges	Negative Correlation Ranges
Perfect Correlation	1	-1
Very Strong Correlation	0.91 to 0.99	-0.91 to -0.99
Strong Correlation	0.71 to 0.9	-0.71 to -0.9
Moderate Correlation	0.51 to 0.7	-0.51 to -0.7

Correlations between the Percentage of Respondents who Chose a Certain Answer and the Respondents' SO Frequency			
Positive Correlations		**Negative Correlations**	
Answer	**ρ**	**Answer**	**ρ**
General Perspectives			
Access to QS would be beneficial: yes	1.0	Access to QS would be beneficial: maybe	-0.9
Importance rating of design feature: sound & very important	0.9	Importance rating of design feature: sound & important	-0.9
Importance rating of design feature: lighting & very important	1.0	Importance rating of design feature: lighting & important	-0.7
Importance rating of design feature: lighting & very important-important	0.9	Importance rating of design feature: lighting & neutral	-0.9
Importance rating of design feature: furniture & very important-important	0.8	Importance rating of design feature: color & important	-0.7
Importance rating of design feature: furniture & important	0.6	Importance rating of design feature: furniture & neutral	-0.8
Importance rating of design feature: furniture & low importance	0.7	QS location importance rating: education & neutral	-0.8
QS location importance rating: education & important	0.7	QS location importance rating: education & not at all important	-0.8
QS location importance rating: education & very important-important	0.9	QS location importance rating: education & neutral - not at all important	-0.9
QS location importance rating: education & low importance	0.9	QS location importance rating: workplace & neutral	-0.9
QS location importance rating: workplace & very important-important	0.7	QS location importance rating: workplace & neutral-not at all important	-0.7
QS location importance rating: workplace & low importance	0.6	QS location importance rating: healthcare & important	-0.7
QS location importance rating: healthcare & very important	0.6	QS location importance rating: healthcare & neutral-not at all important	-0.6
QS location importance rating: healthcare & very important-important	0.6	QS location importance rating: transportation & neutral	-0.8
QS location importance rating: transportation & very important	0.9	QS location importance rating: transportation & low importance	-0.9
QS location importance rating: transportation & very important-important	1.0	QS location importance rating: transportation & not at all important	-0.6

QS location importance rating: retail & very important	0.7	QS location importance rating: transportation & neutral-not at all important	-1.0
QS location importance rating: retail & important	0.6	QS location importance rating: retail & neutral	-0.9
QS location importance rating: retail & very important-important	0.9	QS location importance rating: retail & low importance	-1.0
QS location importance rating: government & very important	0.7	QS location importance rating: retail & neutral-not at all important	-0.9
QS location importance rating: government & very important-important	0.6	QS location importance rating: government & neutral-not at all important	-0.6
QS location importance rating: entertainment & very important	0.9	QS location importance rating: entertainment & low importance	-0.7
QS location importance rating: entertainment & important	0.9	QS location importance rating: entertainment & neutral - not at all important	-1.0
QS location importance rating: entertainment & very important-important	1.0	QS location importance rating: recreation & neutral	-0.6
QS location importance rating: recreation & very important	0.6	QS location importance rating: recreation & low importance	-0.8
QS location importance rating: recreation & important	0.9	QS location importance rating: recreation & not at all important	-0.6
QS location importance rating: recreation & very important-important	1.0	QS location importance rating: recreation & neutral-not at all important	-1.0
Sound			
Preferred soundscape: no sound	1.0	Preferred soundscape: music	-1.0
Preferred soundscape: other	0.9	Preferred soundscape: NP	-0.7
Preferred music quality: instrumental	0.6	Preferred nature sound: water	-1.0
Preferred music quality: slow	0.8	Preferred nature sound: ocean waves	-0.9
Preferred music quality: NP	0.9	Preferred nature sound: deep ocean	-1.0
Preferred music quality: soft, instrumental & slow	0.7	Preferred nature sound: NP	-0.8
		Preferred nature sound: water, ocean waves & deep ocean	-0.9
		Preferred music quality: vocal	-0.8
Lighting			
Preferred CCT: 1-3	0.9	Preferred lighting levels: 3	-0.6
Preferred colored lights: cool	0.9	Preferred CCT: 8-10	-0.8
Preferred colored lights: pink	0.9	Preferred colored lights: warm	-0.8
Window preference: maybe[1]	0.7	Window preference: yes[2]	-0.8
Window preference: other	0.9		
Window preference: yes[4]	0.9		
Space Layout			
Preferred space layout qualities: private	0.9	Preferred space layout qualities: simple	-0.7
Preferred space layout qualities: formal	0.9	Preferred space layout qualities: communal	-0.9

Color			
Preferred material/color scheme: dark	0.8	Preferred walls: NP	-0.6
Preferred material/color scheme: grey scale	0.9	Preferred material/color scheme: light	-0.8
		Preferred material/color scheme: warm	-0.9
		Preferred material/color scheme: varied colors	-0.6
		Preferred material/color scheme: vivid	-0.6
Furniture			
Most important furniture qualities: texture	0.8	Most important furniture quality: comfort	-0.7
Most important furniture qualities: material	0.7	Most important furniture quality: variety	-0.6
Preferred furniture material: leather	0.7	Preferred items in the QS: tables	-0.6
Preferred items in the QS: chairs	0.8	Preferred items in the QS: office supplies	-0.8
Preferred items in the QS: blankets	0.6	Preferred items in the QS: books	-0.9
Preferred items in the QS: play objects	0.7	Preferred items in the QS: hammocks	-0.9
Preferred items in the QS: other	1.0	Preferred items in the QS: NP	-0.8
Decoration			
Preferred elements in the QS: plants	0.7	Preferred elements in the QS: images	-0.7
Preferred elements in the QS: other	0.7	Preferred elements in the QS: decorative objects	-0.7
Preferred images: nature	0.6	Preferred images: abstract art	-0.6
Preferred images: patterns	0.6	Preferred images: people	-0.6
Assessment of Quiet Spaces			
Quiet Space A rating: 2	0.7	Quiet Space A rating: 4	-0.7
Quiet Space A rating: no opinion	1.0	Quiet Space A rating: 5 (very relaxing)	-0.9
QS A liked design feature: objects	0.6	QS A liked design feature: furniture	-0.9
QS A liked design feature: nothing	0.6	QS A disliked design feature: nothing	-0.8
QS A liked design feature: other	0.6	Quiet Space B rating: 1 (not at all relaxing)	-0.8
QS A disliked design feature: decoration	0.6	QS B liked design features: lighting	-0.7
QS A disliked design feature: lighting	0.6	QS B liked design feature: nothing	-0.9
Quiet Space B rating: 2	0.9	QS B disliked design feature: furniture	-0.9
QS B liked design feature: space layout	0.7	QS B disliked design feature: space layout	-0.7
QS B liked design feature: furniture	0.9	Quiet Space C rating: 1 (not at all relaxing)	-0.6
QS B liked design feature: other	0.7	Quiet Space C rating: 2	-0.7
QS B disliked design feature: decoration	0.7	QS C liked design feature: color	-0.7
QS B disliked design feature: other	1.0	QS C liked design feature: space layout	-0.6
Quiet Space C rating: 3	0.6	QS C liked design features: nothing	-0.7
QS C liked design feature: decoration	0.6	QS C disliked design feature: furniture	-0.7
QS C disliked design features: space layout	0.6	QS C disliked design feature: decoration	-0.6
QS fully meets sensory needs: none	0.7	QS fully meets sensory needs: QS A	-0.8

8.2. Appendix B

Chi-Square Test of Homogeneity			
Question	**Group 1**	**Group 2**	**p-value**
ND Groups			
Access to QS would be beneficial	ADHD	LD	0.011
QS location importance rating: healthcare	ASD	LD	0.031
QS location importance rating: retail	ASD	ADHD	0.020
QS location importance rating: government	ASD	ADHD	0.045
QS location importance rating: government	ASD	LD	0.022
Preferred soundscape	ASD	LD	0.028
Preferred lighting levels	ASD	ADHD	0.029
Preferred space layout qualities: private vs. communal	ASD	ADHD	0.017
Preferred space layout qualities: private vs. communal	ASD	LD	0.036
Preferred material/color scheme: few vs. varied colors	DYPX	TS	0.046
SO Groups			
Benefit of having access to QS	WK	NSO	0.015
Importance rating of design feature: sound	ED	NSO	0.001
Importance rating of design feature: sound	MN	NSO	0.028
Importance rating of design feature: space layout	ED	WK	0.005
Importance rating of design feature: space layout	ED	NSO	0.049
Importance rating of design feature: space layout	WK	YR	0.022
Importance rating of design feature: color	ED	WK	0.038
Importance rating of design feature: color	ED	MN	0.009
Importance rating of design feature: decoration	ED	MN	0.019
QS location importance rating: transportation	ED	NSO	0.029
QS location importance rating: retail	ED	NSO	0.008
QS location importance rating: retail	WK	NSO	0.043
QS location importance rating: recreation	ED	NSO	0.024
QS location importance rating: recreation	WK	NSO	0.036
Preferred soundscape	ED	YR	0.023
Preferred soundscape	ED	NSO	0.031
Preferred lighting levels	ED	YR	0.007
Preferred lighting levels	ED	NSO	0.037
Preferred lighting levels	WK	YR	0.007
Preferred lighting levels	WK	NSO	0.005
Preferred lighting levels	MN	YR	0.001
Preferred CCT	ED	YR	0.035
Preferred CCT	MN	YR	0.049
Window preference	ED	YR	0.045
Preferred space layout qualities: private vs. communal	ED	NSO	0.025
Preferred space layout qualities: cozy vs. spacious	ED	YR	0.012
Preferred space layout qualities: cozy vs. spacious	WK	YR	0.003
Preferred space layout qualities: cozy vs. spacious	MN	YR	0.005
Preferred walls	ED	MN	0.038
QS A disliked design features	ED	YR	0.015
QS A disliked design features	MN	YR	0.025
Quiet Space C rating	MN	YR	0.014
QS C liked design features	MN	YR	0.026
QS C liked design features	MN	NSO	0.043

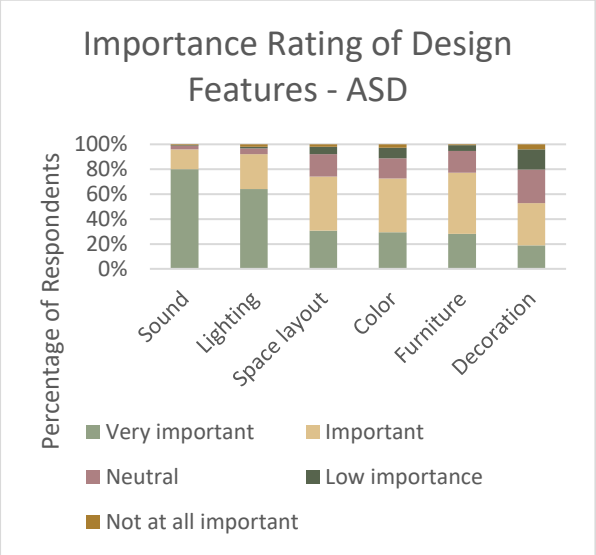
8.3. Appendix C

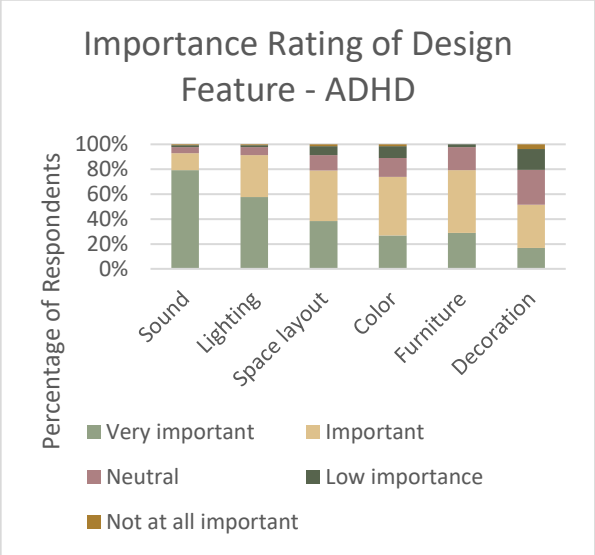
Descriptive Statistics of Rating Questions											
	Element	Count	Min	Max	Mode	Mean	Standard Deviation	Skewness	Kurtosis	Percentile 25% (Q1)	Percentile 75% (Q2)
Experience in a Quiet Space	Sound	44	1	4	2	2.41	0.82	0.71	-0.08	2	3
	Lighting Levels	48	1	5	2	2.88	1.25	0.18	-1.14	2	4
	CCT	50	1	10	2	4.86	2.86	0.46	-1.02	2	7
	Comfort	21	1	5	3	3.19	1.12	0.06	-0.65	2	4
	Hardness - Softness	21	1	5	3	2.86	1.06	0.03	-0.50	2	4
Ideal Quiet Space	Lighting Levels	304	1	5	3	2.47	0.90	0.12	0.14	2	3
	CCT	303	1	10	3	4.25	2.32	0.94	0.14	3	5
	Space layout importance	311	1	5	4	4.05	0.95	-1.08	1.07	4	5
	Color importance	309	1	5	4	3.89	1.00	-0.82	0.17	3	5
	Decoration importance	308	1	5	4	3.50	1.10	-0.44	-0.55	3	4
	Sound importance	312	1	5	5	4.65	0.72	-2.60	7.68	5	5
	Lighting importance	312	1	5	5	4.46	0.82	-1.89	4.19	4	5
	Furniture importance	309	1	5	4	3.94	0.86	-0.76	0.76	3	5
Perception of Quiet Spaces	QS A Relaxation	307	1	5	4	3.09	1.20	-0.06	-0.97	2	4
	QS B Relaxation	310	1	5	4	3.45	1.24	-0.53	-0.66	3	4
	QS C Relaxation	308	1	5	4	3.44	1.14	-0.42	-0.50	3	4
Importance Rating	Workplaces	308	1	5	5	4.52	0.78	-2.09	5.32	4	5
	Education	311	1	5	5	4.66	0.72	-2.89	10.08	5	5
	Healthcare	311	1	5	5	4.27	0.95	-1.51	2.11	4	5
	Transportation	310	1	5	5	4.08	0.99	-1.08	0.84	4	5
	Government	310	1	5	4	3.45	1.17	-0.39	-0.64	3	4
	Retail	310	1	5	5	3.68	1.19	-0.54	-0.71	3	5
	Recreation	307	1	5	3	3.16	1.32	-0.12	-1.08	2	4
	Entertainment	310	1	5	3	3.20	1.31	-0.14	-1.06	2	4

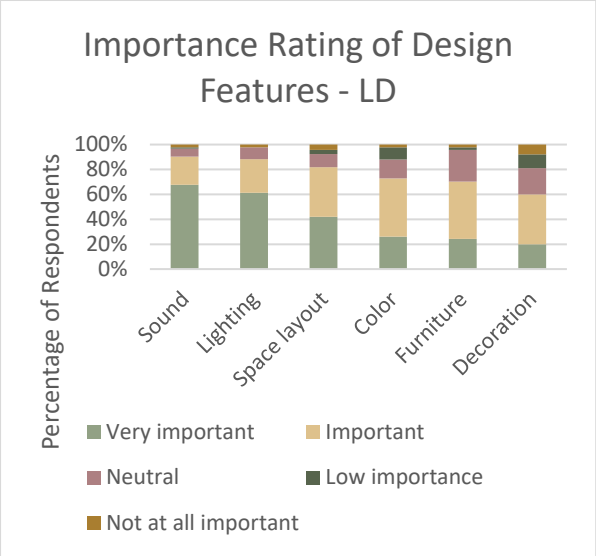
	Rating Spectrum
Sound Rating	1 (Silent) - 5 (Very loud)
Lighting Levels	1 (Very dim lights) - 5 (Very bright lights)
CCT	1 (Orangish (warm)) - 10 (Bluish (cool))
Comfort Rating	1 (Not at all comfortable) - 5 (Very comfortable)
Hardness/Softness Rating	1 (Very hard) - 5 (Very soft)
Importance Rating	1 (Not at all important) - 5 (Very important)
Relaxation Rating	1 (Not at all relaxing) - 5 (Very relaxing)

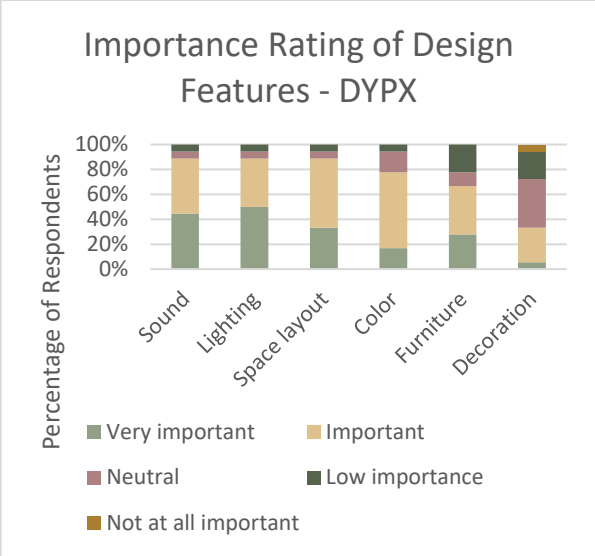
8.4. Appendix D

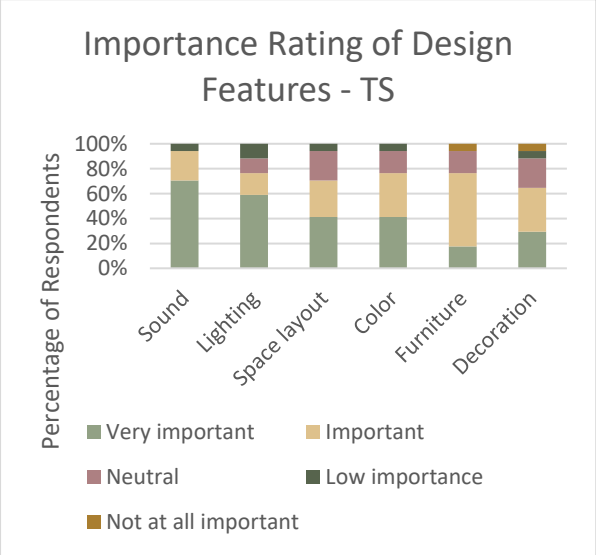
General Perspectives

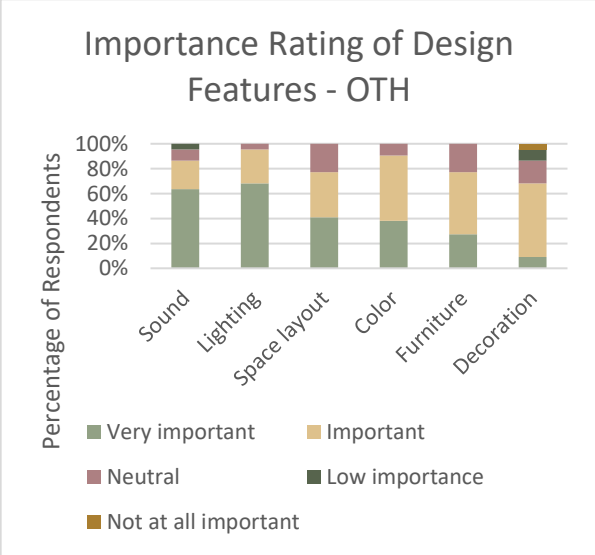


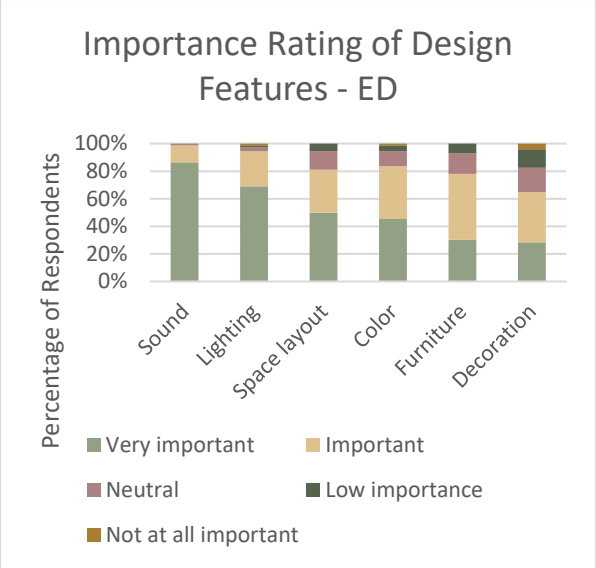


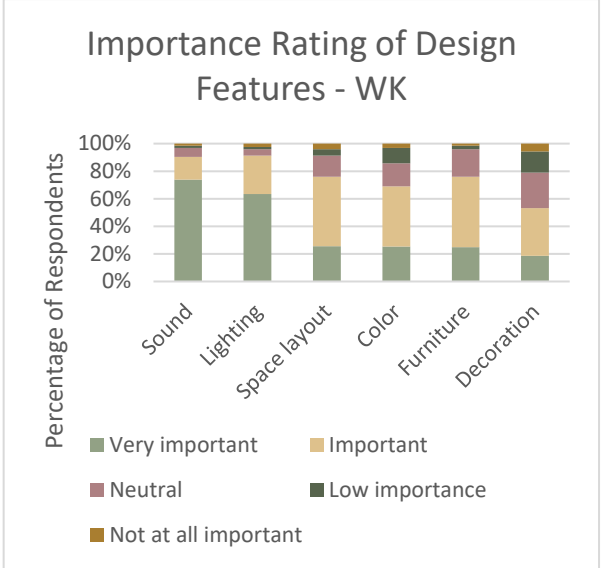









Importance Rating of Design Features - ED
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Sound
Lighting
Space layout
Color
Furniture
Decoration
Very important
Important
Neutral
Low importance
Not at all important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Percentage of Respondents
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80%
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40%
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Sound
Lighting
Space layout
Color
Furniture
Decoration
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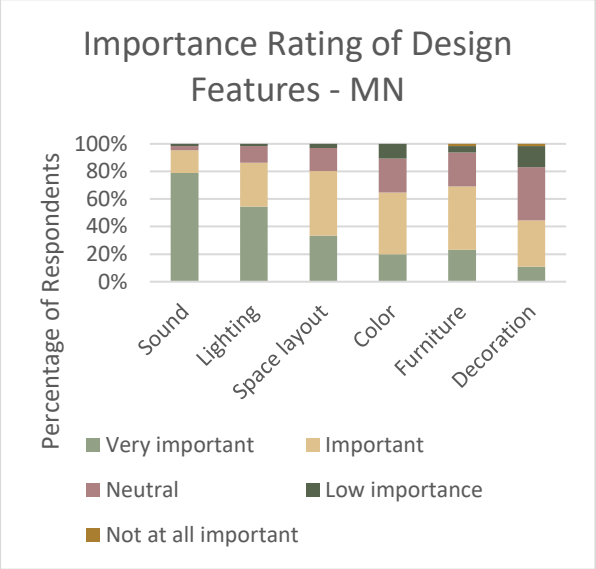
Important
Neutral
Low importance
Not at all important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Percentage of Respondents
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80%
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40%
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0%
Sound
Lighting
Space layout
Color
Furniture
Decoration
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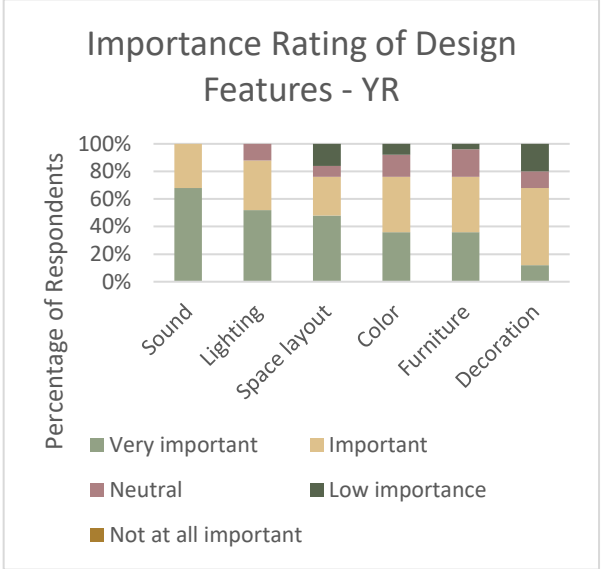
Important
Neutral
Low importance
Not at all important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80%
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40%
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Sound
Lighting
Space layout
Color
Furniture
Decoration
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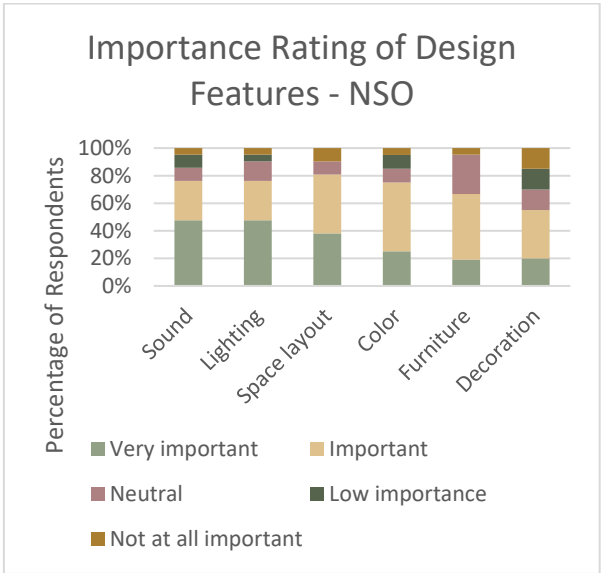
Important
Neutral
Low importance
Not at all important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Percentage of Respondents
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Sound
Lighting
Space layout
Color
Furniture
Decoration
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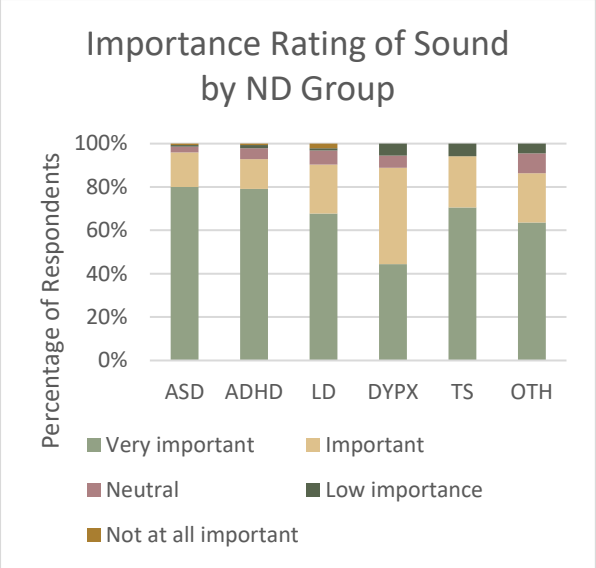
Important
Neutral
Low importance
Not at all important


Importance Rating of Sound by ND Group
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LD
DYPX
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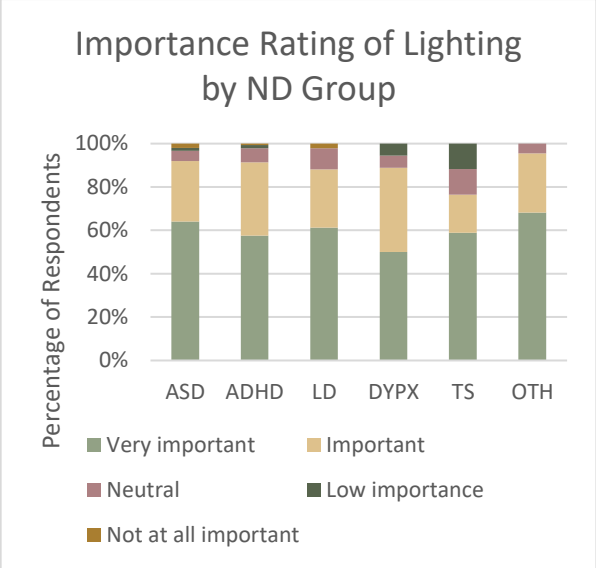
Important
Neutral
Low importance
Not at all important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LD
DYPX
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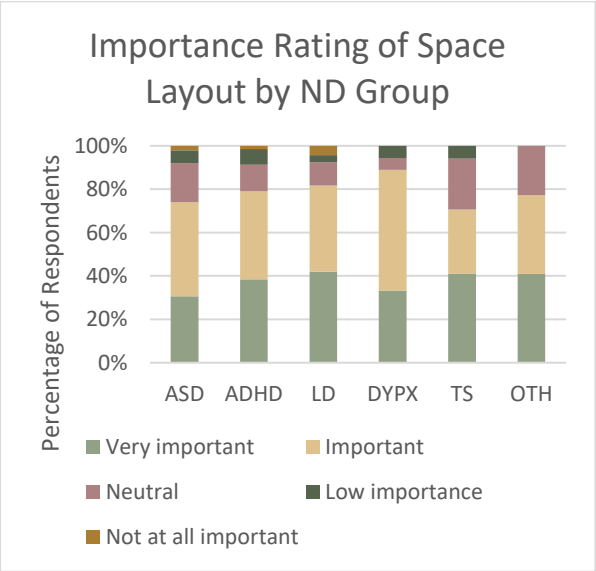
Important
Neutral
Low importance
Not at all important


Importance Rating of Space Layout by ND Group
Percentage of Respondents
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80%
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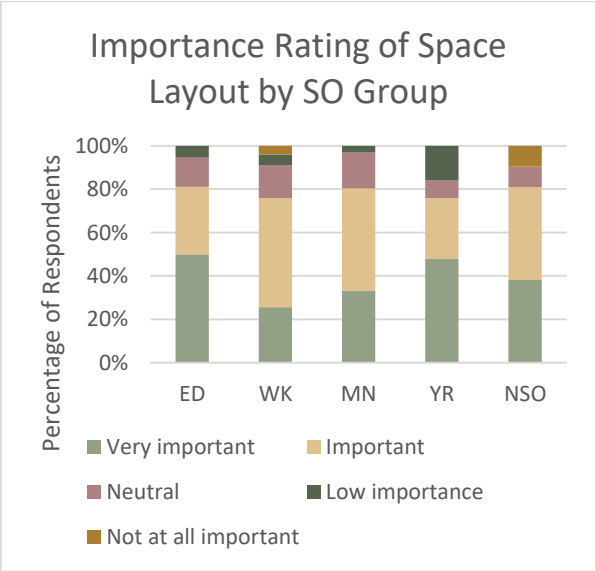
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Very important
Important
Neutral
Low importance
Not at all important


Importance Rating of Space Layout by SO Group
Percentage of Respondents
100%
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ED
WK
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YR
NSO
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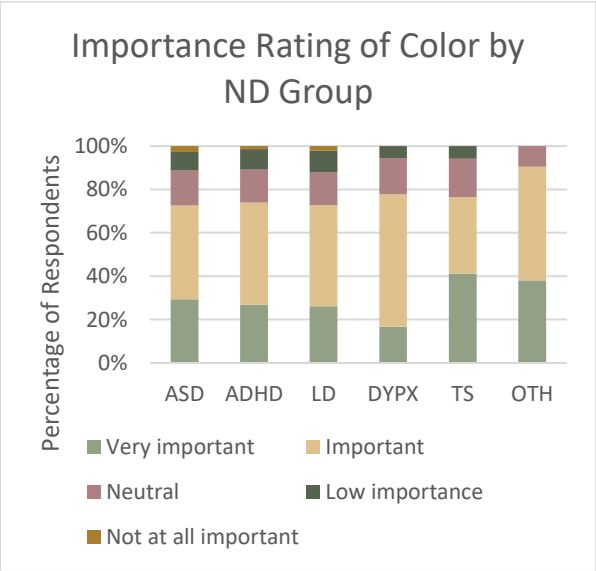
Important
Neutral
Low importance
Not at all important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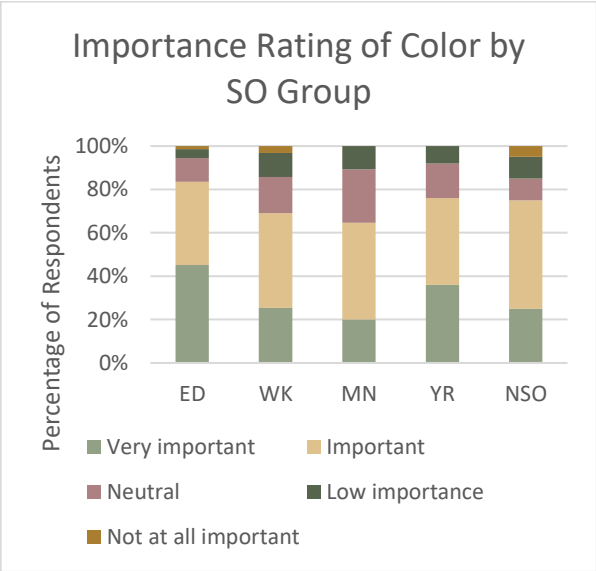
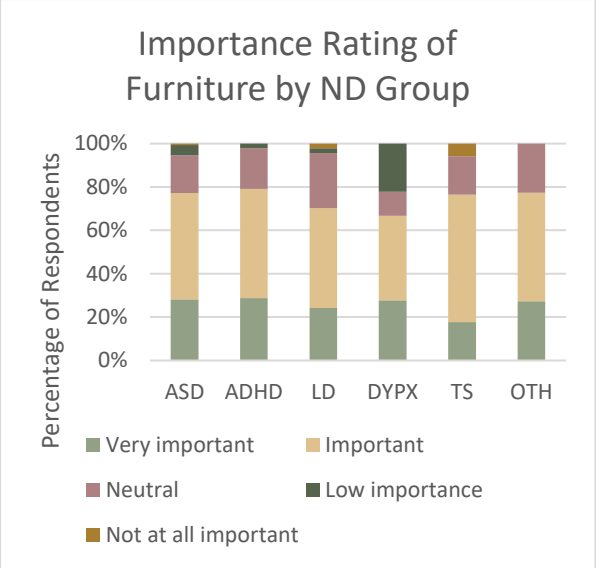
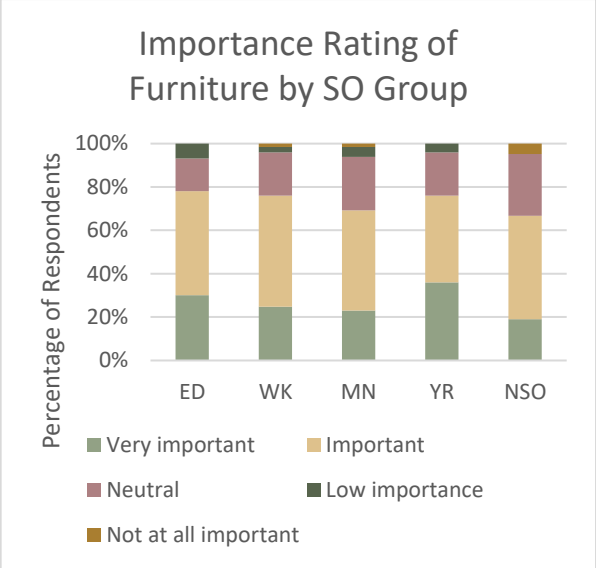
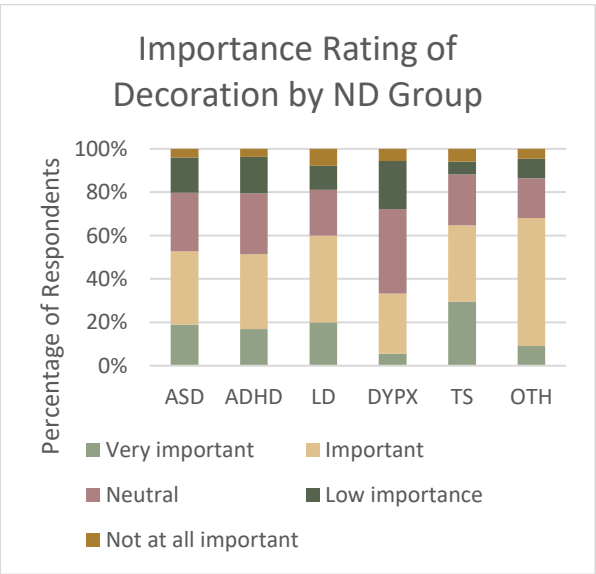
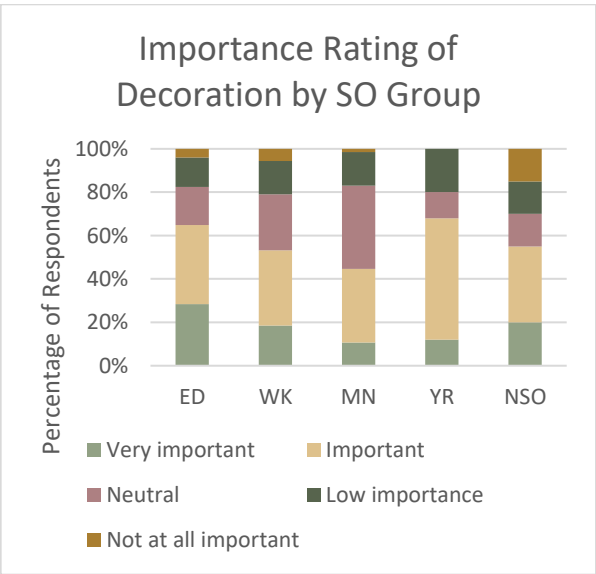
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Very important
Important
Neutral
Low importance
Not at all important

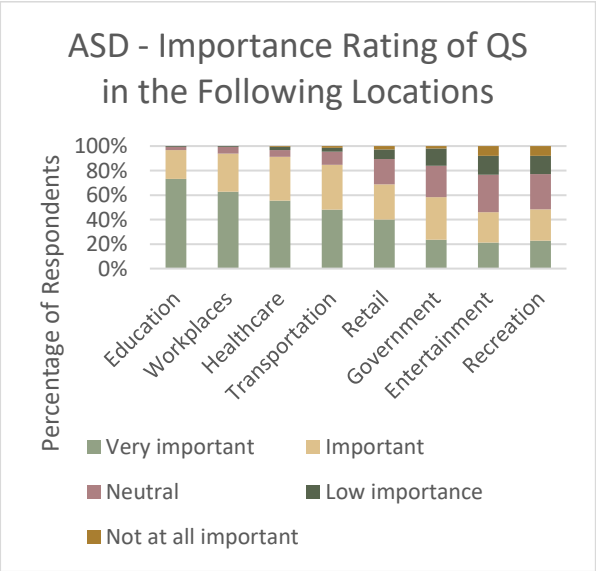

Importance Rating of Color by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Very important
Important
Neutral
Low importance
Not at all important

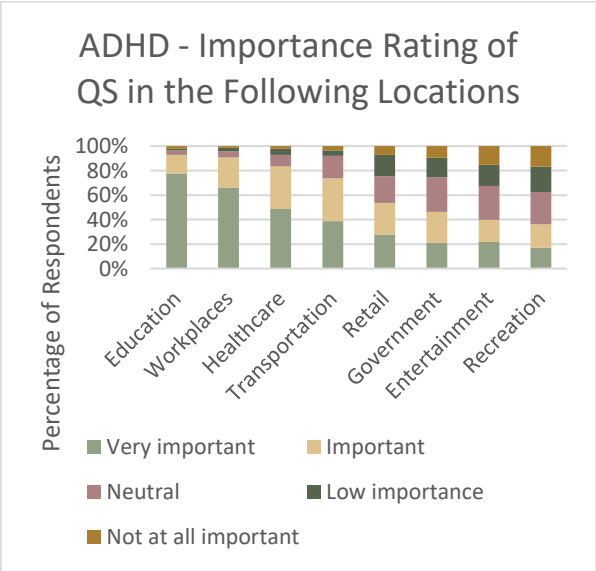

Importance Rating of Furniture by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Very important
Important
Neutral
Low importance
Not at all important

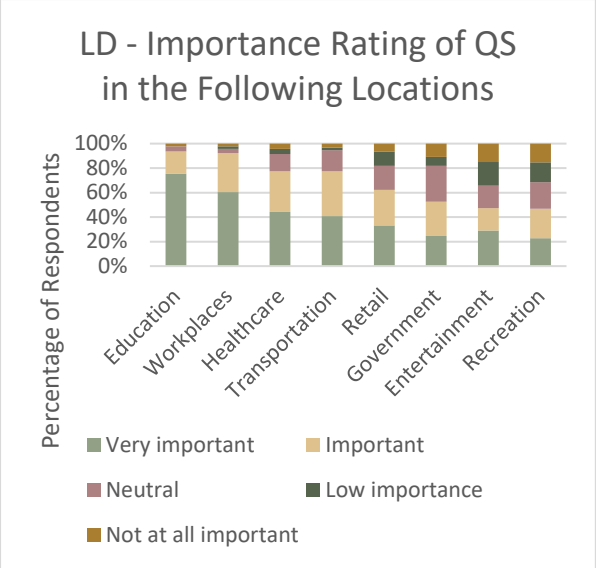

Importance Rating of Furniture by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Very important
Important
Neutral
Low importance
Not at all important

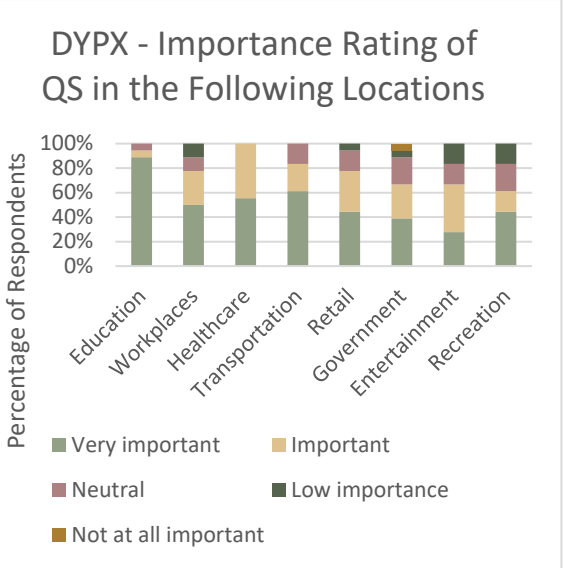

Importance Rating of Decoration by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Very important
Important
Neutral
Low importance
Not at all important

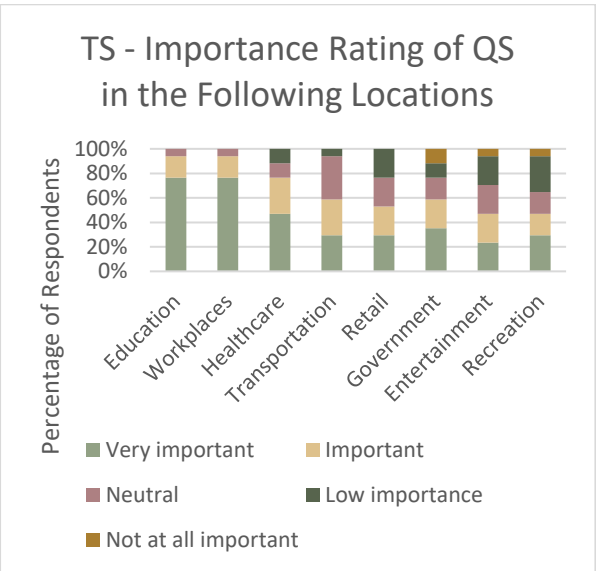

Importance Rating of Decoration by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Very important
Important
Neutral
Low importance
Not at all important

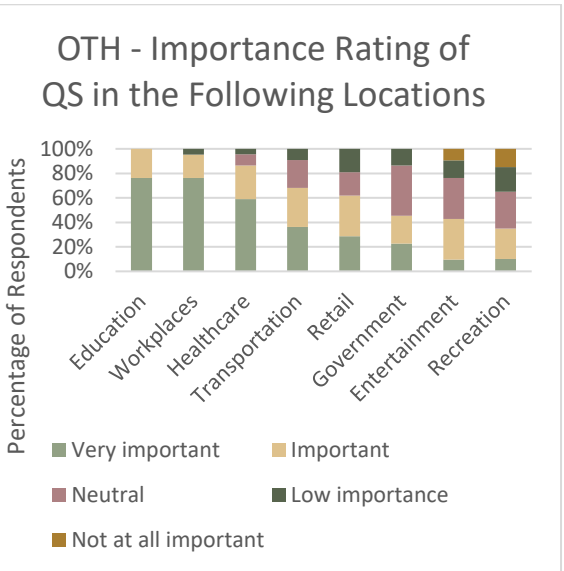

ASD - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

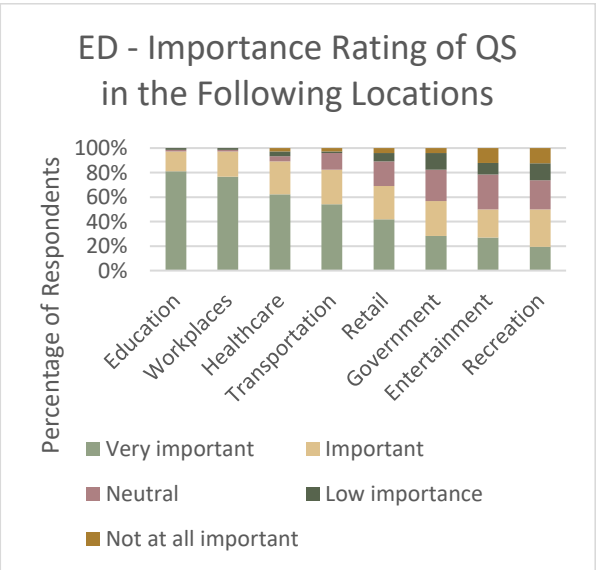

ADHD - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

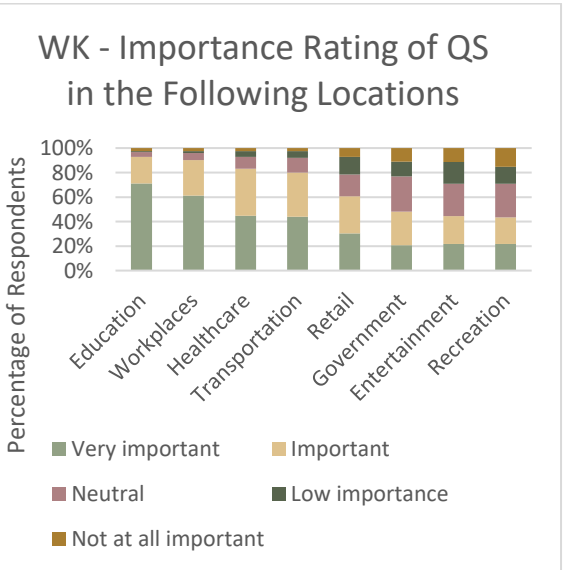

LD - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

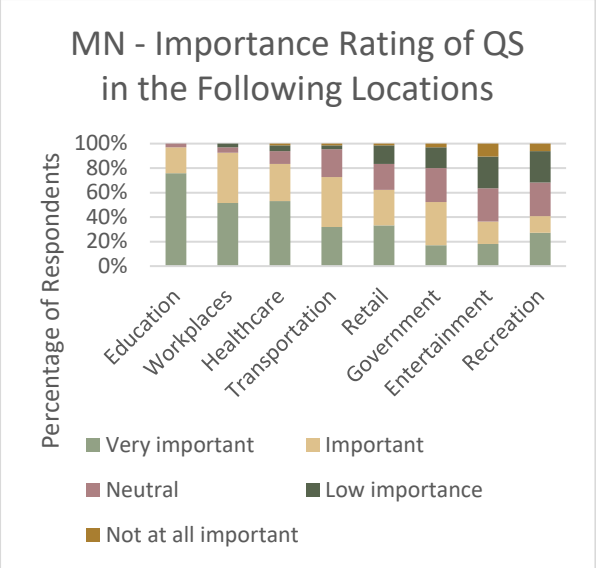

DYPX - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

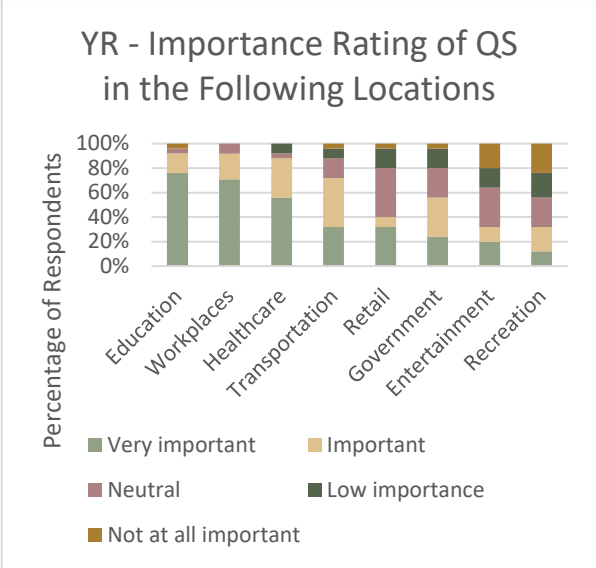

TS - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

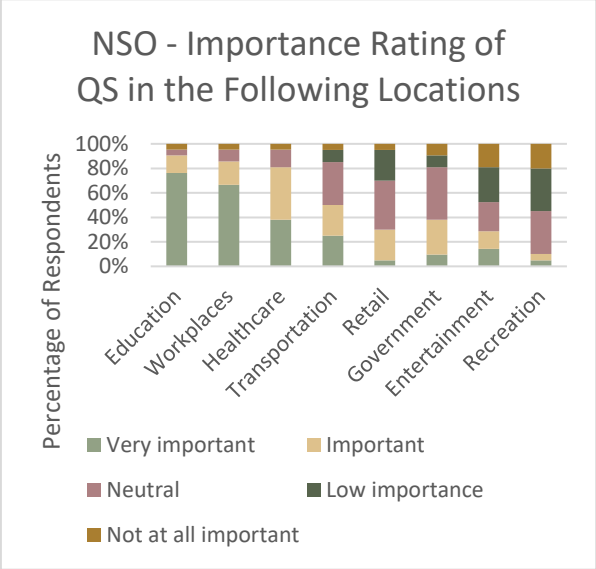

OTH - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important


ED - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

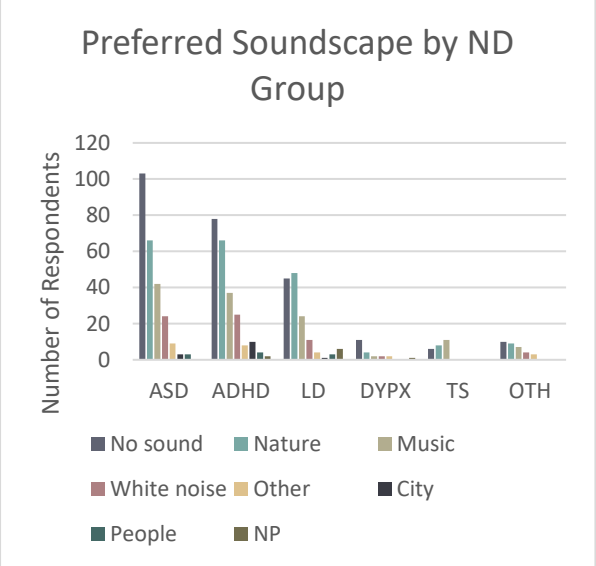

WK - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

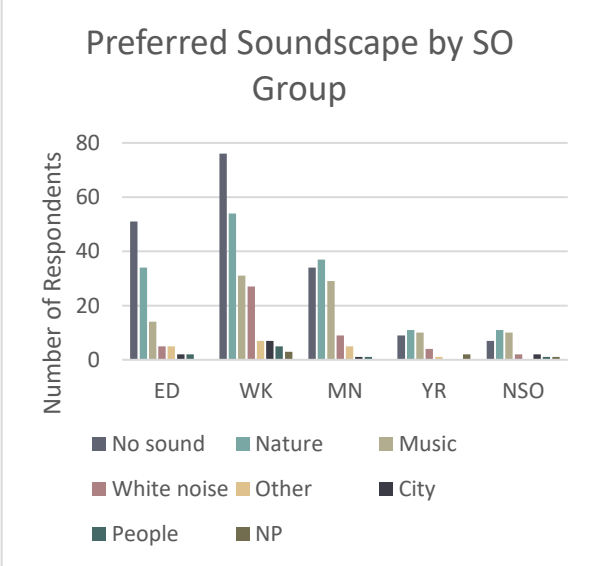

MN - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

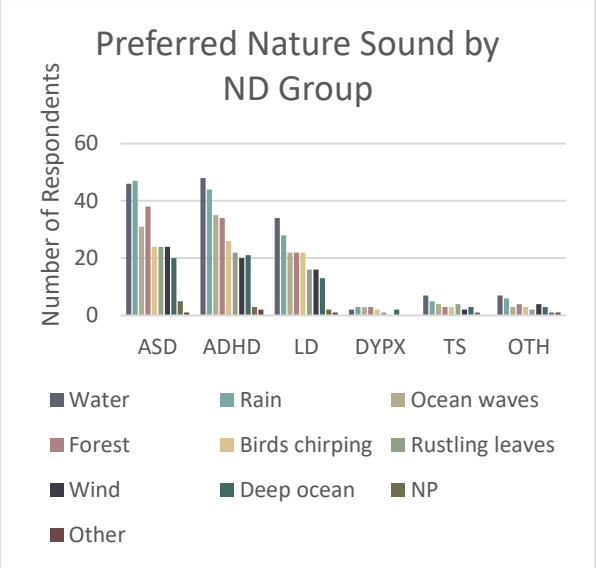

YR - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

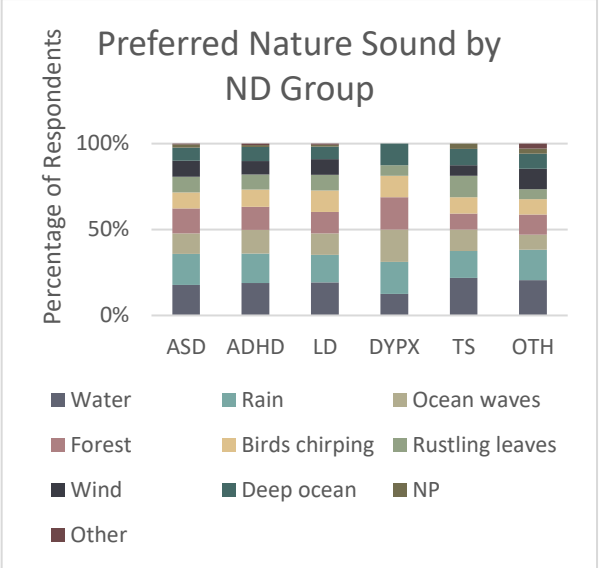

NSO - Importance Rating of QS in the Following Locations
Percentage of Respondents
100%
80%
60%
40%
20%
0%
Education
Workplaces
Healthcare
Transportation
Retail
Government
Entertainment
Recreation
Very important
Important
Neutral
Low importance
Not at all important

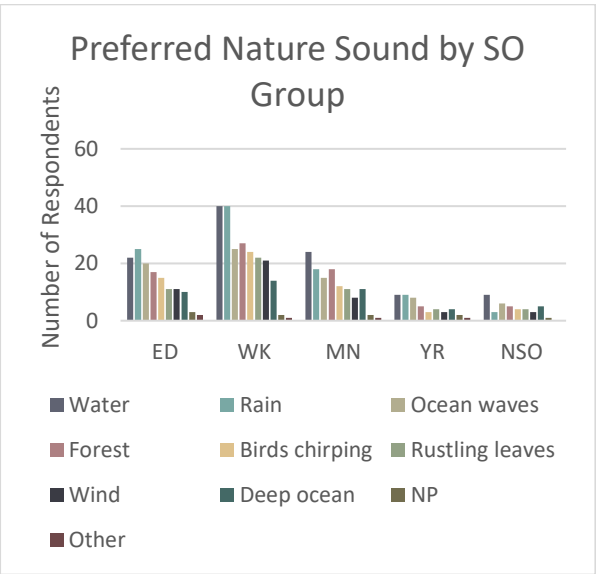
Sound

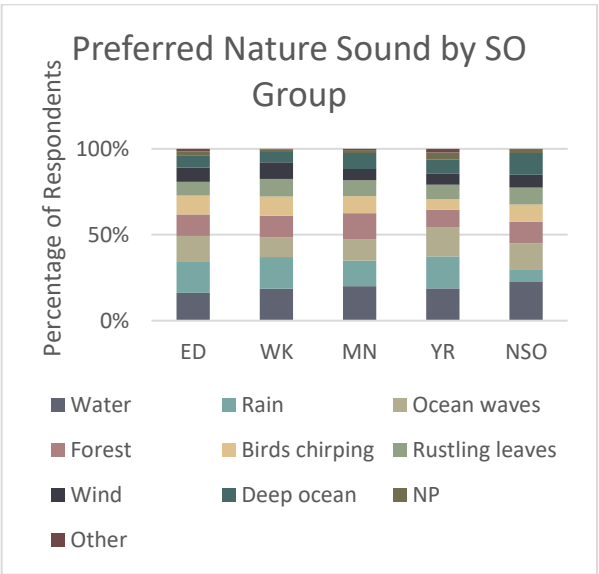

Preferred Soundscape by ND Group
Number of Respondents
120
100
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
No sound
Nature
Music
White noise
Other
City
People
NP

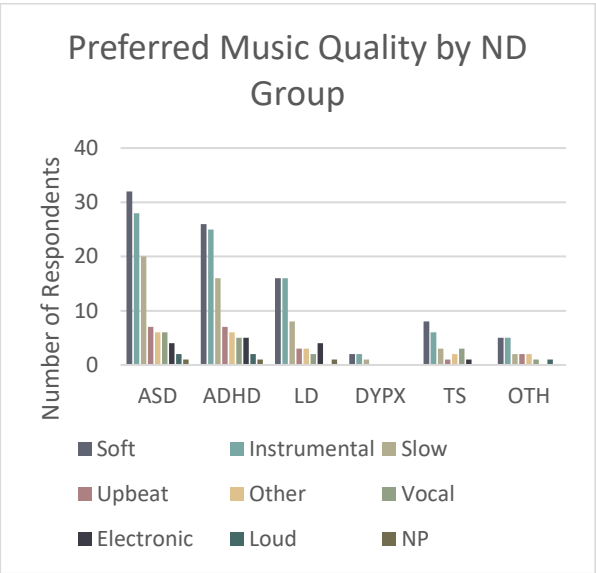

Preferred Soundscape by SO Group
Number of Respondents
80
60
40
20
0
ED
WK
MN
YR
NSO
No sound
Nature
Music
White noise
Other
City
People
NP

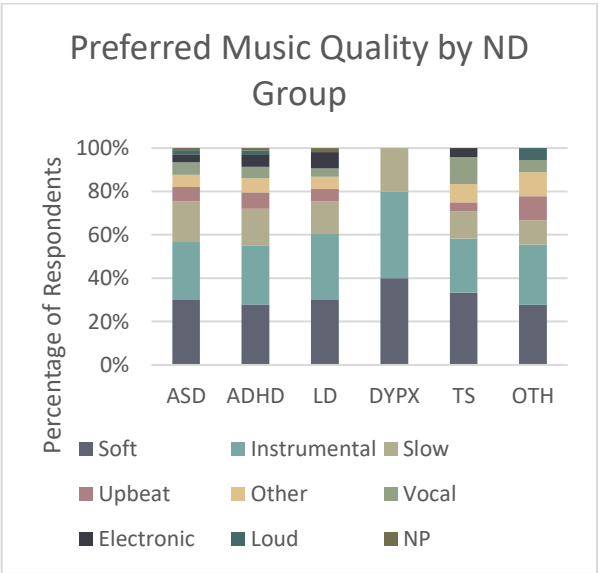

Preferred Nature Sound by ND Group
Number of Respondents
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
Water
Rain
Ocean waves
Forest
Birds chirping
Rustling leaves
Wind
Deep ocean
NP
Other

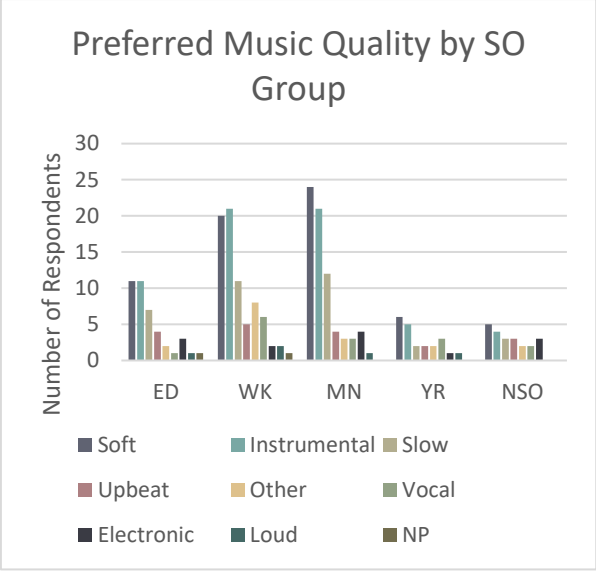

Preferred Nature Sound by ND Group
Percentage of Respondents
100%
50%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Water
Rain
Ocean waves
Forest
Birds chirping
Rustling leaves
Wind
Deep ocean
NP
Other

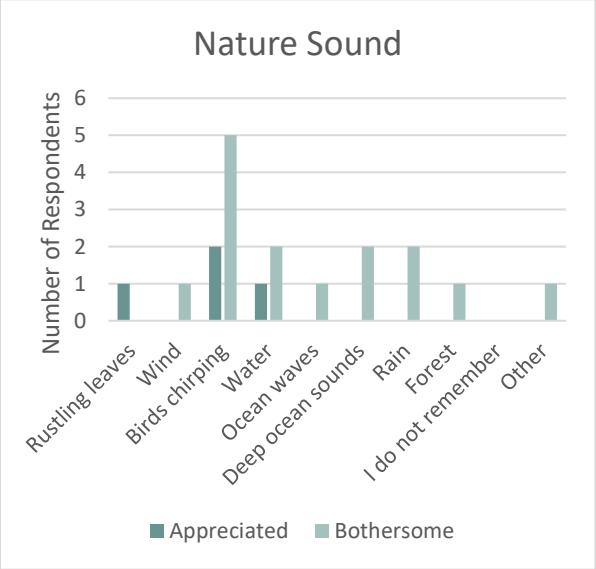

Preferred Nature Sound by SO Group
Number of Respondents
60
40
20
0
ED
WK
MN
YR
NSO
Water
Rain
Ocean waves
Forest
Birds chirping
Rustling leaves
Wind
Deep ocean
NP
Other

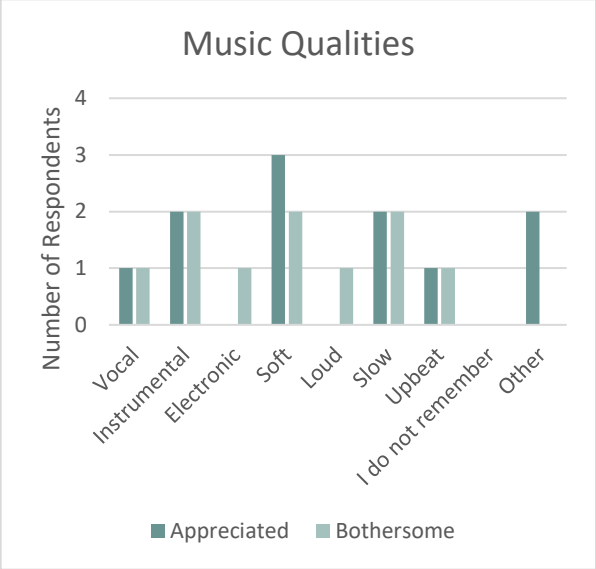

Preferred Nature Sound by SO Group
Percentage of Respondents
100%
50%
0%
ED
WK
MN
YR
NSO
Water
Rain
Ocean waves
Forest
Birds chirping
Rustling leaves
Wind
Deep ocean
NP
Other


Preferred Music Quality by ND Group
Number of Respondents
40
30
20
10
0
ASD
ADHD
LD
DYPX
TS
OTH
Soft
Instrumental
Slow
Upbeat
Other
Vocal
Electronic
Loud
NP

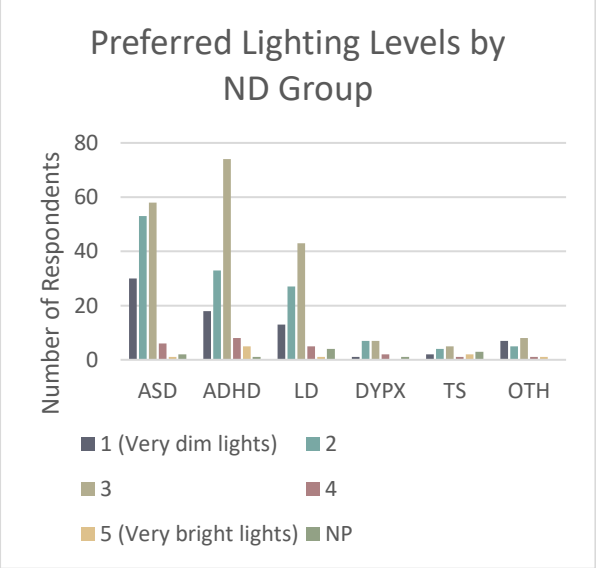

Preferred Music Quality by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Soft
Instrumental
Slow
Upbeat
Other
Vocal
Electronic
Loud
NP

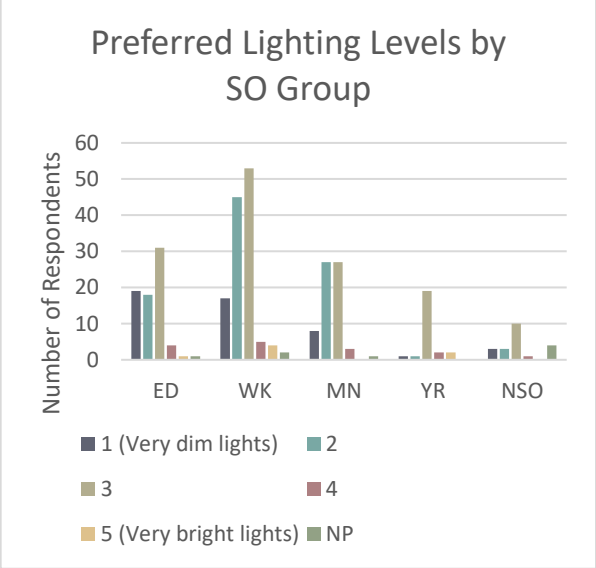

Preferred Music Quality by SO Group
Number of Respondents
30
25
20
15
10
5
0
ED
WK
MN
YR
NSO
Soft
Instrumental
Slow
Upbeat
Other
Vocal
Electronic
Loud
NP

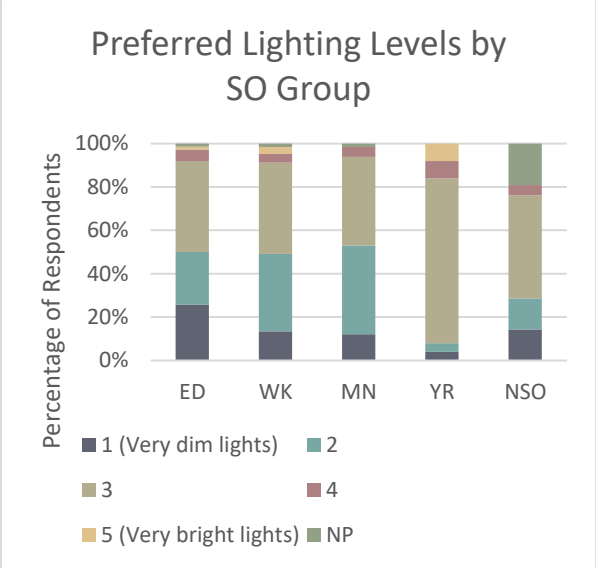

Nature Sound
Number of Respondents
6
5
4
3
2
1
0
Rustling leaves
Wind
Birds chirping
Water
Ocean waves
Deep ocean sounds
Rain
Forest
I do not remember
Other
Appreciated
Bothersome

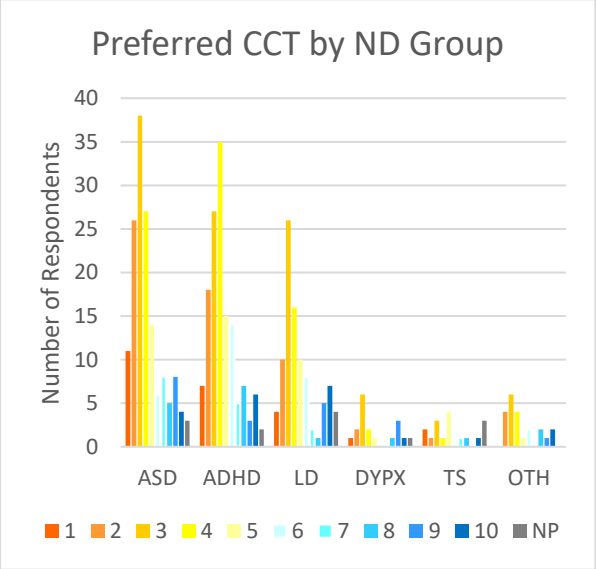

Music Qualities
Number of Respondents
4
3
2
1
0
Vocal
Instrumental
Electronic
Soft
Loud
Slow
Upbeat
I do not remember
Other
Appreciated
Bothersome

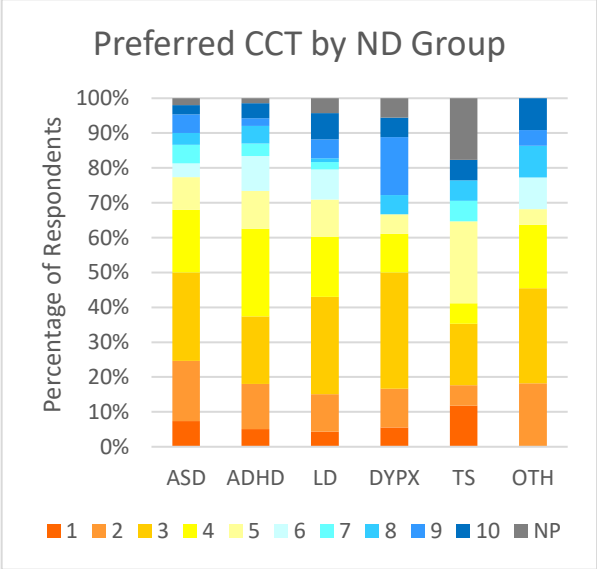
Lighting

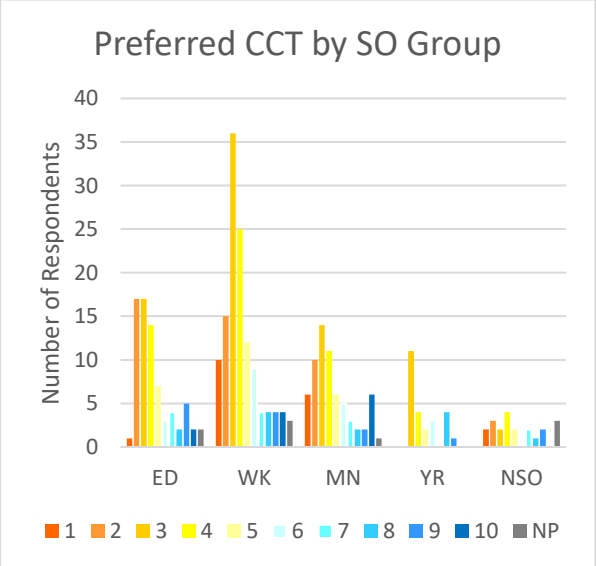

Preferred Lighting Levels by ND Group
Number of Respondents
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
1 (Very dim lights)
2
3
4
5 (Very bright lights)
NP

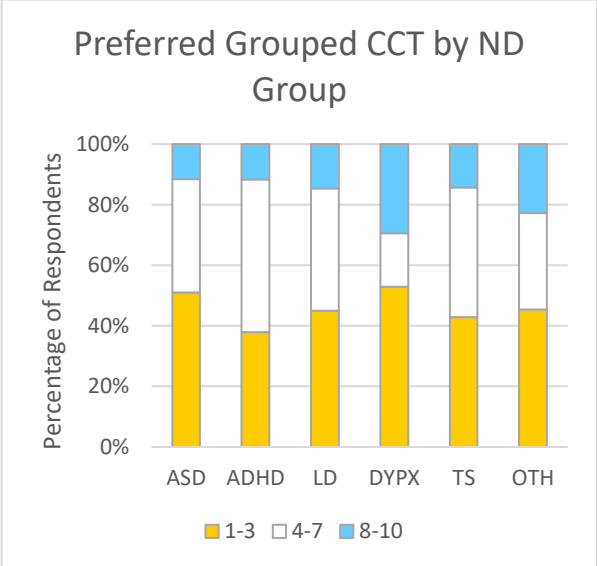

Preferred Lighting Levels by SO Group
Number of Respondents
60
50
40
30
20
10
0
ED
WK
MN
YR
NSO
1 (Very dim lights)
2
3
4
5 (Very bright lights)
NP

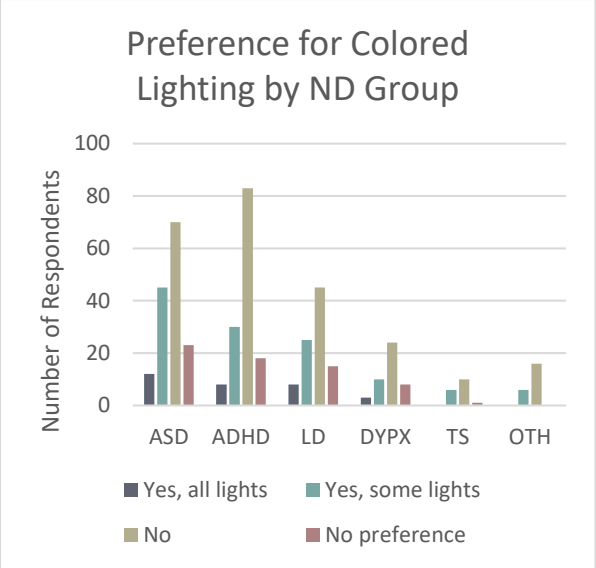

Preferred Lighting Levels by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
1 (Very dim lights)
2
3
4
5 (Very bright lights)
NP

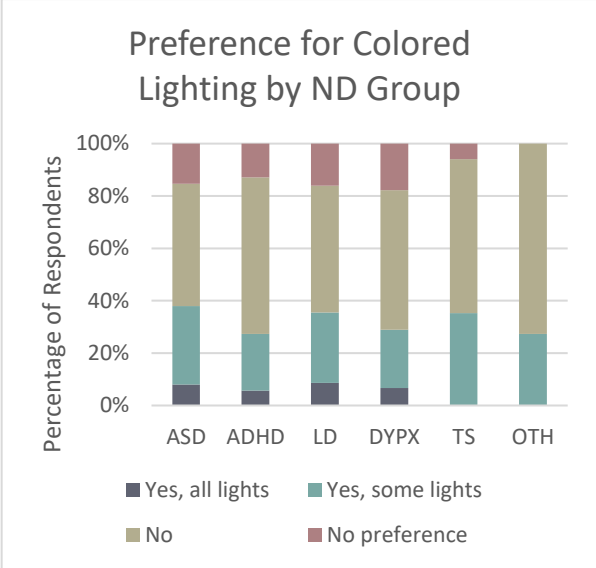

Preferred CCT by ND Group
Number of Respondents
40
35
30
25
20
15
10
5
0
ASD
ADHD
LD
DYPX
TS
OTH
1 2 3 4 5 6 7 8 9 10 NP

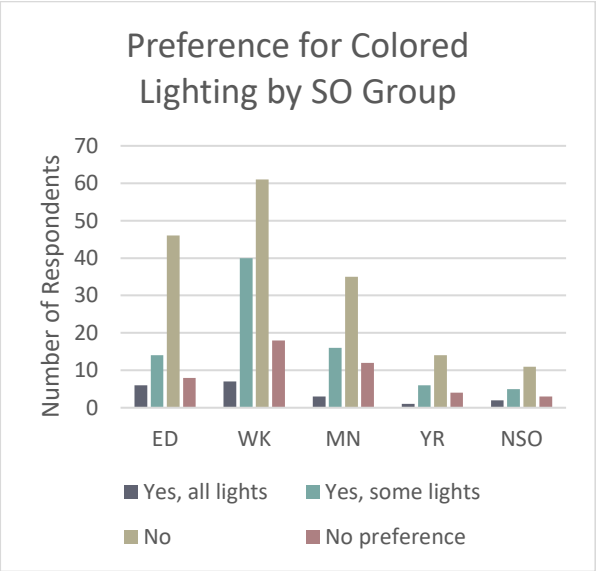

Preferred CCT by ND Group
Percentage of Respondents
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
ASD
ADHD
LD
DYPX
TS
OTH
1 2 3 4 5 6 7 8 9 10 NP

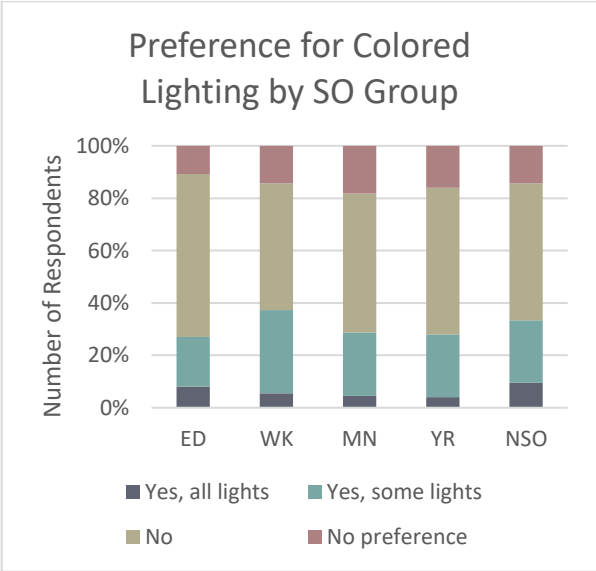

Preferred CCT by SO Group
Number of Respondents
40
35
30
25
20
15
10
5
0
ED
WK
MN
YR
NSO
1 2 3 4 5 6 7 8 9 10 NP

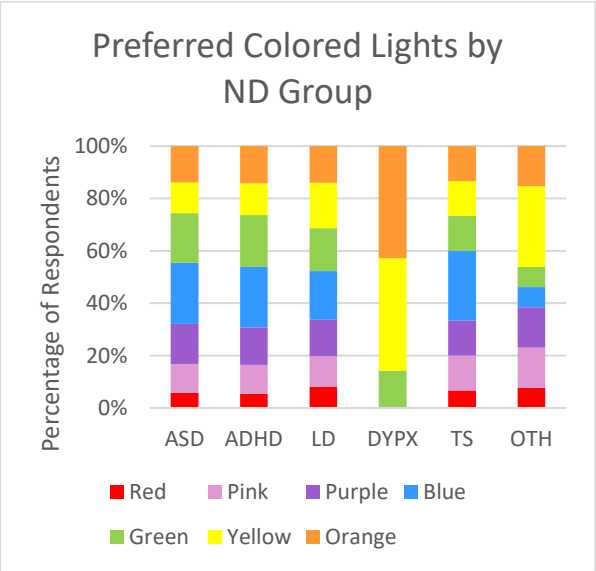

Preferred Grouped CCT by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
1-3
4-7
8-10

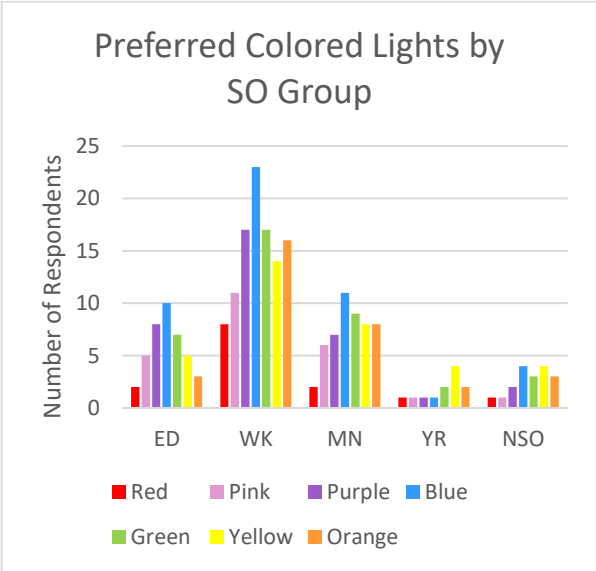

Preference for Colored Lighting by ND Group
Number of Respondents
100
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
Yes, all lights
Yes, some lights
No
No preference

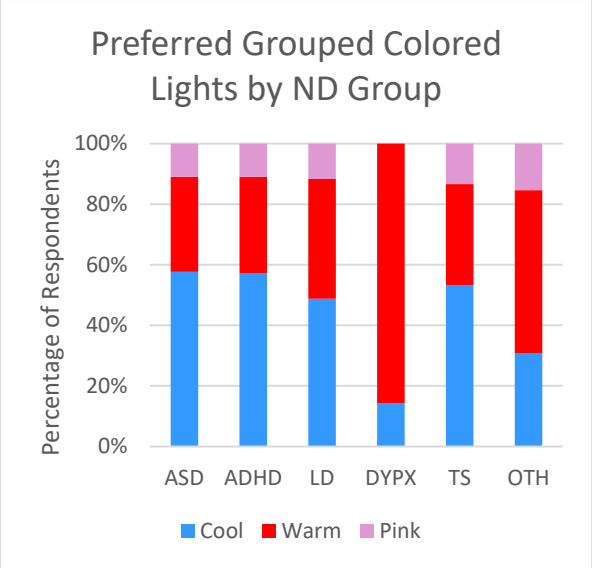

Preference for Colored Lighting by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Yes, all lights
Yes, some lights
No
No preference

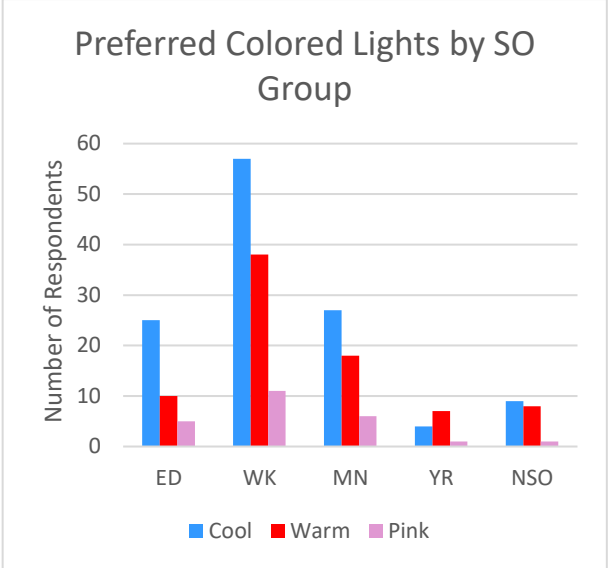

Preference for Colored Lighting by SO Group
Number of Respondents
70
60
50
40
30
20
10
0
ED
WK
MN
YR
NSO
Yes, all lights
Yes, some lights
No
No preference

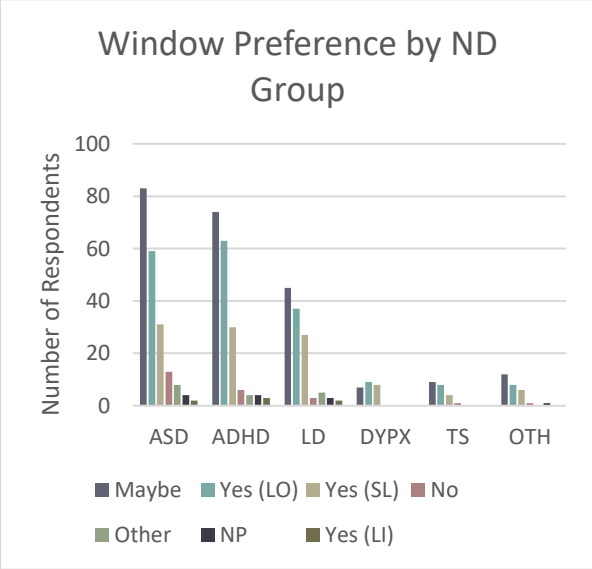

Preference for Colored Lighting by SO Group
Number of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Yes, all lights
Yes, some lights
No
No preference

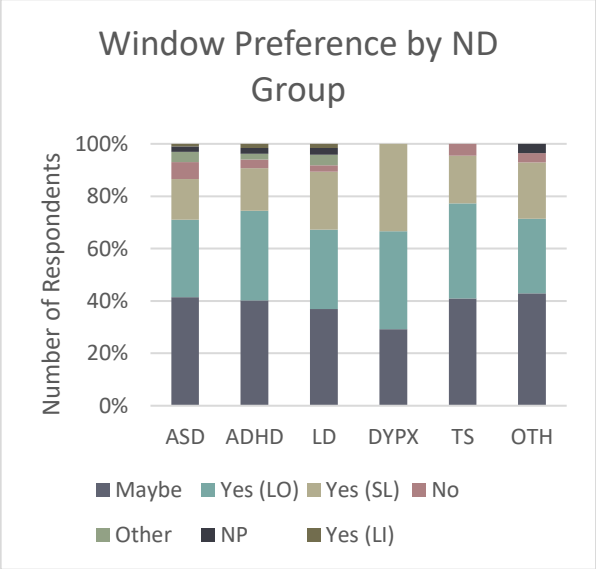

Preferred Colored Lights by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Red
Pink
Purple
Blue
Green
Yellow
Orange

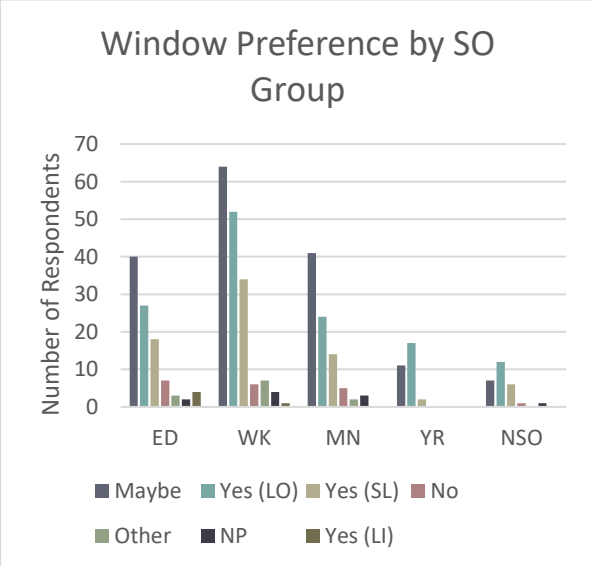

Preferred Colored Lights by SO Group
Number of Respondents
25
20
15
10
5
0
ED
WK
MN
YR
NSO
Red
Pink
Purple
Blue
Green
Yellow
Orange

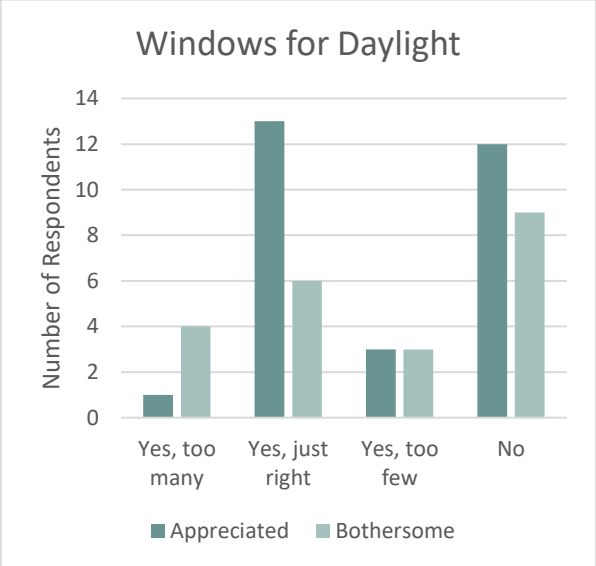

Preferred Grouped Colored Lights by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Cool
Warm
Pink

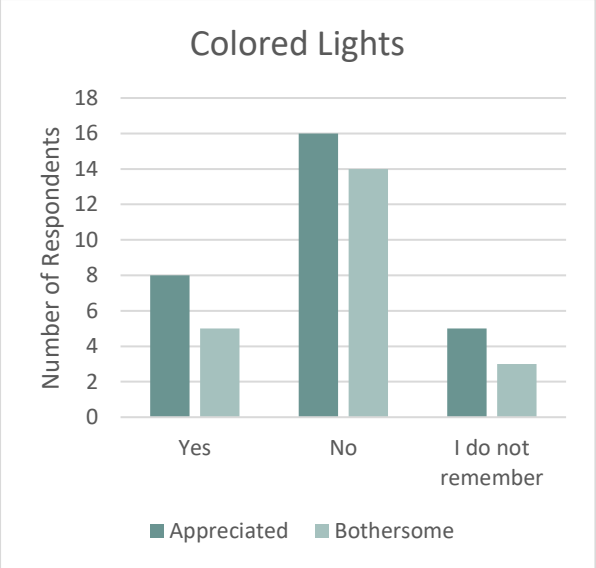

Preferred Colored Lights by SO Group
Number of Respondents
60
50
40
30
20
10
0
ED
WK
MN
YR
NSO
Cool
Warm
Pink

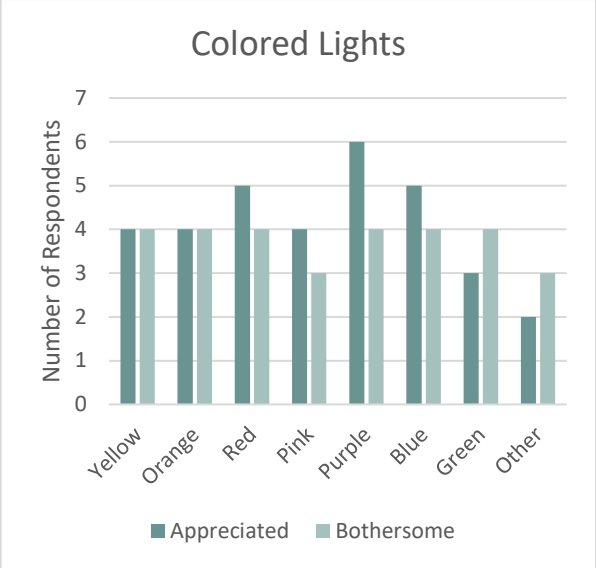

Window Preference by ND Group
Number of Respondents
100
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
Maybe
Yes (LO)
Yes (SL)
No
Other
NP
Yes (LI)


Window Preference by ND Group
Number of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Maybe
Yes (LO)
Yes (SL)
No
Other
NP
Yes (LI)

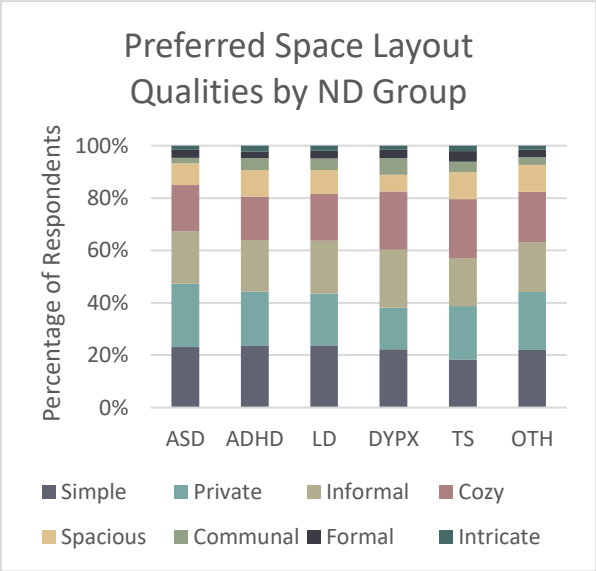

Window Preference by SO Group
Number of Respondents
70
60
50
40
30
20
10
0
ED
WK
MN
YR
NSO
Maybe
Yes (LO)
Yes (SL)
No
Other
NP
Yes (LI)

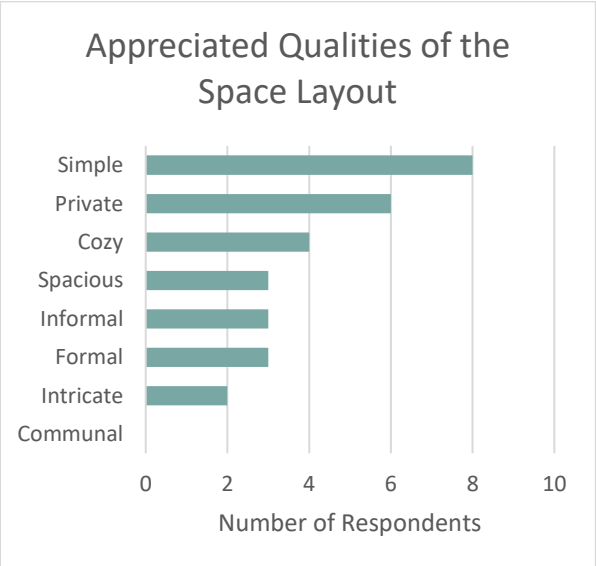

Windows for Daylight
Number of Respondents
14
12
10
8
6
4
2
0
Yes, too many
Yes, just right
Yes, too few
No
Appreciated
Bothersome

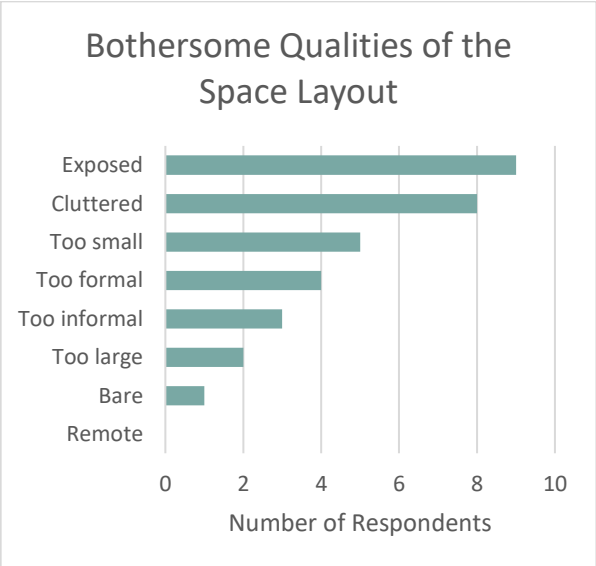




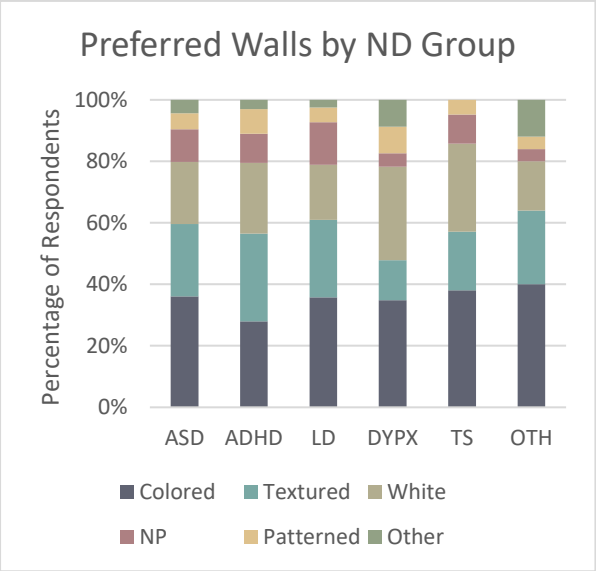
Space Layout

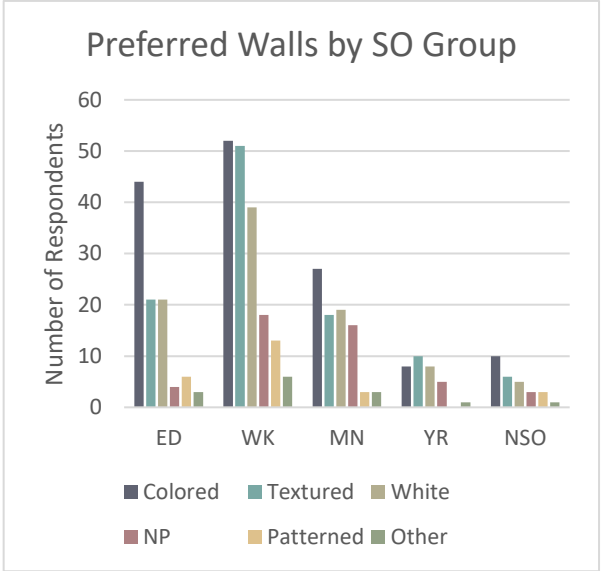


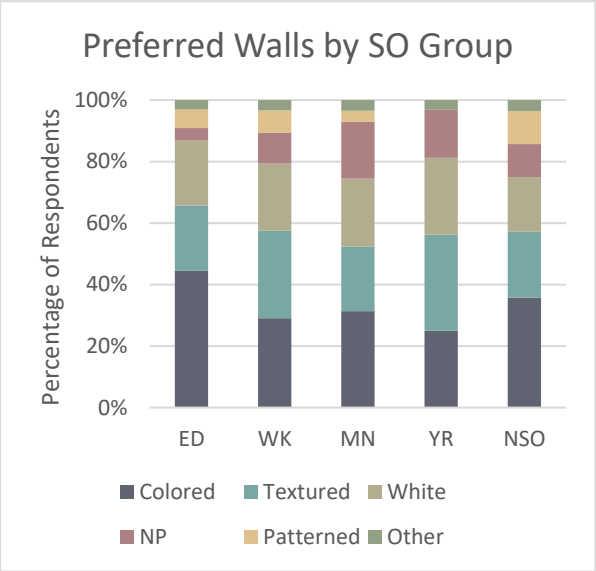


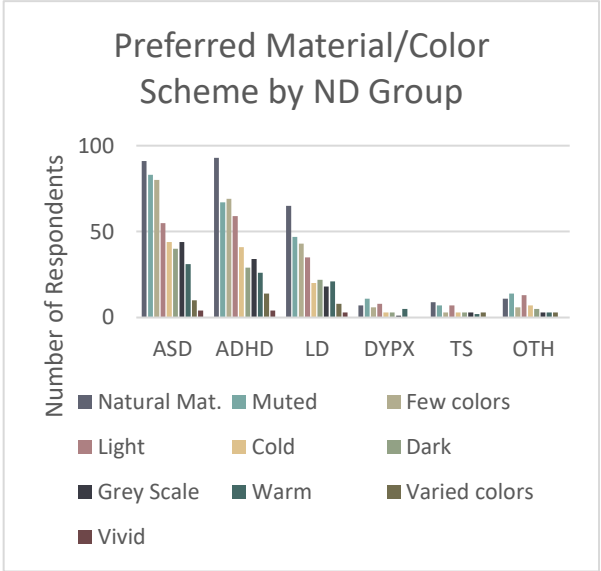


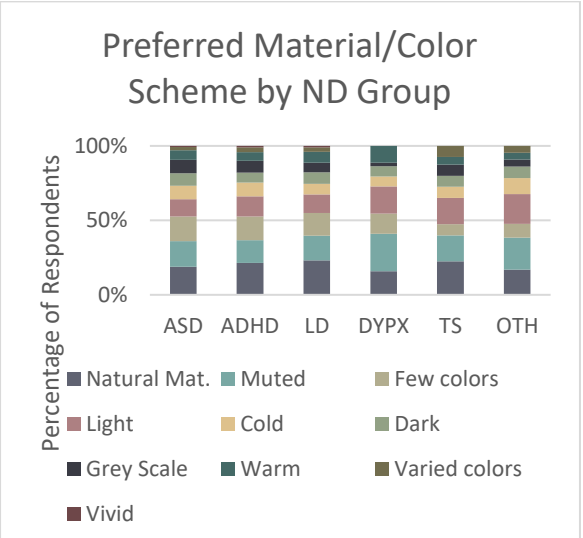
Color

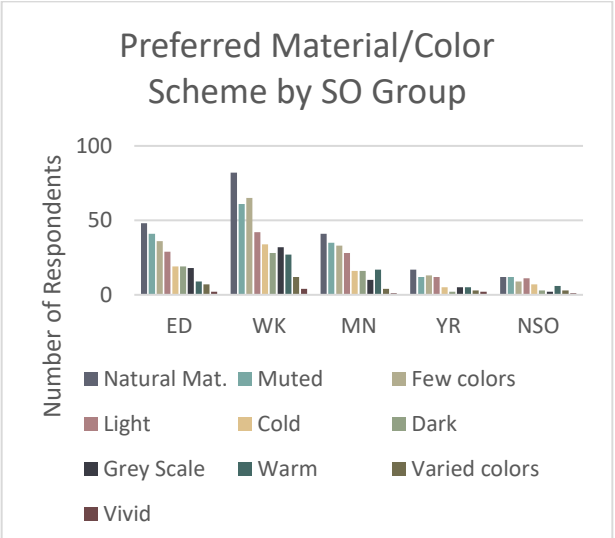

Preferred Walls by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Colored
Textured
White
NP
Patterned
Other

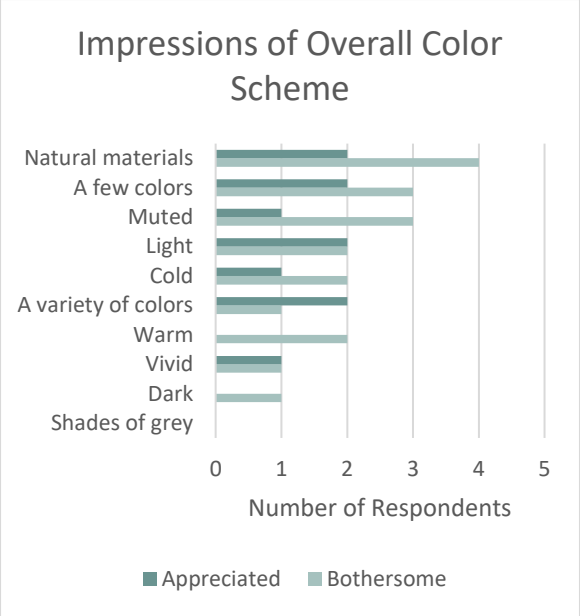

Preferred Walls by SO Group
Number of Respondents
60
50
40
30
20
10
0
ED
WK
MN
YR
NSO
Colored
Textured
White
NP
Patterned
Other

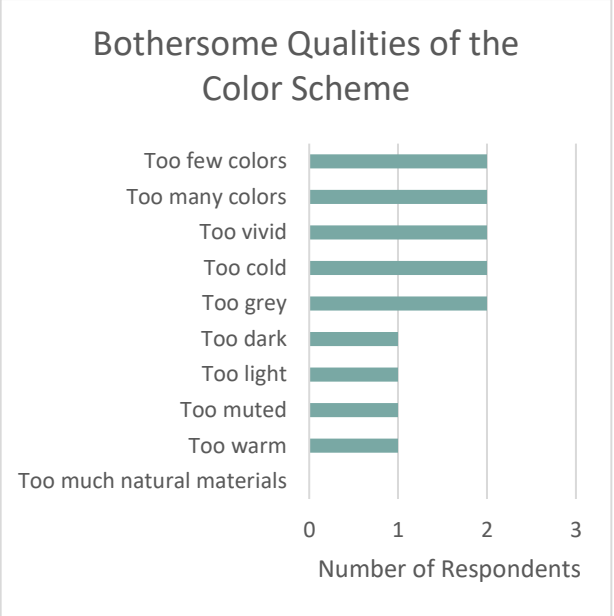

Preferred Walls by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Colored
Textured
White
NP
Patterned
Other


Preferred Material/Color Scheme by ND Group
Number of Respondents
100
50
0
ASD
ADHD
LD
DYPX
TS
OTH
Natural Mat.
Muted
Few colors
Light
Cold
Dark
Grey Scale
Warm
Varied colors
Vivid

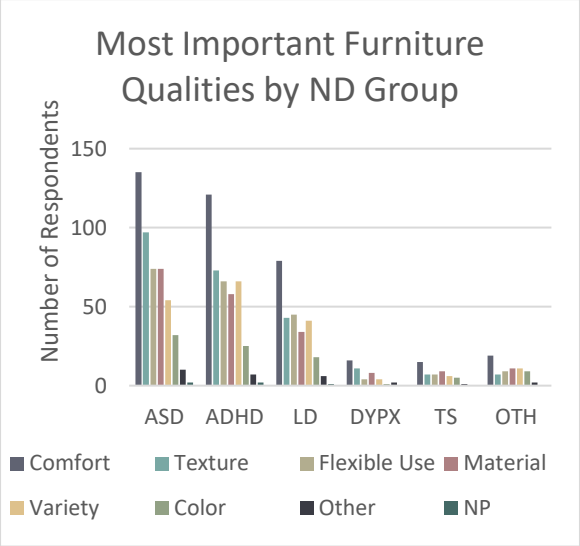

Preferred Material/Color Scheme by ND Group
Percentage of Respondents
100%
50%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Natural Mat.
Muted
Few colors
Light
Cold
Dark
Grey Scale
Warm
Varied colors
Vivid

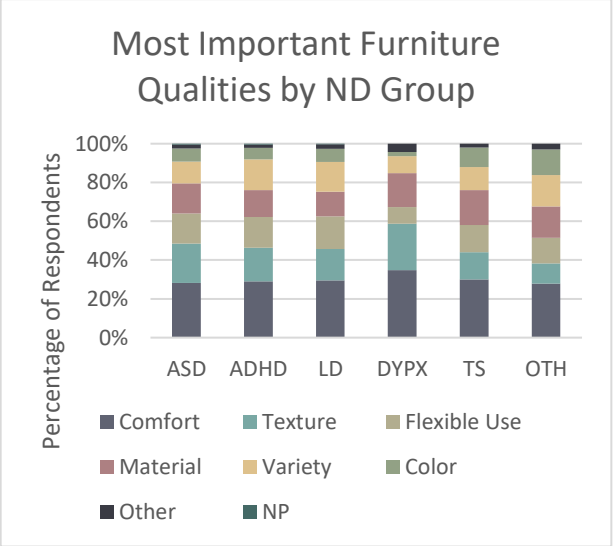

Preferred Material/Color Scheme by SO Group
Number of Respondents
100
50
0
ED
WK
MN
YR
NSO
Natural Mat.
Muted
Few colors
Light
Cold
Dark
Grey Scale
Warm
Varied colors
Vivid

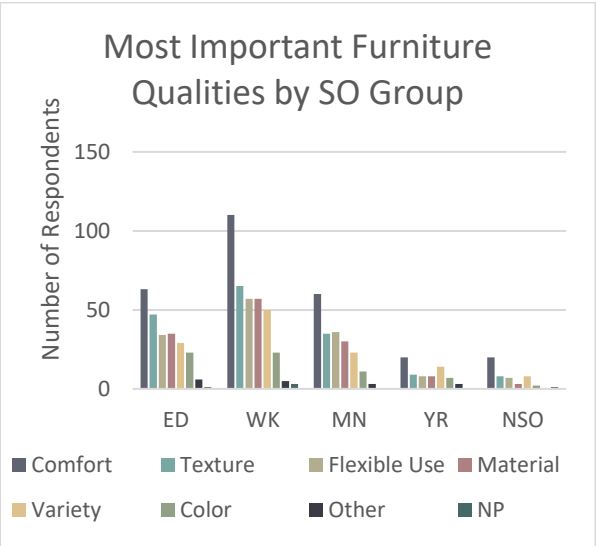

Impressions of Overall Color Scheme
Natural materials
A few colors
Muted
Light
Cold
A variety of colors
Warm
Vivid
Dark
Shades of grey
0
1
2
3
4
5
Number of Respondents
Appreciated
Bothersome

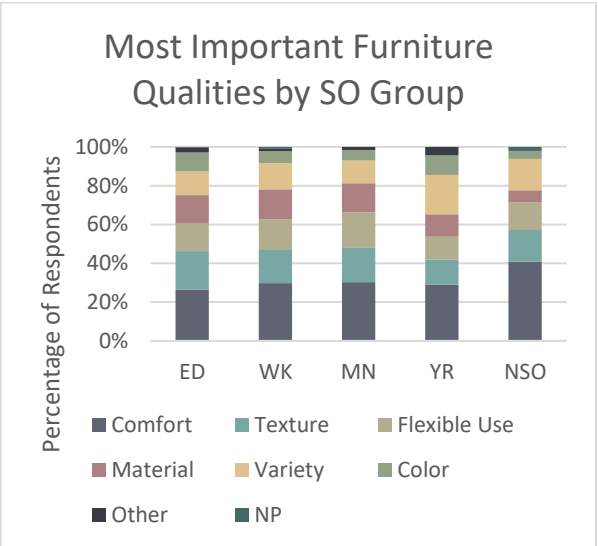

Bothersome Qualities of the Color Scheme
Too few colors
Too many colors
Too vivid
Too cold
Too grey
Too dark
Too light
Too muted
Too warm
Too much natural materials
0
1
2
3
Number of Respondents

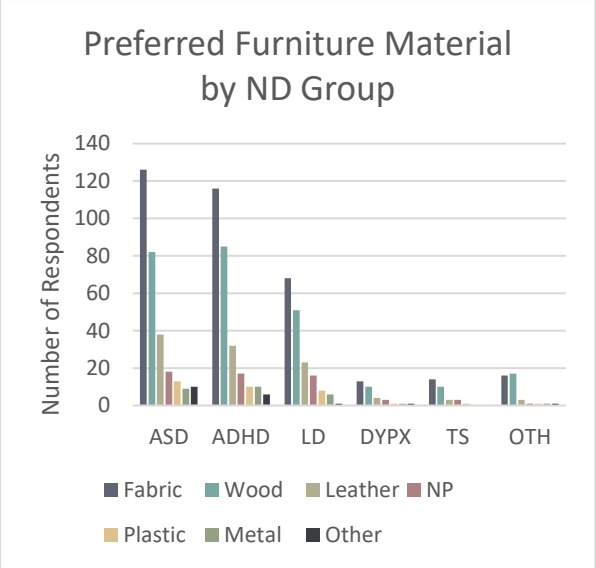
Furniture

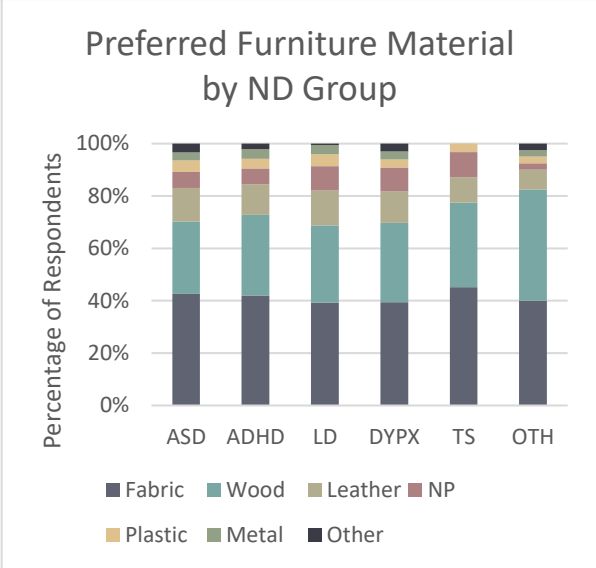

Most Important Furniture Qualities by ND Group
Number of Respondents
150
100
50
0
ASD
ADHD
LD
DYPX
TS
OTH
Comfort
Texture
Flexible Use
Material
Variety
Color
Other
NP

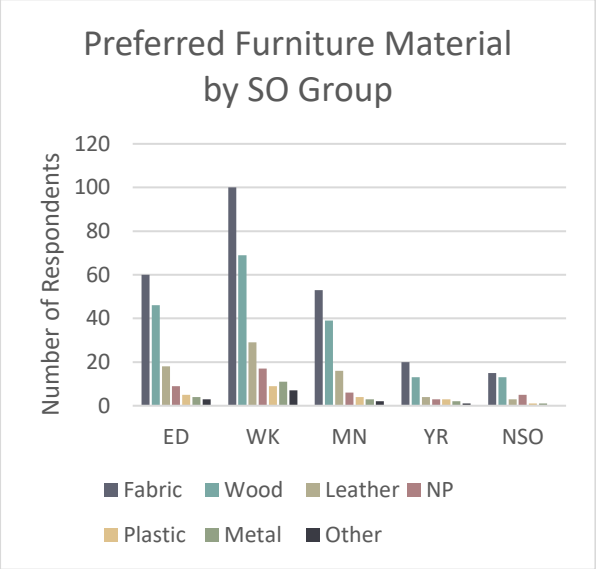

Most Important Furniture Qualities by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Comfort
Texture
Flexible Use
Material
Variety
Color
Other
NP

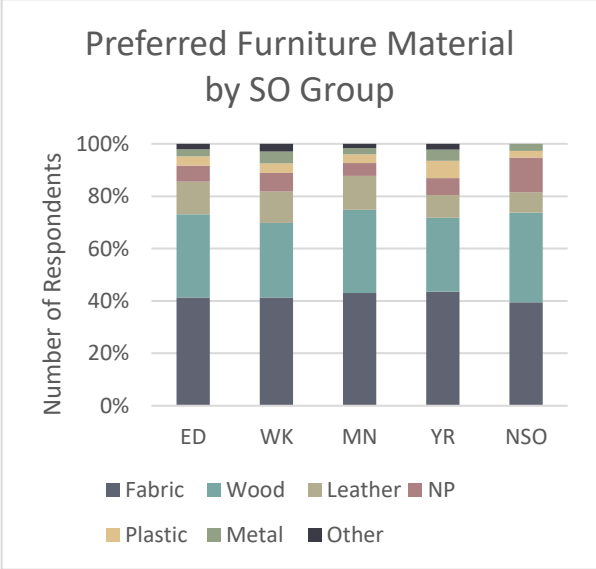

Most Important Furniture Qualities by SO Group
Number of Respondents
150
100
50
0
ED
WK
MN
YR
NSO
Comfort
Texture
Flexible Use
Material
Variety
Color
Other
NP

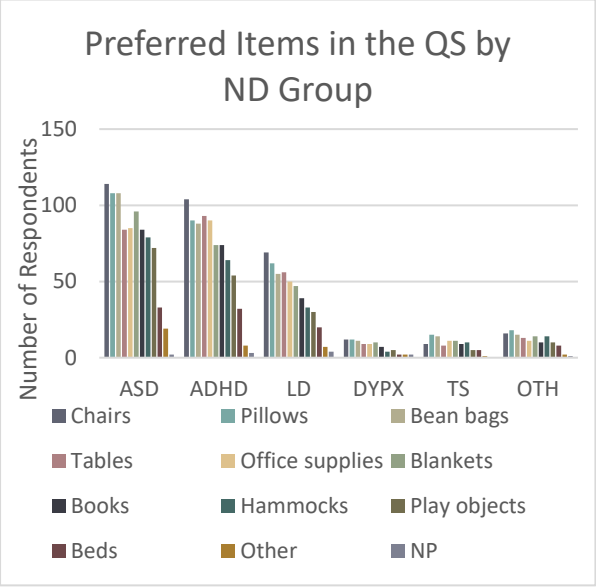

Most Important Furniture Qualities by SO Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Comfort
Texture
Flexible Use
Material
Variety
Color
Other
NP

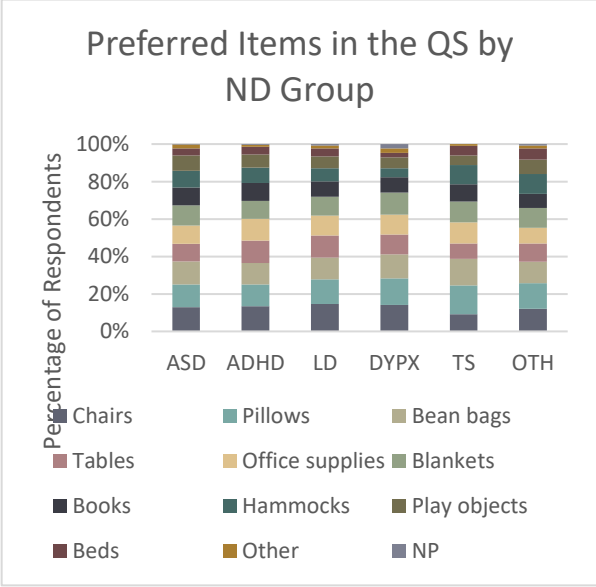

Preferred Furniture Material by ND Group
Number of Respondents
140
120
100
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
Fabric
Wood
Leather
NP
Plastic
Metal
Other

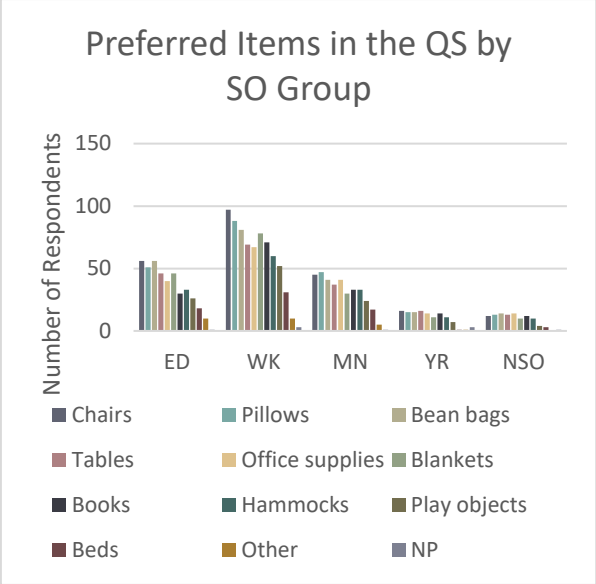

Preferred Furniture Material by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Fabric
Wood
Leather
NP
Plastic
Metal
Other

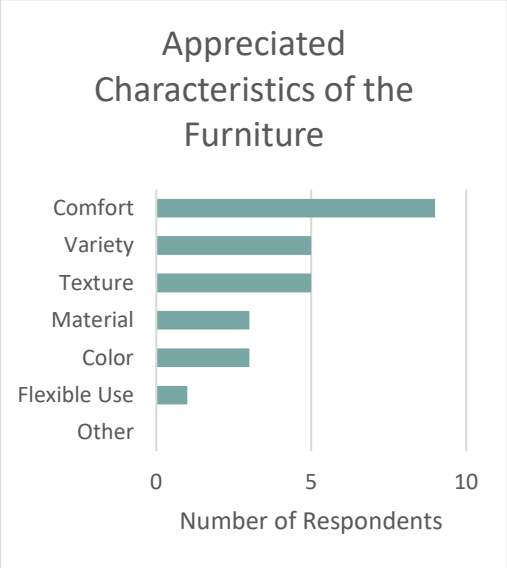

Preferred Furniture Material by SO Group
Number of Respondents
120
100
80
60
40
20
0
ED
WK
MN
YR
NSO
Fabric
Wood
Leather
NP
Plastic
Metal
Other

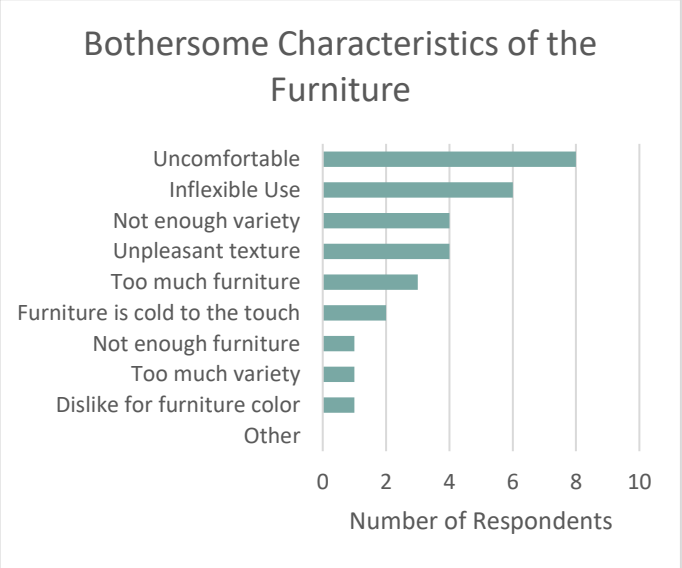

Preferred Furniture Material by SO Group
Number of Respondents
100%
80%
60%
40%
20%
0%
ED
WK
MN
YR
NSO
Fabric
Wood
Leather
NP
Plastic
Metal
Other


Preferred Items in the QS by ND Group
Number of Respondents
150
100
50
0
ASD
ADHD
LD
DYPX
TS
OTH
Chairs
Pillows
Bean bags
Tables
Office supplies
Blankets
Books
Hammocks
Play objects
Beds
Other
NP

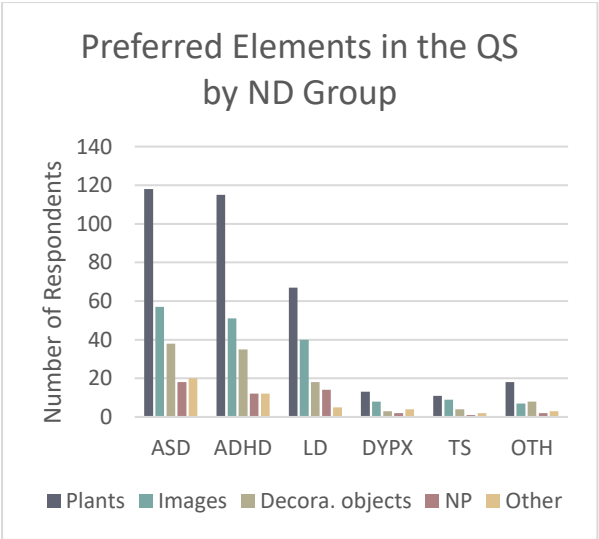

Preferred Items in the QS by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Chairs
Pillows
Bean bags
Tables
Office supplies
Blankets
Books
Hammocks
Play objects
Beds
Other
NP

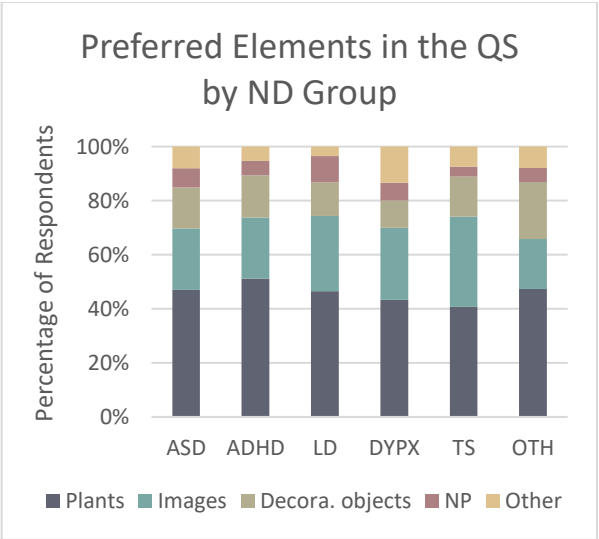

Preferred Items in the QS by SO Group
Number of Respondents
150
100
50
0
ED
WK
MN
YR
NSO
Chairs
Pillows
Bean bags
Tables
Office supplies
Blankets
Books
Hammocks
Play objects
Beds
Other
NP

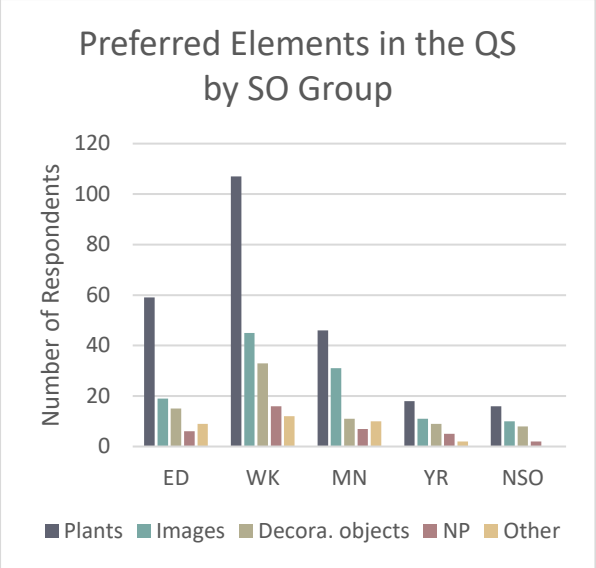

Appreciated Characteristics of the Furniture
Comfort
Variety
Texture
Material
Color
Flexible Use
Other
0
5
10
Number of Respondents

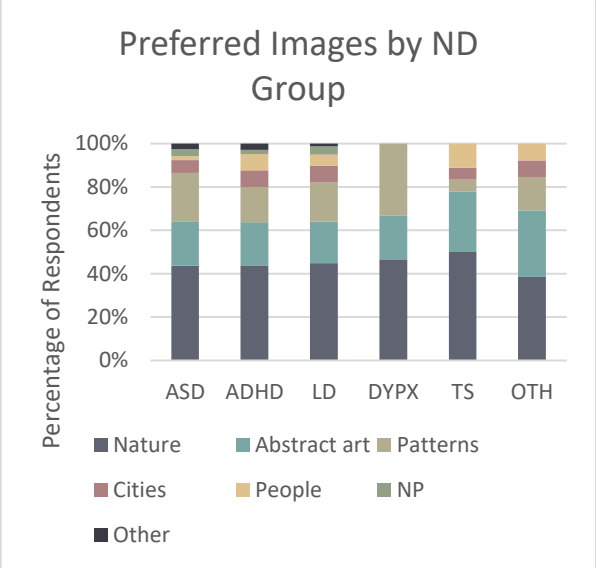

Bothersome Characteristics of the Furniture
Uncomfortable
Inflexible Use
Not enough variety
Unpleasant texture
Too much furniture
Furniture is cold to the touch
Not enough furniture
Too much variety
Dislike for furniture color
Other
0
2
4
6
8
10
Number of Respondents

Decoration

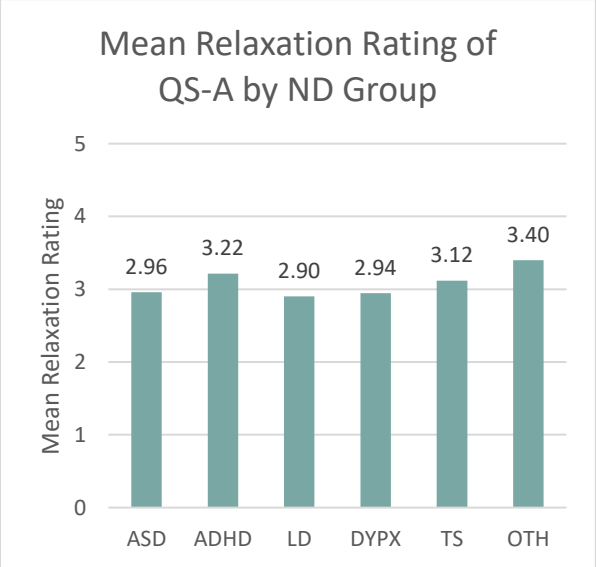

Preferred Elements in the QS by ND Group
Number of Respondents
140
120
100
80
60
40
20
0
ASD
ADHD
LD
DYPX
TS
OTH
Plants
Images
Decora. objects
NP
Other

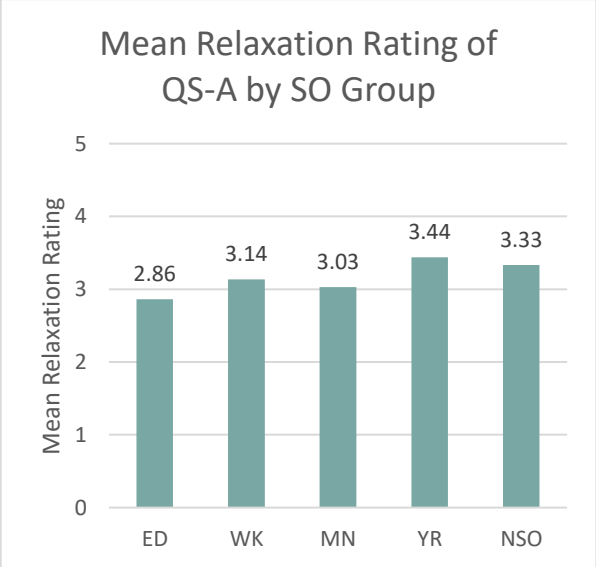

Preferred Elements in the QS by ND Group
Percentage of Respondents
100%
80%
60%
40%
20%
0%
ASD
ADHD
LD
DYPX
TS
OTH
Plants
Images
Decora. objects
NP
Other

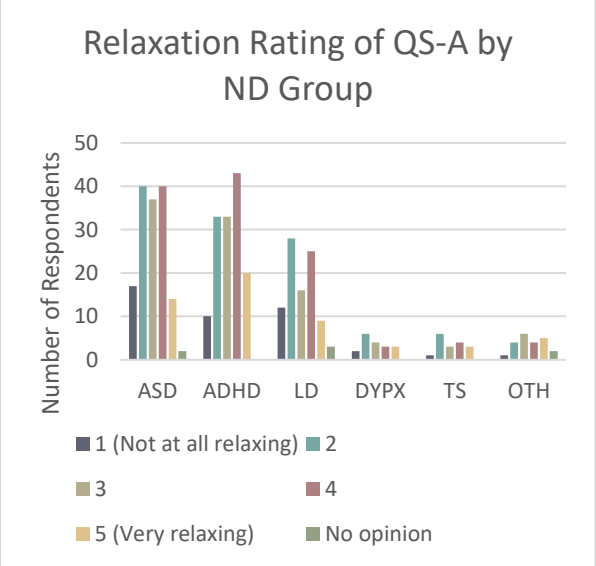


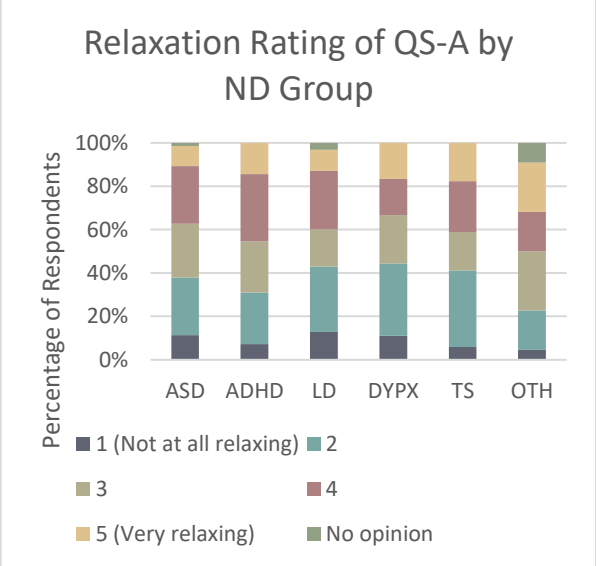


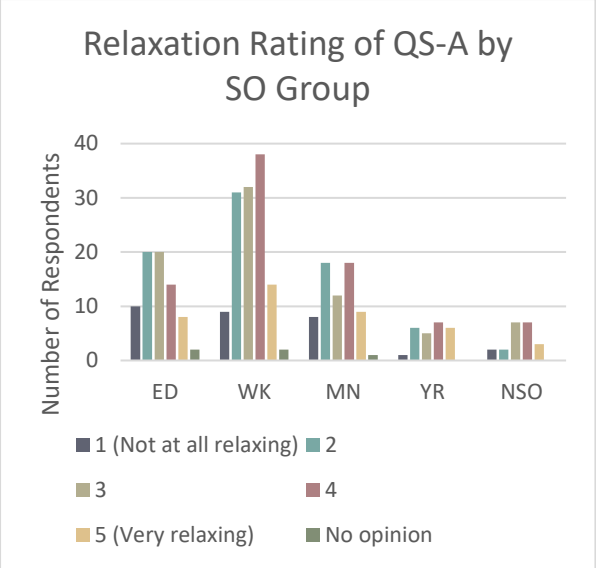
Quiet Space A










Relaxation Rating of QS-A by SO Group
Number of Respondents
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30
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ED
WK
MN
YR
NSO
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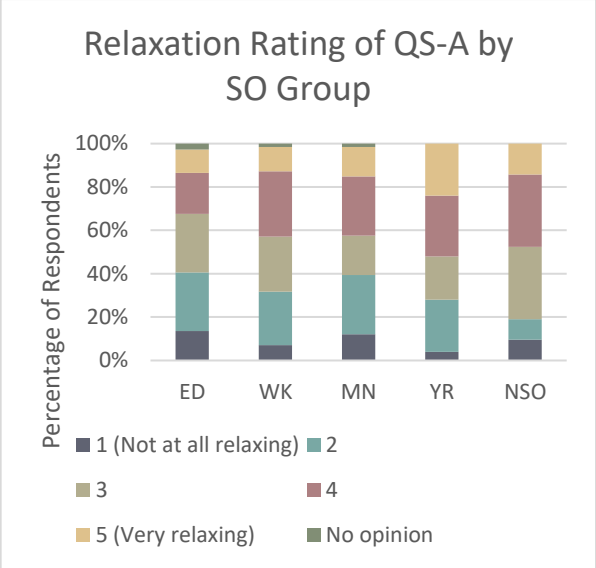
2
3
4
5 (Very relaxing)
No opinion


Relaxation Rating of QS-A by SO Group
Percentage of Respondents
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80%
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40%
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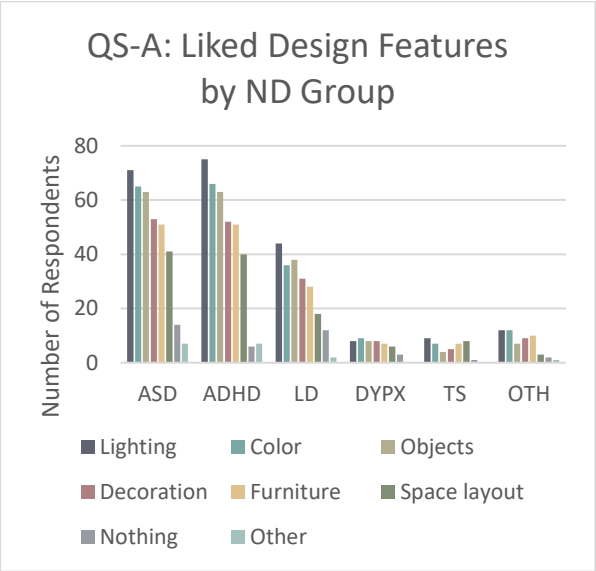
0%
ED
WK
MN
YR
NSO
1 (Not at all relaxing)
2
3
4
5 (Very relaxing)
No opinion


QS-A: Liked Design Features by ND Group
Number of Respondents
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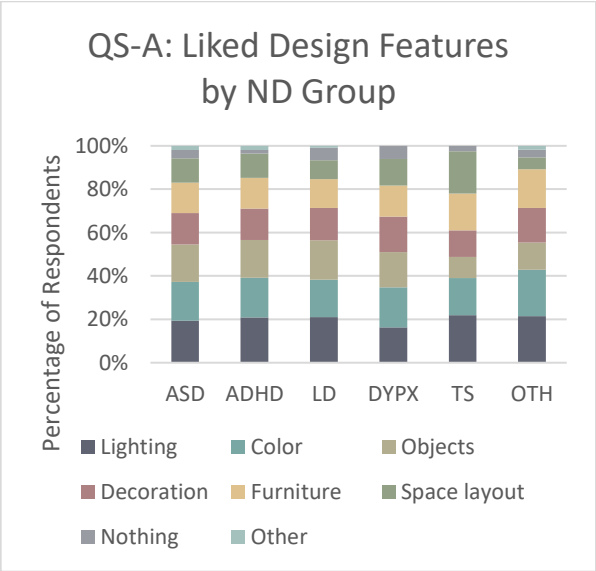
ASD
ADHD
LD
DYPX
TS
OTH
Lighting
Color
Objects
Decoration
Furniture
Space layout
Nothing
Other


QS-A: Liked Design Features by ND Group
Percentage of Respondents
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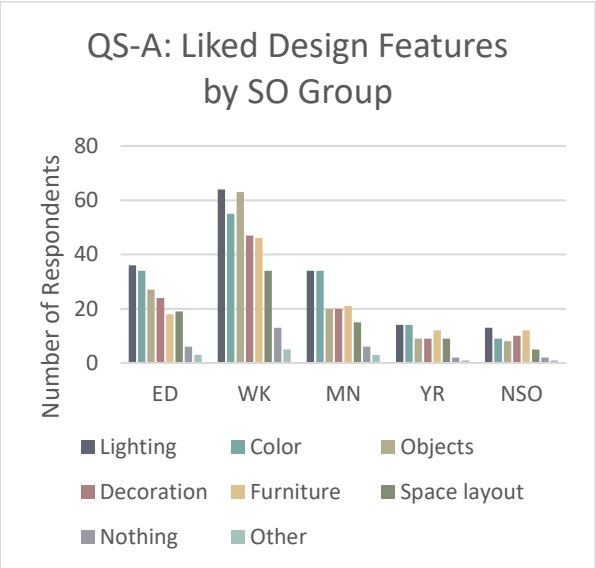
ADHD
LD
DYPX
TS
OTH
Lighting
Color
Objects
Decoration
Furniture
Space layout
Nothing
Other


QS-A: Liked Design Features by SO Group
Number of Respondents
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60
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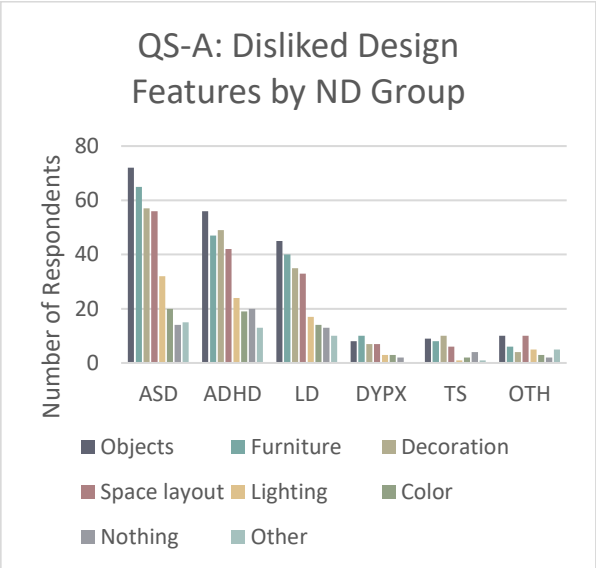
ED
WK
MN
YR
NSO
Lighting
Color
Objects
Decoration
Furniture
Space layout
Nothing
Other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Number of Respondents
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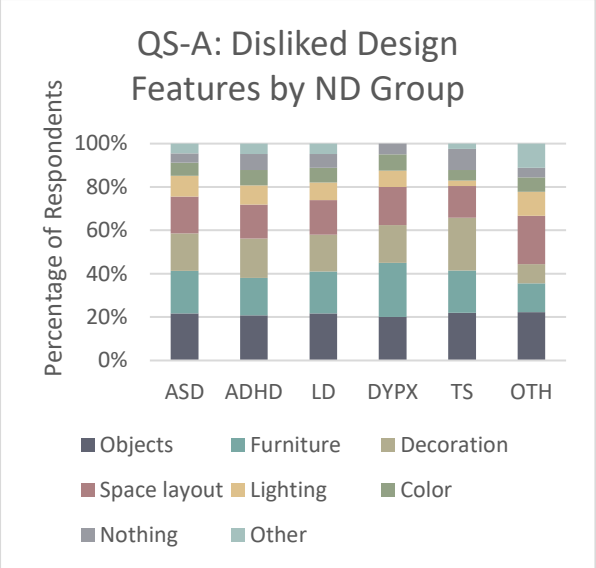
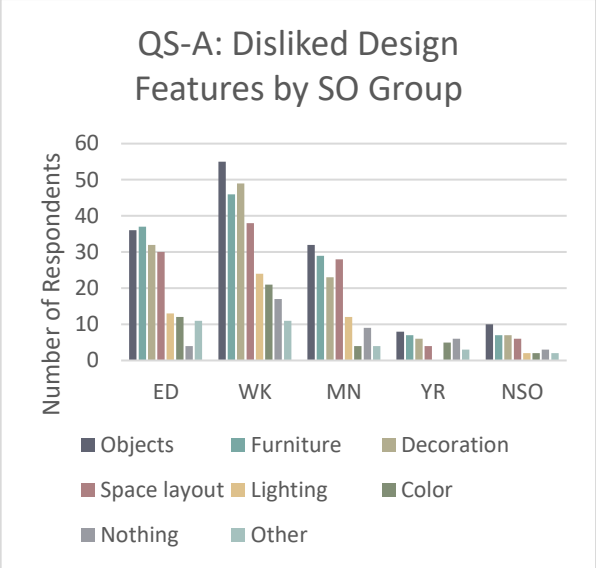
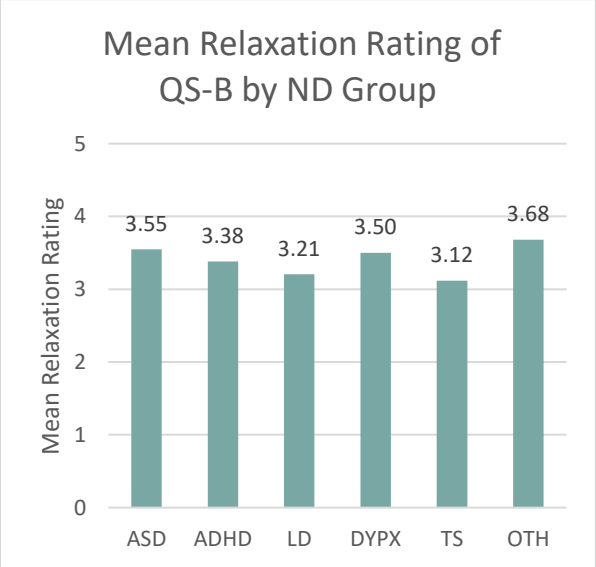
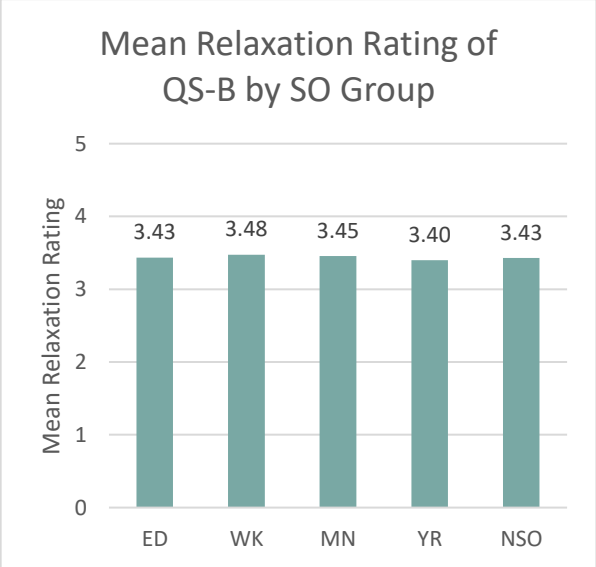
ASD
ADHD
LD
DYPX
TS
OTH
Objects
Furniture
Decoration
Space layout
Lighting
Color
Nothing
Other

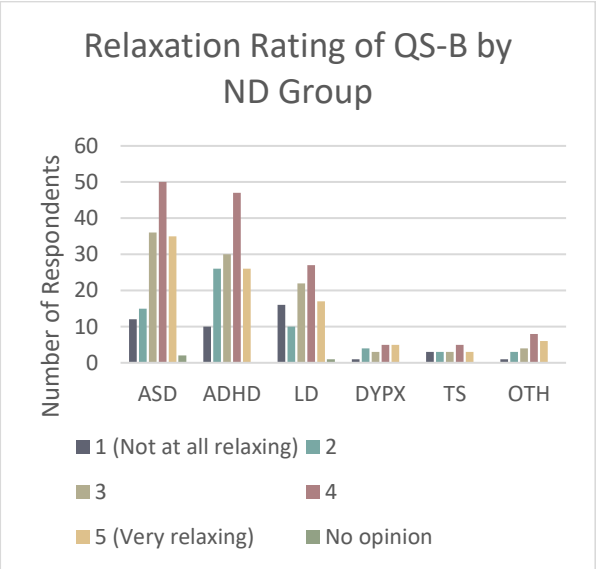


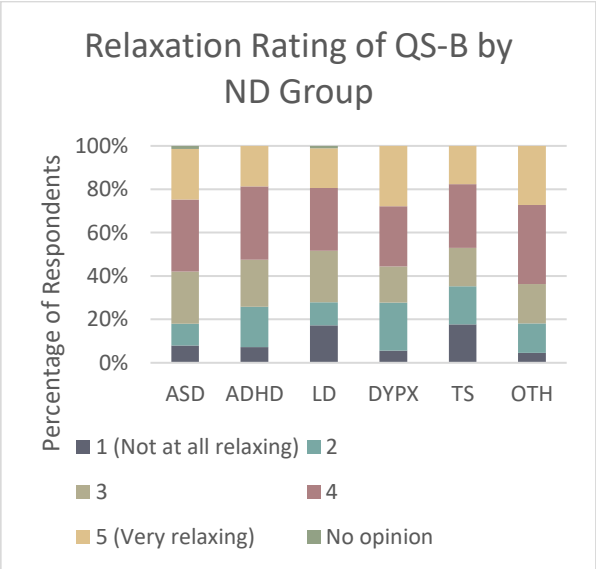


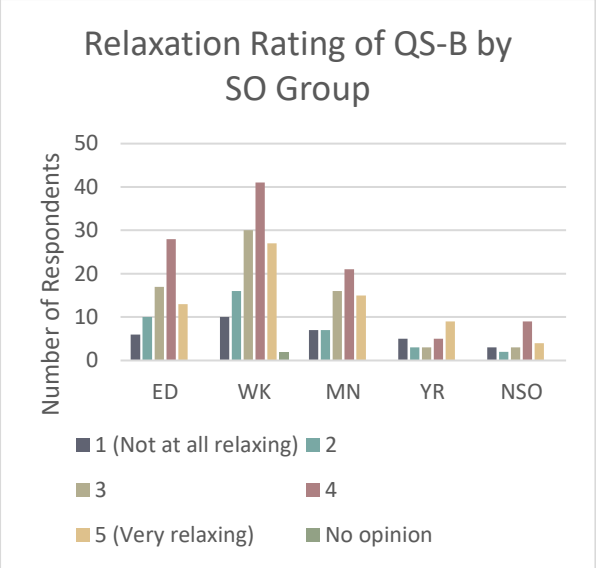
Quiet Space B










Relaxation Rating of QS-B by SO Group
Number of Respondents
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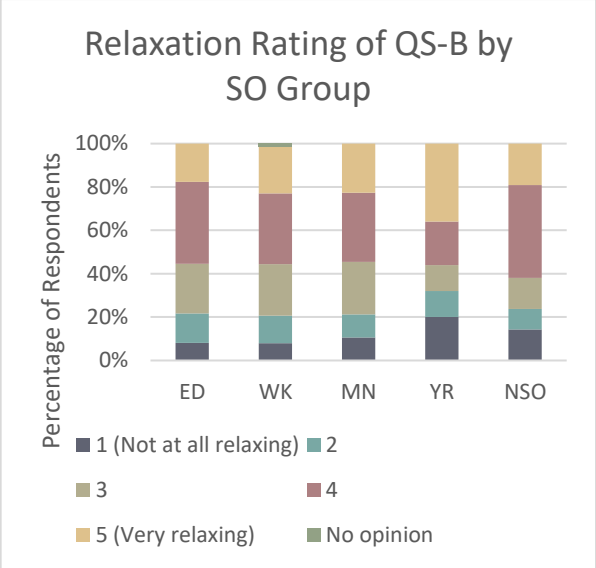
ED
WK
MN
YR
NSO
1 (Not at all relaxing)
2
3
4
5 (Very relaxing)
No opinion


Relaxation Rating of QS-B by SO Group
Percentage of Respondents
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40%
20%
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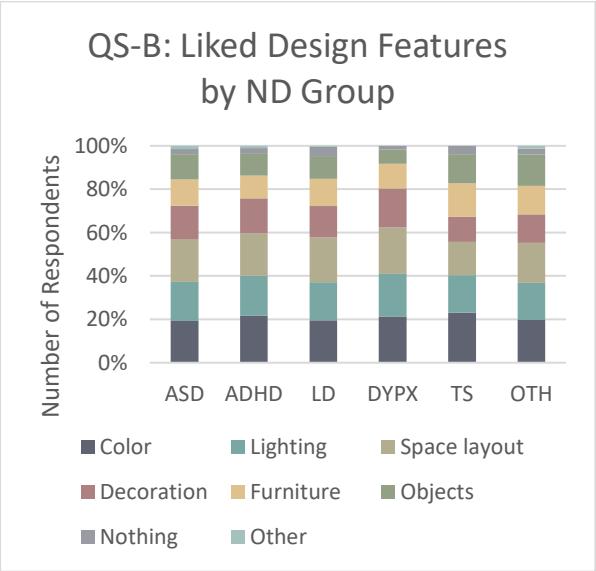
ED
WK
MN
YR
NSO
1 (Not at all relaxing)
2
3
4
5 (Very relaxing)
No opinion


QS-B: Liked Design Features by ND Group
Number of Respondents
100%
80%
60%
40%
20%
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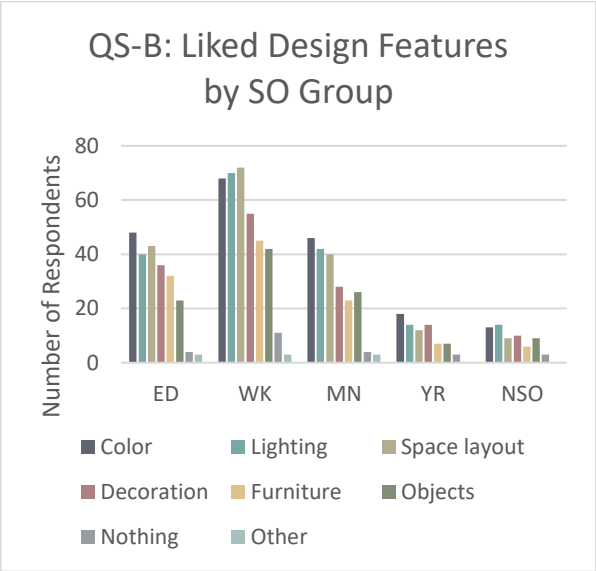
ASD
ADHD
LD
DYPX
TS
OTH
Color
Lighting
Space layout
Decoration
Furniture
Objects
Nothing
Other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Number of Respondents
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Furniture
Objects
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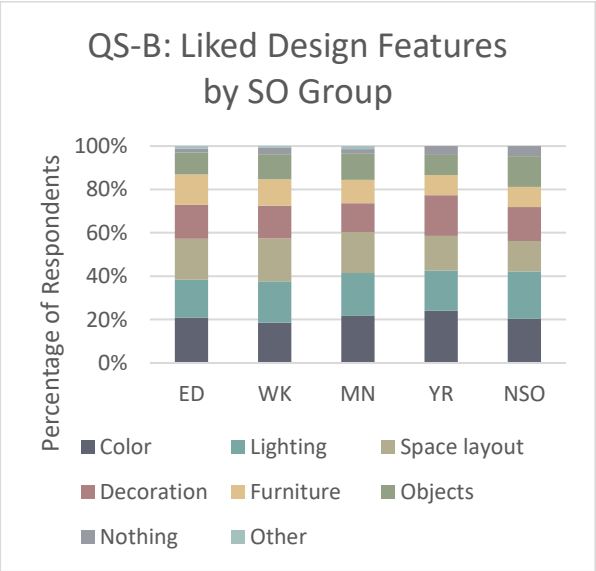
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WK
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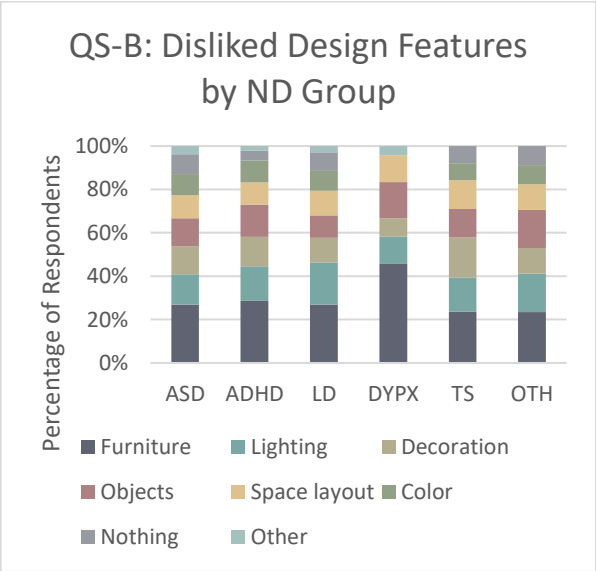
NSO
Color
Lighting
Space layout
Decoration
Furniture
Objects
Nothing
Other


QS-B: Disliked Design Features by ND Group
Percentage of Respondents
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20%
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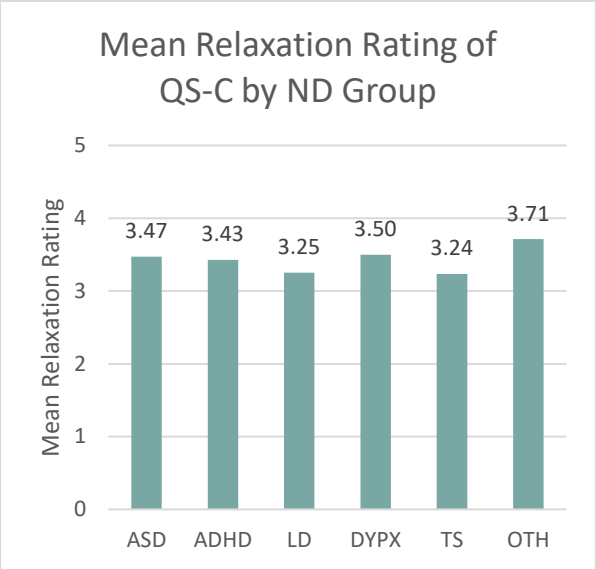
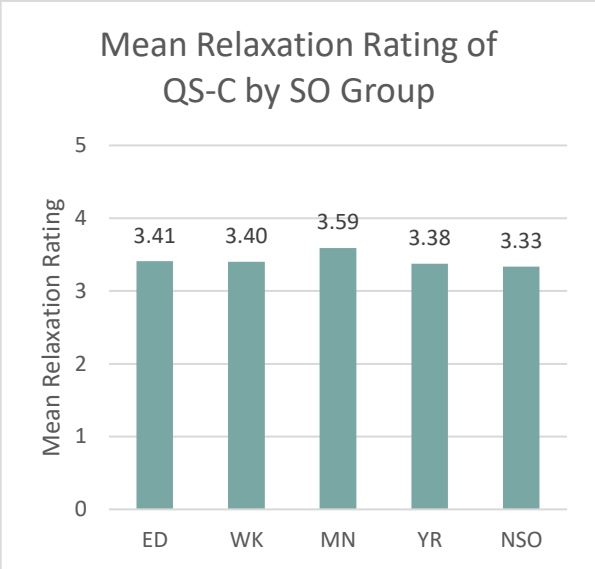
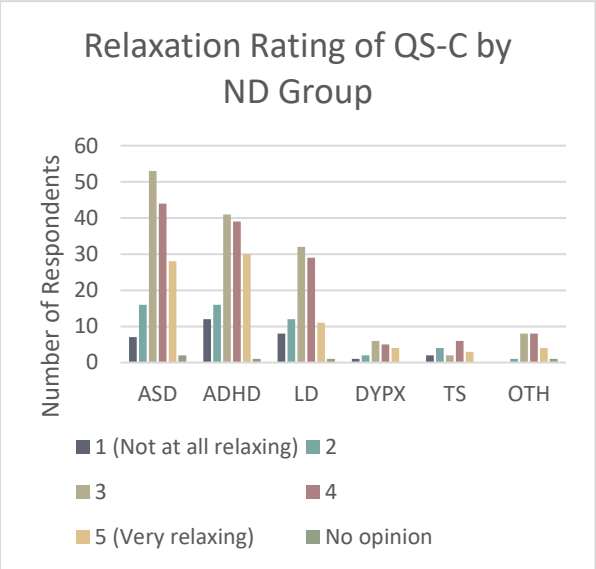
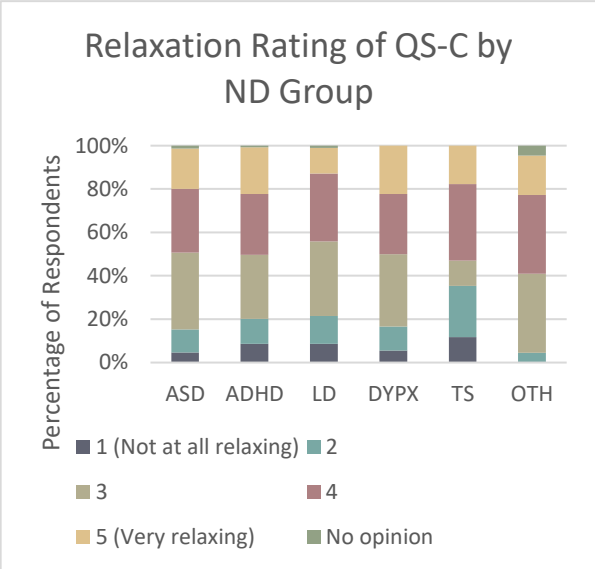
LD
DYPX
TS
OTH
Furniture
Lighting
Decoration
Objects
Space layout
Color
Nothing
Other

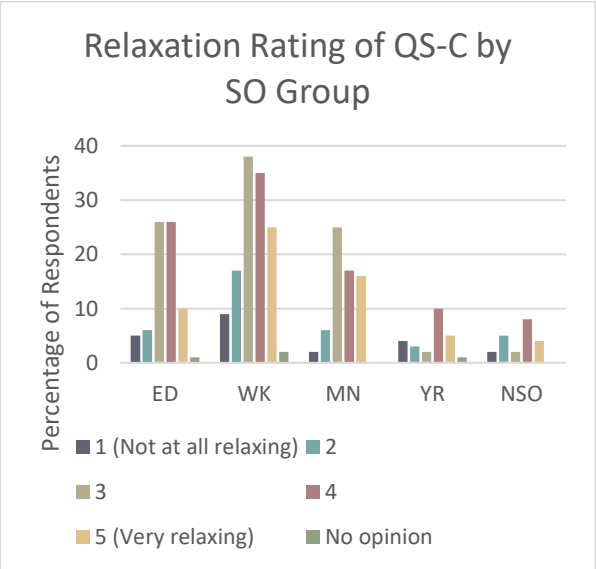
Quiet Space C

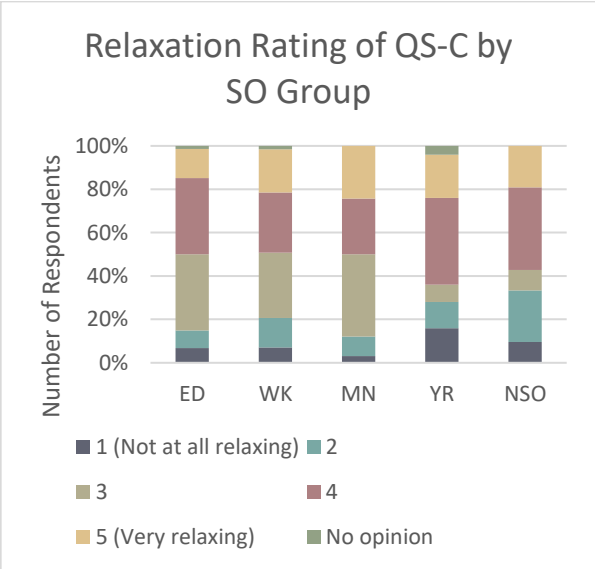


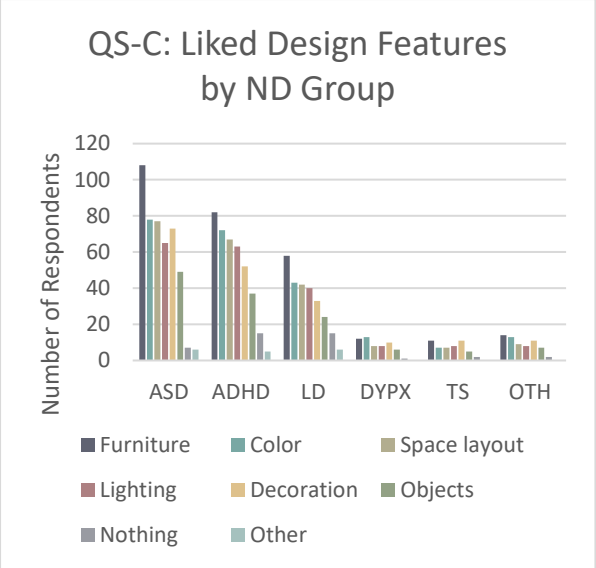


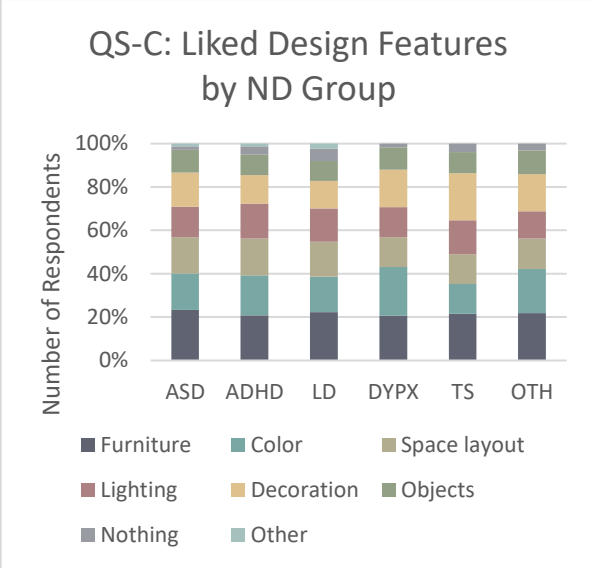


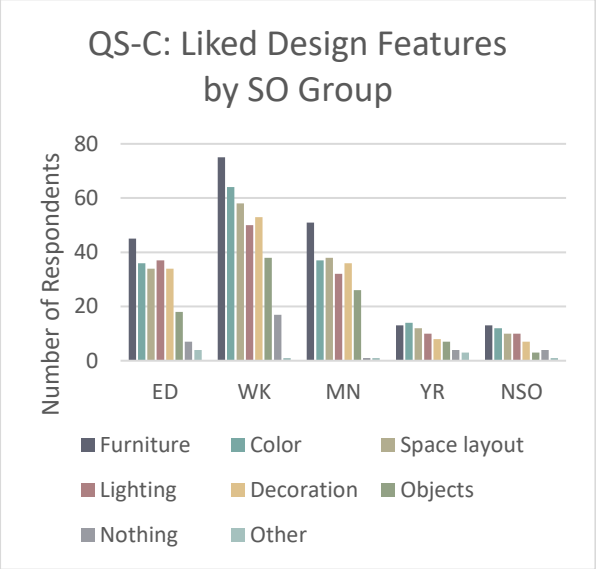


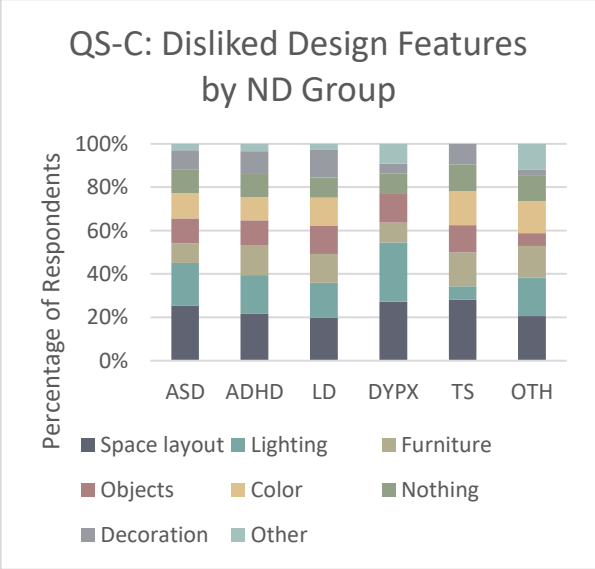




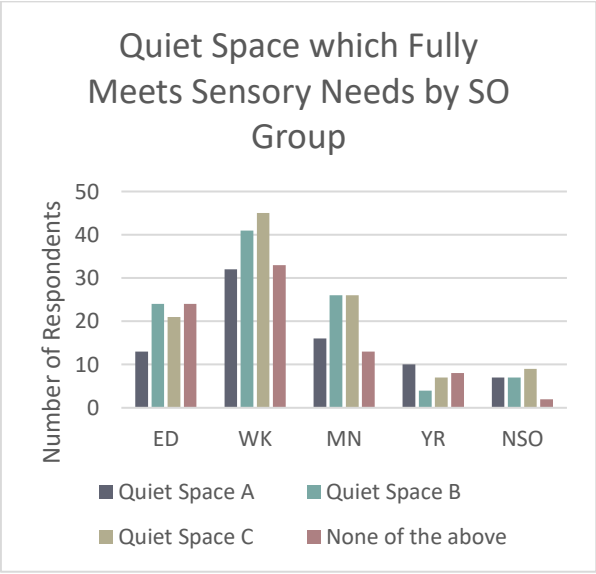








Quiet Space A-C



8.5. Appendix E

Statement of Risk Assessment & Ethics Approval Requirements

Student Candidate Number:19121242
Student Name: Toar Sadia
Student UCL Email Address: toar.sadia.19@ucl.ac.uk
Supervisor Name: Dr Helen Pineo
Supervisor UCL Email Address: helen.pineo@ucl.acuk
Dissertation Research Proposal:

- Title / Topic: **Exploring the preferred design features for quiet spaces by neurodivergent populations**
- Research Question(s) / Aims & Objectives:

  1) What are the current knowledge gaps in designing quiet spaces for neurodivergent populations from the industry perspective?
  2) Which design features of existing quiet spaces are appreciated by neurodivergent populations, and which cause disturbance?
  3) Which design features are preferred for the ideal quiet space for neurodivergent populations?
  4) How do the preferred design features of quiet spaces compare between people with different neurodivergent conditions and how can the design of quiet spaces respond to their varied needs?
  5) Does susceptibility to sensory overload influence the design preferences of neurodivergent people for quiet spaces?

- Data & source (specify all data to be used; if none, explain why): Primary data collected by online survey and interviews.
- Method(s) (specify all methods to be used): Online survey and interviews.

I have read and understood **Step A1 'Does the research require a Risk Assessment?'** and:

- This planned research does NOT require a risk assessment.

I have read and understood **Step A2 'Does the research require External research ethics approval?'** and:

- This planned research does NOT require external ethics review.

External ethics approval is *not required* and
I have read and understood **Step A3 'Is the research Exempt from the need for ethics approval?'** and:

- This planned research is NOT EXEMPT from the need for research ethics approval.

The research is *not exempt* from the need for ethics approval and
I have read and understood **Step A4 'Does the research require High Risk ethics approval?'** and:

- This planned research is NOT deemed high risk.

The research is *not exempt* from the need for ethics approval, does not require high risk ethics approval and:
I have read and understood **Step A5 'Does the research require IEDE MSc low risk ethics review for questions-based methods OR BSEER low risk ethics review for other methods?'** and:

- This planned research requires IEDE MSc Low Risk Ethics approval for questions-based methods and approval will be secured before data collection starts.

I confirm that:

- the information I have provided is accurate to the best of my knowledge.
- if the answers to any of these questions changes, I will go through this protocol again.

NEXT STEPS:

- **STUDENT:** Copy the text of the *completed* statement above into an email and email it to your supervisor.
- **SUPERVISOR:** Reply to the email confirming your approval of the completed statement.
- **STUDENT:**
  - Submit this A6 Statement (matching the one approved by your supervisor) on Moodle as your Dissertation Ethics Declaration.
  - Include this A6 Statement as a Dissertation Appendix after you have BLACKED OUT YOUR NAME & EMAIL ADDRESS so the second marker can mark anonymously.

The Dissertation mark sheet asks the second marker whether this form was filled out correctly and, if not, what % mark deduction they recommend.

THE BARTLETT SCHOOL OF ENVIRONMENT, ENERGY AND RESOURCES

IEDE MSc Dissertation Module
Research Ethics, Data Protection & Risk Check for Question-based Methods
Part D: Review

This form is for the use of the IEDE MSc Dissertation coordinator or their delegate(s) to evaluate student applications completed on the *IEDE MSc Dissertation Research Ethics, Data Protection and Risk Check for Question-based Methods Part B: Student Protocol and Application Form.*

Evaluators must ensure all applications collecting sensitive / special category / criminal records data are reviewed with the Ethics and Dissertation coordinators. Ethics coordinators ensure that any application with any features of High Risk research (see Part A, Step A4) are referred to UCL Research Ethics Committee.

Evaluators must provide students with a completed PDF of this form (not the Word version).

DISSERTATION & TEAM (Refer to B1)	
Student Name: Toar Sadia	Supervisor Name: Helen Pineo
Student UCL Email Address toar.sadia.19@ucl.ac.uk	Supervisor UCL Email Address: helen.pineo@ucl.acuk
Student Candidate Number: 19121242	
Dissertation Research Project Title/Topic: Exploring the preferred design features for quiet spaces by neurodivergent populations	

EVALUATION		Unsatisfactory	Satisfactory	N/A
Evaluator's Name: Lorna Flores Villa				
Date: 08/07/20				
Study is low risk and may commence	☒			
Study requires revised submission to IEDE MSc Research Ethics Team & approval prior to data collection/processing	☐			
Study requires approval from BSEER / UCL (cross out as applicable) Research Ethics Team prior to data collection/processing	☐			
RESEARCH METHOD (Refer to B3, B4, B5 and Attached Questions / Interview/Discussion Guide)				
The research exclusively uses **Question-based Methods** covered by this protocol		☐	☒	
Research does not focus on **vulnerable** participants and there are adequate safeguards to exclude **children** (<18y.o.) from the study		☐	☒	
RESEARCH RISK & PERMISSIONS (Refer to B2 and B6)				
Student and supervisor confirm that the research does not require **external** ethics committee approval.		☐	☒	
Student and supervisor confirm that the research is not deemed **high risk.**		☐	☒	
Correctly identifies if **permission** is necessary and, if necessary, indicates that this will be obtained prior to data collection?		☐	☒	☐
Correctly identifies any **risks** to the researcher and attaches any necessary Risk Assessment?		☐	☒	☐
If research will be conducted in a country where requiring **local ethical approval** (according to UCL's Flowchart for Planning Overseas Research [under development]), has sufficient evidence of local ethical approval been attached to the application?		☐	☐	☒
CONSENT (Refer to B5, Attached Participant Information and consent process)				
Process of **choosing and inviting participants** and **providing Participant Information in advance** are all satisfactory		☐	☒	
Participant Information covers **necessary issues** (Researcher & says if student, Institution, funder, study title & purpose, how participant selected, what happens to participant, how long it will take, benefits, potential risks/harms, anonymity/confidentiality, voluntariness, right to withdraw, contact details)		☐	☒	
Participant Information is written in an **appropriate style** (Study title and content appropriately phrased for participants, level of detail appropriate for participants, sufficiently concise)		☐	☒	
If participants known to researcher…appropriate procedures to ensure participants feel free to not participate & withdraw from the study		☐	☒	☐
Process of **recording consent** uses a method approved for this light-touch within-module review		☐	☒	
SENSITIVITY, DATA PROTECTION & PRIVACY (Refer to B4, B5 and Attached Questions / Interview/Discussion Guide)				
Correctly identifies whether/not **personal data** are being collected / processed (Definition of personal data is embedded in the form…check whole application to ensure applicant answered this Q correctly)		☐	☒	
Correctly identifies whether/not **special category** personal data and/or criminal records data are being collected / processed (Examples of such data embedded in the form…check whole application to ensure applicant answered this Q correctly)		☐	☒	
If **sensitive** questions / **special category** / criminal records data used… application includes all questions / discussion / interview guides?		☐	☒	☐
If **sensitive** questions / **special category** / criminal records data used… Ethics and Dissertation coordinators approved? Must demonstrate public interest & using minimum special category data necessary Research of particular concern is that conducted overseas and/or in sensitive contexts and/or with colleagues / students / clients		☐	☒	☐
If **personal data and/or special category** / criminal records personal data are being used… confirms will follow the protocol		☐	☐	☒
If **participants are known to researcher**…procedures to protect participants' privacy (EG data collected &/or collection method)		☐	☐	☒

8.6. Appendix F

Quiet Spaces Survey

English

* *Indicates required questions*

You are invited to participate in this survey as a part of a Master's research project. The survey should take about 10-20 minutes of your time. You can save your progress at any time by clicking on the 'save' button and returning at a later time.

What is the research's purpose? Certain populations with neurodivergent conditions have been shown to benefit from having access to quiet spaces. This study explores how neurodivergent populations would prefer for quiet spaces to be designed.

What are neurodivergent conditions? Neurodiversity is a perspective by which neurological differences are viewed as normal human variations. These differences are considered neurodivergent and may include conditions such as dyslexia, attention deficit hyperactivity disorder and autism spectrum disorder*.

What is a quiet space? A quiet space provides a calm environment with lower stimulation where people can find relief from stress and sensory overload. The space does not necessarily have to be silent but rather create a mentally 'quiet' environment promoting relaxation. Such spaces can sometimes be found in airports, schools and offices.

Do I have to participate? No, participation in the research is entirely voluntary. You can withdraw from participating in the research at any time without giving a reason and without any penalty.

Will my participation be kept confidential? Yes, all the information that we collect about you during the research will be kept anonymous and strictly confidential. You will not be able to be identified in any ensuing reports or publications.

What will happen to the results? The results of the research project will be included in a dissertation which will be electronically available within University College London. Please let the researcher know if you would like a copy of the dissertation. The results of the research will help to inform design guidelines and to bring about better and more suitable design of quiet spaces for neurodivergent populations.

Contacts

For further information or if you are concerned about any part of this research, please contact:

The researcher: Toar Sadia, toar.sadia.19@ucl.ac.uk

The supervisor & HWSB MSc Course Director: Dr Helen Pineo, helen.pineo@ucl.ac.uk

The Department Director of Ethics: Michelle Shipworth, m.shipworth@ucl.ac.uk

*Additional examples of conditions include dyscalculia, dysgraphia, dyspraxia, epilepsy, hyperlexia, obsessive compulsive disorder (OCD) and Tourette syndrome.

Participant Consent

- I am 18 years of age or older and I am independent and capable of self-care.
- I understand the project information for this research and all of my questions have been answered.
- I know that I can stop the survey at any time without giving a reason.
- I agree that my anonymised research data may be used by others for future research.

Do you agree with the above statements and wish to participate in this survey? *

- ○ Yes
- ○ No

Neurodivergent conditions include: attention deficit hyperactivity disorder (ADHD), autism spectrum disorder* (ASD), dyscalculia, dysgraphia, dyslexia, dyspraxia, epilepsy, hyperlexia, obsessive compulsive disorder (OCD) and Tourette syndrome.

*Autism spectrum disorder includes Asperger's syndrome, autistic disorder and pervasive developmental disorder not otherwise specified.

Do you identify yourself as having a neurodivergent condition? *

- ○ Yes
- ○ No
- ○ Prefer not to answer
- ○ I am not sure

If you have any comments, please enter them below:

If you would like to identify which neurodivergent condition you have, please select below. This question is optional.

- ☐ Attention deficit hyperactivity disorder (ADHD)
- ☐ Autism spectrum disorder (ASD)
- ☐ Learning disability/difference (dyslexia, dyscalculia and/or dysgraphia)
- ☐ Prefer not to answer
- ☐ Other

'**Sensory overload** is a condition in which sensory stimuli are received at an excessive rate or intensity. Sensory overload can produce increases in heart rate, breathing, blood pressure, confusion, anxiety, mental distress, and/or erratic behavior.' (Medical dictionary, 2009)

Sensory overload may happen when lights feels unbearably bright or the environment sounds intolerably loud, such as when multiple conversations are going on in one space.

Have you had any experiences of sensory overload? *

- ○ Yes, recently
- ○ Yes, a long time ago
- ○ No

Approximately at which frequency did you experience or are you experiencing sensory overload? *

- ○ Everyday
- ○ Once to a few times a week
- ○ Once to a few times a month
- ○ Once to a few times a year
- ○ Once every couple of years

A **quiet space** provides a calm environment with lower stimulation where people can find relief from stress and sensory overload. The space does not necessarily have to be silent but rather create a mentally 'quiet' environment promoting relaxation. Such spaces can sometimes be found in airports, schools and offices.

A quiet space may also be called a restorative, retreat, contemplation, meditation, silence, refuge, escape or calming space.

Have you ever been to a dedicated quiet space? *

- ○ Yes
- ○ No

Experience in a Quiet Space

Was the room where the quiet space was located used only for the quiet space or shared with another use?

- ○ Used only for the quiet space
- ○ Shared with another use
- ○ I have been in both types of quiet spaces

Which other use was the quiet space shared with? Choose all that apply.

- ☐ Learning (e.g. classroom)
- ☐ Working (e.g. office)
- ☐ Exercising (e.g. gymnasium)
- ☐ Other

From your experience in quiet space (one or multiple), which of the following design features did you appreciate most?

- ○ Space layout
- ○ Color
- ○ Decoration
- ○ Sound
- ○ Lighting
- ○ Furniture
- ○ None
- ○ Other

From your experience in quiet spaces (one or multiple), which of the following design features bothered you most?

- ○ Space layout
- ○ Color
- ○ Decoration
- ○ Sound
- ○ Lighting
- ○ Furniture
- ○ None
- ○ Other

How would you describe the qualities you appreciated of the space layout? Choose one option for each row.

○	Simple	○	Intricate
○	Cozy	○	Spacious
○	Private	○	Communal
○	Informal	○	Formal

If you have any additional comments, please enter them below:

How would you describe the qualities of the space layout which bothered you? Choose one option for each row.

○	Bare	○	Cluttered
○	Too small	○	Too large
○	Remote	○	Exposed
○	Too informal	○	Too formal

If you have any additional comments, please enter them below:

How would you describe the overall color scheme of the quiet space (including walls, furniture, etc.)? Choose all that apply.

☐	A few colors	☐	A variety of colors
☐	Dark	☐	Light
☐	Vivid (e.g. bright yellow)	☐	Muted (e.g. pastel)
☐	Warm (e.g. red)	☐	Cold (e.g. blue)
☐	Shades of grey	☐	Natural materials (e.g. wood)

If you have any additional comments, please enter them below:

How would you describe what bothered you about the overall color scheme of the quiet space (including walls, furniture, etc.)? Choose all that apply.

☐	Too few colors	☐	Too many colors
☐	Too dark	☐	Too light
☐	Too vivid	☐	Too muted
☐	Too warm	☐	Too cold
☐	Too grey	☐	Too much natural materials

If you have any additional comments, please enter them below:

What bothered you about the decoration in the quiet space? Choose all that apply.

- [ ] Too much decoration
- [ ] Too little decoration
- [ ] Unpleasant decoration
- [ ] Distracting decoration
- [ ] Other

Which of the following could you find in the quiet space? Choose all that apply.

- [ ] Images (e.g. artwork, photos)
- [ ] Plants
- [ ] Decorative objects
- [ ] None
- [ ] Other

Which types of images were in the quiet space? Choose all that apply.

- [ ] Nature
- [ ] Cities
- [ ] People
- [ ] Patterns
- [ ] Abstract art
- [ ] None
- [ ] I do not remember
- [ ] Other

How noisy or quiet was the quiet space?

	1	2	3	4	5		I do not remember
Silent (1)	○	○	○	○	○	Very loud (5)	○

What were the main sources of sound? Choose all that apply.

- [ ] No sound
- [ ] Sound from outside
- [ ] Sound from inside
- [ ] White noise
- [ ] Nature sounds
- [ ] City sounds
- [ ] Sounds from people
- [ ] Music
- [ ] Other

Which type of nature sound was it most similar to? Choose all that apply.

- [ ] Rustling leaves
- [ ] Wind
- [ ] Birds chirping
- [ ] Water
- [ ] Ocean waves
- [ ] Deep ocean sounds
- [ ] Rain
- [ ] Forest
- [ ] I do not remember
- [ ] Other

How would you describe the music? Choose all that apply.

- ☐ Vocal
- ☐ Instrumental
- ☐ Electronic
- ☐ Soft
- ☐ Loud
- ☐ Slow
- ☐ Upbeat
- ☐ I do not remember
- ☐ Other _____

How would you describe the lighting levels?

	1	2	3	4	5		
Very dim lights (1)	○	○	○	○	○	Very bright lights (5)	I do not remember ○

Which of the following best describes the lighting of the quiet space?

Credit: Shutterstock

	1	2	3	4	5	6	7	8	9	10		
Orangish (warm)	○	○	○	○	○	○	○	○	○	○	Bluish (cold)	I do not remember ○

How would you describe the qualities of the lighting which bothered you? Choose all that apply.

- [ ] Too bright
- [ ] Too dim
- [ ] Too many sources of light
- [ ] Too few sources of light
- [ ] Too much daylight
- [ ] No daylight
- [ ] Too much glare
- [ ] Unsatisfied with lighting color
- [ ] Unsatisfied with luminaire type (e.g. incandescent, fluorescent, LED)
- [ ] Unsatisfied with direction of light
- [ ] Unsatisfied with lack of control over lighting
- [ ] Other

Were there any windows to allow daylight into the quiet space?

- ○ Yes, too many
- ○ Yes, just right
- ○ Yes, too few
- ○ No

Was there any colored lighting in the quiet space (outside of typical white light variations)?

- ○ Yes
- ○ No
- ○ I do not remember

Which colors were the lights? Choose all that apply.

- [ ] Yellow
- [ ] Orange
- [ ] Red
- [ ] Pink
- [ ] Purple
- [ ] Blue
- [ ] Green
- [ ] Other

How comfortable did you find the furniture?

	1	2	3	4	5		
Not at all comfortable (1)	○	○	○	○	○	Very comfortable (5)	I do not remember ○

How would you describe the hardness or softness of the furniture?

	1	2	3	4	5	
Very hard (1)	○	○	○	○	○	Very soft (5)

Which materials was the furniture made of? Choose all that apply.

- [ ] Plastic
- [ ] Wood
- [ ] Metal
- [ ] Leather
- [ ] Fabric
- [ ] Other

What did you appreciate about the characteristics of the furniture? Choose all that apply.

- [ ] The variety in types of furniture
- [ ] Comfort
- [ ] Color
- [ ] Material
- [ ] Texture (e.g. smooth, rough)
- [ ] Flexibility in use
- [ ] Other

What bothered you about the furniture? Choose all that apply.

- ☐ Too much furniture
- ☐ Not enough furniture
- ☐ Too much variety
- ☐ Not enough variety
- ☐ Uncomfortable furniture
- ☐ Dislike for furniture color
- ☐ Unpleasant texture
- ☐ Furniture is cold to the touch
- ☐ Inflexibility in use
- ☐ Other

Which of the following were in the quiet space? Choose all that apply.

- ☐ Tables
- ☐ Chairs
- ☐ Bean bags
- ☐ Hammocks
- ☐ Pillows
- ☐ Blankets
- ☐ Beds
- ☐ Books
- ☐ Play objects
- ☐ Office supplies (e.g. paper, colored pencils)
- ☐ Other

What did you appreciate about the feature you specified () in the quiet space?

What bothered you about the feature you specified () in the quiet space?

Do you have any additional comments about what you appreciated or what bothered you in the quiet space?

Ideal Quiet Space

The following questions are about how you would like to design the ideal quiet space.

Ideally, how would you like the space layout of the quiet space to be? Choose one option for each row. *

○	Simple	○	Intricate
○	Cozy	○	Spacious
○	Private	○	Communal
○	Informal	○	Formal

If you have any additional comments, please enter them below:

Which types of walls would you like in a quiet space? Choose all that apply. *

- ☐ White walls
- ☐ Colored walls
- ☐ Wallpaper with pattern
- ☐ Walls with texture (e.g. brick, wood)
- ☐ No preference
- ☐ Other

Which overall color scheme would you prefer for a quiet space (including walls, furniture, etc.)? Choose all that apply. *

☐	A few colors	☐	A variety of colors
☐	Dark	☐	Light
☐	Vivid (e.g. bright yellow)	☐	Muted (e.g. pastel)
☐	Warm (e.g. red)	☐	Cold (e.g. blue)
☐	Shades of grey	☐	Natural materials (e.g. wood)

If you have any additional comments, please enter them below:

Which of the following would you like to have in a quiet space? Choose all that apply. *

- ☐ Images (e.g. artwork, photos)
- ☐ Plants
- ☐ Decorative objects
- ☐ No preference
- ☐ Other

Which types of images would you like to have? Choose all that apply.

- ☐ Nature
- ☐ Cities
- ☐ People
- ☐ Patterns
- ☐ Abstract art
- ☐ No preference
- ☐ Other

Would you prefer to have windows in the quiet space? Choose all that apply. *

- [ ] Yes, looking outside
- [ ] Yes, only for sunlight and above eye level to avoid distracting views
- [ ] Yes, looking into the building
- [ ] Maybe, depending on the potential views
- [ ] No
- [ ] No preference
- [ ] Other

Which types of sounds would you prefer in a quiet space? Choose all that apply. *

- [ ] No sound
- [ ] White noise
- [ ] Nature sounds
- [ ] City sounds
- [ ] Sounds from people
- [ ] Music
- [ ] No preference
- [ ] Other

Which types of nature sounds would you prefer in a quiet space? Choose all that apply.

- [ ] Rustling leaves
- [ ] Wind
- [ ] Birds chirping
- [ ] Water
- [ ] Ocean waves
- [ ] Deep ocean sounds
- [ ] Rain
- [ ] Forest
- [ ] No preference

☐ Other

How would you like the music to be? Choose all that apply.

☐ Vocal

☐ Instrumental

☐ Electronic

☐ Soft

☐ Loud

☐ Slow

☐ Upbeat

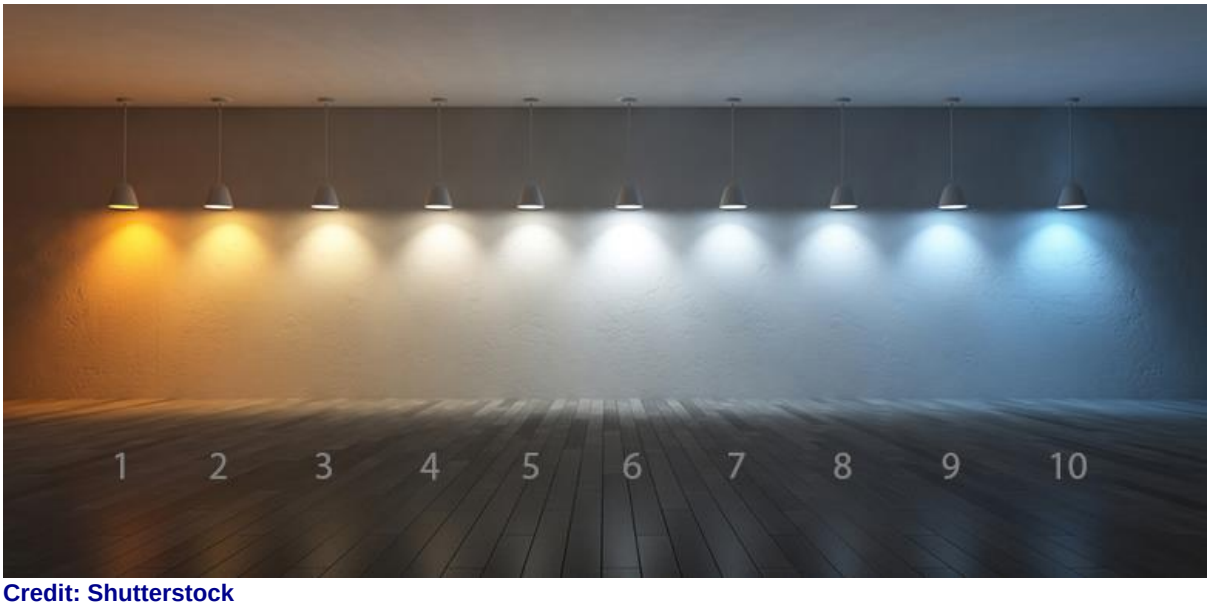
☐ No preference

☐ Other

Which lighting levels would you prefer for a quiet space? *

	1	2	3	4	5		No preference
Very dim lights (1)	○	○	○	○	○	Very bright lights (5)	○

Which lighting would you prefer for a quiet space? *



Credit: Shutterstock

	1	2	3	4	5	6	7	8	9	10		No preference
Orangish (warm)	○	○	○	○	○	○	○	○	○	○	Bluish (cold)	○

Would you prefer the quiet space to have colored lighting (outside of typical white light variations)? *

- ○ Yes, all lights
- ○ Yes, some lights
- ○ No
- ○ No preference

Which colored lights would you prefer? Choose all that apply.

- ☐ Yellow
- ☐ Orange
- ☐ Red
- ☐ Pink
- ☐ Purple
- ☐ Blue
- ☐ Green
- ☐ No preference
- ☐ Other

Which of the following do you find important for the furniture of the quiet space? Choose all that apply. *

- ☐ Having a variety of furniture
- ☐ Comfort
- ☐ Color
- ☐ Material
- ☐ Texture (e.g. smooth, rough)
- ☐ Flexibility in use
- ☐ No preference
- ☐ Other

Which materials would you prefer that the furniture be made of? Choose all that apply. *

- [ ] Plastic
- [ ] Wood
- [ ] Metal
- [ ] Leather
- [ ] Fabric
- [ ] No preference
- [ ] Other

Which of the following would you like to have in the quiet space? Choose all that apply. *

- [ ] Tables
- [ ] Chairs
- [ ] Bean bags
- [ ] Hammocks
- [ ] Pillows
- [ ] Blankets
- [ ] Beds
- [ ] Books
- [ ] Play objects
- [ ] Office supplies (e.g. paper, colored pencils)
- [ ] No preference
- [ ] Other

How would you rate the importance of each feature in a quiet space? *

	Not at all important	Low importance	Neutral	Important	Very important
Space layout	○	○	○	○	○
Color	○	○	○	○	○
Decoration	○	○	○	○	○
Sound	○	○	○	○	○
Lighting	○	○	○	○	○
Furniture	○	○	○	○	○

Perception of Quiet Spaces

Credit: Houzz, Albuquerque

Quiet Space A

How relaxing do you find Quiet Space A? *

	1	2	3	4	5		No opinion
Not at all relaxing (1)	○	○	○	○	○	Very relaxing (5)	○

If anything, what do you like about Quiet Space A? Choose all that apply. *

- [ ] Space layout
- [ ] Color
- [ ] Decoration
- [ ] Lighting
- [ ] Furniture
- [ ] Objects
- [ ] Nothing
- [ ] Other

If you have any additional comments or clarifications, please enter them below:

If anything, what do you dislike about Quiet Space A? Choose all that apply. *

- [ ] Space layout
- [ ] Color
- [ ] Decoration
- [ ] Lighting
- [ ] Furniture
- [ ] Objects
- [ ] Nothing
- [ ] Other

If you have any additional comments or clarifications, please enter them below:

Credit: Dusit Thani Manila

Quiet Space B

How relaxing do you find Quiet Space B? *

	1	2	3	4	5		No opinion
Not at all relaxing (1)	○	○	○	○	○	Very relaxing (5)	○

If anything, what do you like about Quiet Space B? Choose all that apply. *

- ☐ Space layout
- ☐ Color
- ☐ Decoration
- ☐ Lighting
- ☐ Furniture
- ☐ Objects
- ☐ Nothing
- ☐ Other

If you have any additional comments or clarifications, please enter them below:

If anything, what do you dislike about Quiet Space B? Choose all that apply. *

- [ ] Space layout
- [ ] Color
- [ ] Decoration
- [ ] Lighting
- [ ] Furniture
- [ ] Objects
- [ ] Nothing
- [ ] Other

If you have any additional comments or clarifications, please enter them below:

Which of the quiet spaces appear to fully meet your sensory needs? Choose all that apply. *

- [ ]

Quiet Space A

Quiet Space B

Quiet Space C

None of the above

Do you think it would be beneficial for you to have access to a quiet space at certain times? *

Yes

Maybe

No

From your experience, how important would it be to have a quiet space in each of the following spaces? *

	Not at all important	Low importance	Neutral	Important	Very important
Workplaces	○	○	○	○	○
Educational spaces (e.g. schools, universities)	○	○	○	○	○
Healthcare spaces (e.g. hospitals, clinics)	○	○	○	○	○
Transportation hubs (e.g. airports, train stations)	○	○	○	○	○
Government buildings (e.g. post office, courts)	○	○	○	○	○
Malls, shopping centers	○	○	○	○	○
Stadiums, sport centers	○	○	○	○	○
Theaters, music venues	○	○	○	○	○

Are there any additional places in which you think it would be beneficial to have quiet spaces? If so, please specify.

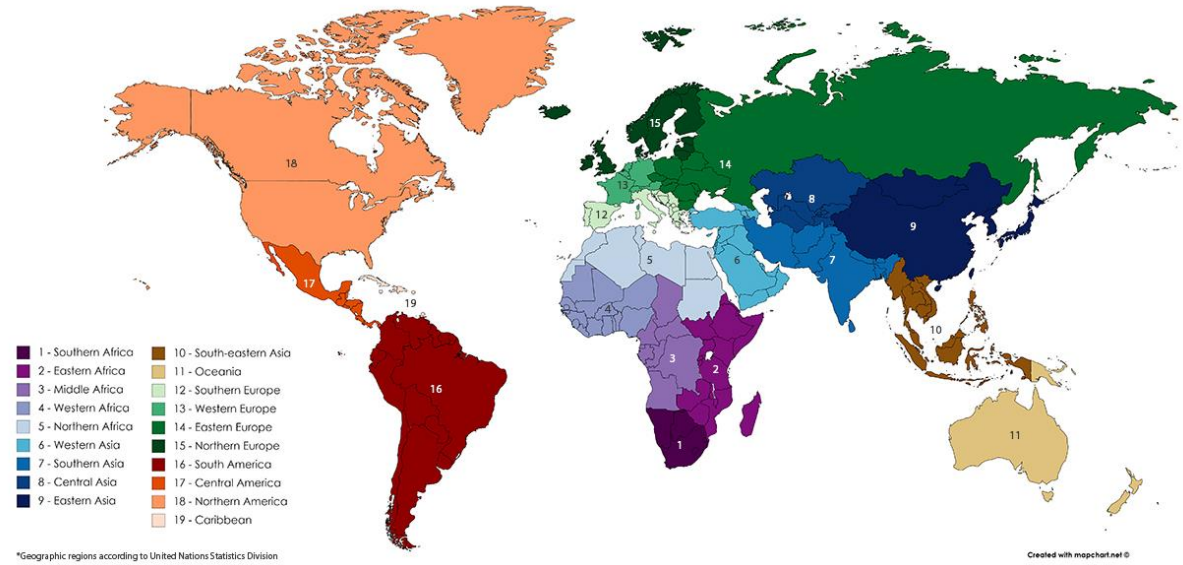
Would you like to share any additional thoughts or comments? If so, please do so below.

Please select your gender *

- ○ Female
- ○ Male
- ○ Non-binary/third gender
- ○ Prefer not to answer
- ○ Other

Please select your age range *

- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- 65 - 74
- 75 and over
- Prefer not to answer



In which region do you currently live? *

This is the final question, in order to submit the survey please click on 'Finish'.