Alberta
Rural
Development
Network

Psychology of Aesthetics
A design guide for affordable housing

A collaborative partnership between

Alberta Rural Development Network
and
Alberta Real Estate Foundation

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INTRODUCTION

In 1983, an Environmental Psychologist named Roger Ulrich observed something unexpected while working at a suburban Pennsylvania hospital: certain patients happened to be having significantly better recovery than others within the same surgical ward. Urlich was examining the medical records of patients recovering from gallbladder surgery. Some fraction of patients had quicker recoveries, a lower need for pain medication, and had fewer post-surgery complications, in a way that was consistent across several years. There was nothing remarkable about the ward itself. Patients shared rooms in pairs, and each room had a window. This particular wing of the hospital stretched outwards towards the edge of the hospital grounds, so that several of the rooms looked out onto a forested area, while the others looked across at a brick wall on the side of the hospital. As it turns out, this was critical: it was the rooms with windows facing a forest view that held the patients who had better recoveries. Ulrich had discovered through the scientific process what tenants all over the world had known for decades: that our physical surroundings could have a direct impact on our health.

He was by no means alone in his assessment. The influence of our "lived environment" on behavior has long been acknowledged by architects, designers, and indigenous healers. It's not simply physical health that has been demonstrated to be influenced by our lived spaces. The scientific literature on the impact of interior design on mental health is extensive, with a wide range of study such as hospitals [1], school settings [2] [3], office environments [4], and commercial settings [5].

The effort to incorporate "healthy design" into new builds has taken off in the past decade. Several groups have published building standards - in-depth guides by which developers can plan and promote their commercial and residential spaces. These standards follow rubrics, and train evaluators to measure adherence to the recommendations, and to provide certification levels to be displayed with the building. The drawbacks to these standards are that they are often cost-prohibitive, and exist primarily for commercial spaces. Funding constraints in developments like affordable housing mean there is limited room in budgets for healthy design considerations.

Given the harsh realities and personal challenges faced by those who seek affordable housing, mental well-being should be a critical consideration when designing places for the most vulnerable to live. And yet, those looking for information geared towards building healthy affordable housing - with its particular needs and challenges - currently have few resources available to them. This highlights the need for this project, which we are calling the Psychology of Aesthetics. Through an innovative approach, the Alberta Rural Development Network (ARDN), with the support of the Alberta Real Estate Fund (AREF), has created the first-ever scientifically-supported interior building recommendations specifically for the development of affordable housing.

Our aim is to not only redefine how affordable housing is designed and built but to also redefine how the broader community perceives new affordable developments. We aim to promote that explores and tests how humans respond to their environments. The key goal is to capture proven aesthetic elements from the laboratory work bench that can be woven into real world affordable housing design.
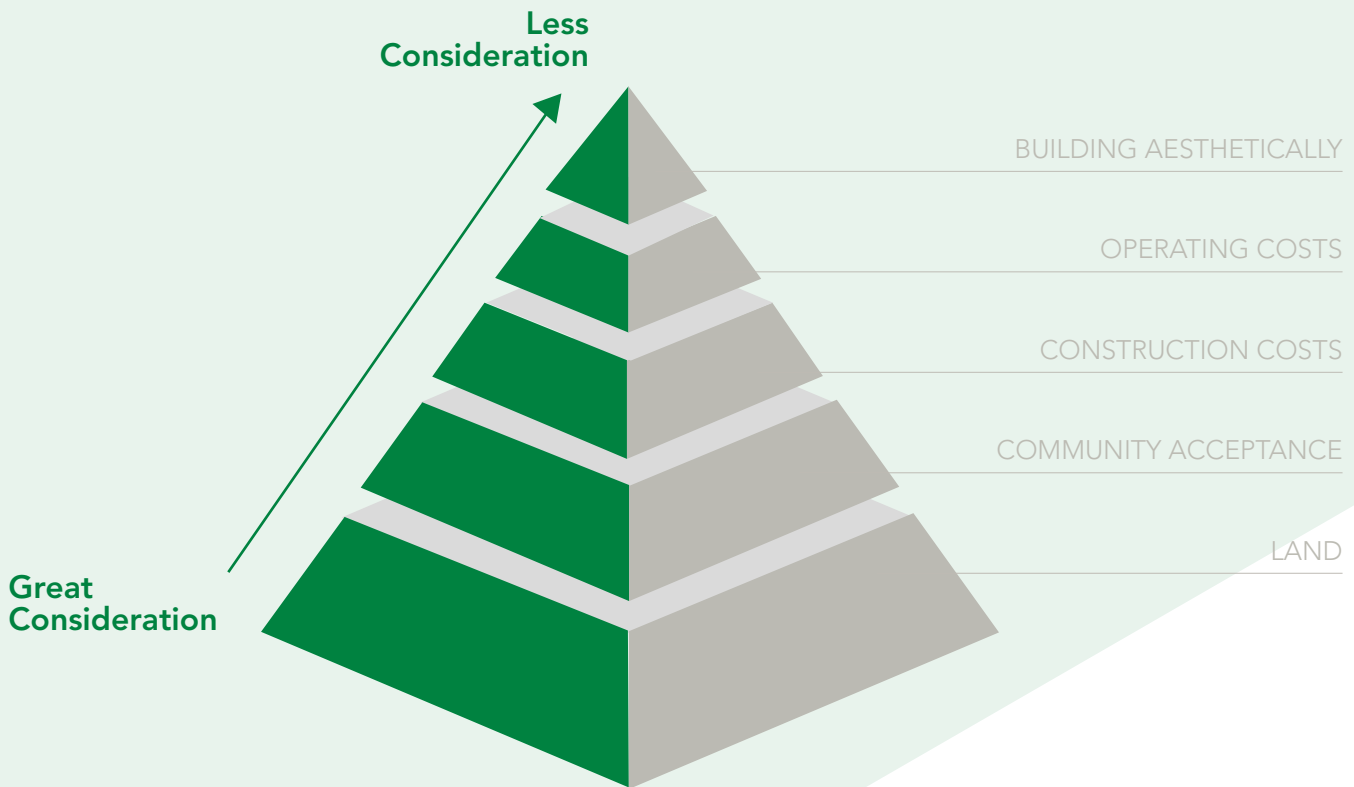
Our aim is to not only redefine how affordable housing is designed and built but to also redefine how the broader community perceives new affordable developments. We aim to promote better community acceptance and reduction of nimbyism, better operator success, and ultimately, better mental well-being for tenants. What makes our design guide unique is its scientific approach. This set of recommendations is built on knowledge gathered through peer-reviewed scientific literature that explores and tests how humans respond to their environments. The key goal is to capture proven aesthetic elements from the laboratory work bench that can be woven into real world affordable housing design.

PURPOSE

The primary goal of this guide is to provide design recommendations - derived from evidence-based scientific literature - that may enhance mental wellbeing. This guide hopes to be a benchmark to allow affordable housing stakeholders to consider the psychological impact of certain design elements. This is achieved by considering a balance between the cost efficiency of the design elements, and the benefit as supported by peer-reviewed psychological studies.

When planning an affordable housing project, typically the greatest amount of time and effort is invested in the "basics": acquiring land, gaining community support, and applying for capital funding in order in order to finally proceed to construction. Consideration of design aesthetics are often afterthoughts and may be rushed due to timelines, assuming few measurable benefits. However, their long-lasting effects on the residents should not be underestimated and can provide added value.

This guide's recommendations are meant to benefit several of the stakeholders in affordable housing developments. The added features and design considerations in a house will increase the sense of belonging in the residents, increasing tenant retention and leading to reduced vacancy rates. This same effect would ideally lead to the owner-operator saving on money and resources in maintenance due to vandalism. In addition, the successful delivery of the project will redefine how affordable housing is perceived in communities and help to reduce nimbyism. In other words, buildings that look like they belong to the community will give a sense of belonging to their tenants and be accepted by the community. The ultimate goal of our recommendations is to help affordable housing projects to have a considerable impact on the quality of life of the tenants. Living in an environment with elements that increase feelings of well-being and relaxation will improve the mental well-being of those individuals.

Less Consideration

Great Consideration

BUILDING AESTHETICALLY

OPERATING COSTS

CONSTRUCTION COSTS

COMMUNITY ACCEPTANCE

LAND

APPROACH

The methods incorporated in this guide are evidence-based research and secondary research. Our approach began with a scan of the existing building guides such as WELL and Fitwell, as well as peer-reviewed articles in the fields of architecture, interior design, psychology, and mental health. Our findings were compiled into tables, which summarize and categorize the information, to allow quick reference.

Each recommendation is assigned a position on the traffic light based on selected factors. These factors form the terms of reference so that any recommendation of this guide follows the same criteria. Firstly, each recommendation had to be cost-effective. Although these recommendations are applicable for any type of dwelling, the main target is affordable housing. The output of this project should be convincing to private funders, public funding agencies, construction and architectural companies, and residents who are already shy of the risk involved. The second measurement is the amount of supporting peer-reviewed studies that can be found on the subject. The third and last criteria in developing recommendations is the scalability of each statement. How adaptable are the laboratory-scale findings to practical application in the real world? This is important so that scientific evidence of mental health improvements can be applied to many different building designs and needs.

This table is coded in the style of a traffic light, with colours denoting the validity of the recommendations:

RED

reveals misconceptions which - as it turns out - either hold little merit in the scientific literature or prove to be cost-prohibitive;

AMBER

indicates recommendations that are either weakly supported by the scientific literature, or perhaps not as cost-effective as would be desired;

GREEN

indicates recommendations that are both widely supported in the scientific literature, and could prove cost-effective as well.

We explore four distinct categories of recommendations:

- Light and Openness;
- Colour;
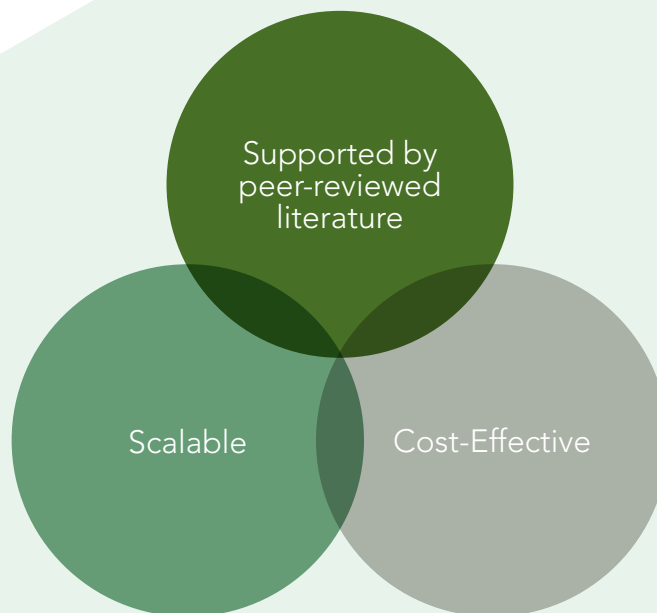- Form and Size; and
- Interior

Figure 2: The three factors of a green light recommendation.

LIGHTING AND OPENNESS

During our waking hours, our time indoors is spent bathed in the ultraviolet, visible, and infrared light produced by natural or electric lighting. Good quality light is not only required for completing tasks in a well-lit, comfortable setting, but it also contributes to the character and identity of a house. Conversely, harsh lighting at night can disrupt our sleep cycles and circadian rhythms, which is associated with an increased risk of cancer [7]. As a result, proper lighting is a critical consideration in designing living spaces.

Researchers have conducted studies in each of these areas and how they influence mental health. Multiple dimensions such as daylight, light colour, and intensity affect a person's perception of light [7]. There is extensive research on the benefits of sunlight and bright light. When researchers Timo Partonen and Jouko Lonnqvist asked office workers to work in front of a bright, 2500 lux light for only an hour a day during winter, they noticed a significant reduction in symptoms of depression - even in those who had previously suffered depressive symptoms [4]. A different research group, Kathleen Beauchemin and Peter Hays used an approach that should sound familiar to us: comparing the effect of patients recovering in hospital rooms with either a bright and sunny view or dimly lit rooms [1]. Similar to what Roger Ulrich observed, patients recovering in the bright and sunny rooms had a shorter stay by 15%. This research taken together stresses the importance of bright light and sunlight on the mental health of the people indoors, and they can be used as guidelines in designing new spaces in a way that those rooms provide the proper and sufficient daylight and/or bright light (at least 2500 lux). For example, architects can consider possible alternatives for the orientation of a room, size of openings, and position of the openings so that they find the optimum solution.

The colour of light is another factor that affects the ambiance of a room and psychological responses. Coloured lights influence psychological states. Odabasioglu and Olgunturk found that space was perceived to be least comfortable and least spacious under red lighting, whereas it was perceived as most spacious under white, and more comfortable under white and green lighting [8]. However, this does not mean that red light should be avoided completely. In a letter published by Harvard Health [9], it was warned that exposure to blue light at night suppresses the secretion
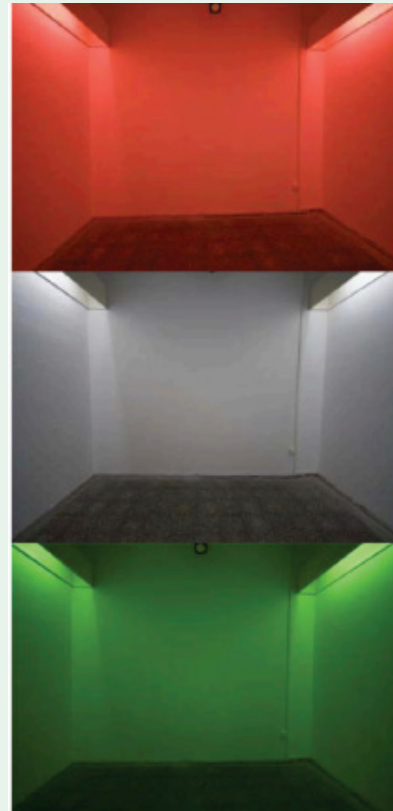

Figure 3: Researchers Odabasioglu and Olgunturk conducted their experiment in rooms with three lighting colours. Red was perceived to be the least spacious.

of melatonin. In order to avoid this and enjoy a better quality sleep it is helpful to be exposed to lots of bright light during the day (in the white range above 3000k lights) and use warmer lights of a more red wavelength for evenings (2700k lights and below). This allows bright daylight to help to boost your mood during the day, yet avoid the danger in that same light causing a shift in circadian rhythms and suppression of melatonin. Apart from physical factors, other concepts such as a sense of control are of importance in influencing stress levels and wellness [10]. Ulrich argues that lack of control is associated with negative consequences such as depression, passivity, elevated blood pressure, and reduced immune system functioning. Giving dwellers control over the noise coming from outside by using double glazed windows or control over light levels via curtains and blinds can be some of the design strategies that follow this proposed statement.
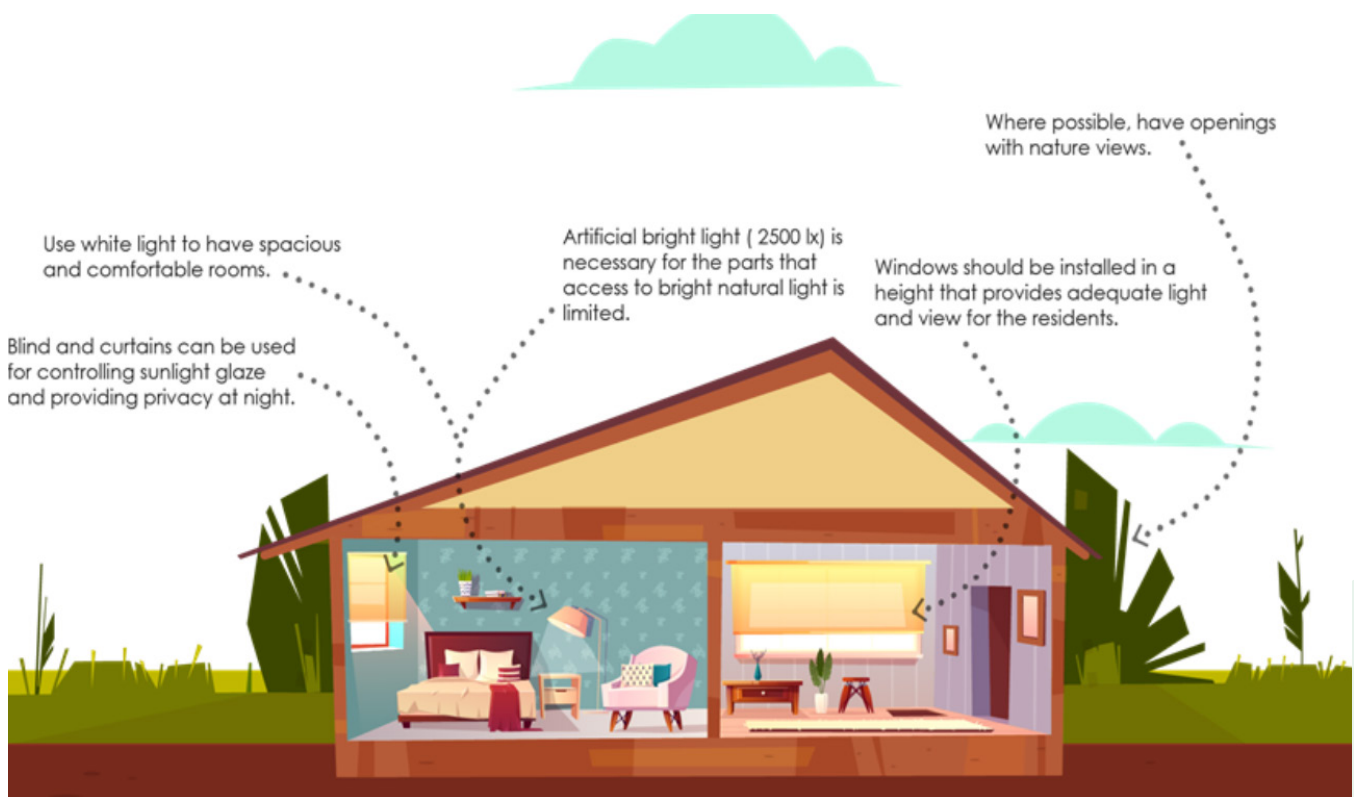
Figure 4: A schematic figure visualizing application of recommendations in the Lighting and Openness section.

Use white light to have spacious and comfortable rooms.

Blind and curtains can be used for controlling sunlight glaze and providing privacy at night.

Artificial bright light (2500 lx) is necessary for the parts that access to bright natural light is limited.

Windows should be installed in a height that provides adequate light and view for the residents.

Where possible, have openings with nature views.

APPROACH

The methods incorporated in this guie are evidence-based research and secondary research. Our approach began with a scan of the existing building guides such as WELL and Fitwell, as well as peer-reviewed articles in the fields of architecture, interior design, psychology, and mental health. Our findings were compiled into tables, which summarize and categorize the information, to allow quick reference.

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in developing recommendations is the scalability of each statement. How adaptable are the laboratory-scale findings to practical application in the real world? This is important so that scientific evidence of mental health improvements can be applied to many different building designs and needs.

Recommendation	Cost	Level of Impact
It is better to use dim red light for night light	$$	Low
Use proper window technology (like double-glazed windows) to minimize negative uncontrollable factors like exterior noise and smoke	$$$	Moderate
Windows should be installed in a heaight that provides adequate light and view for the residents	$$$	Low
Rooms that residents spend most hours in should be positioned in a way that gets the most light during all seasons	$$$	High
Locate mirrors opposite the window to create brighter interiors	$$	Moderate
Exposure to blue light should be kept at minimum	$	Moderate
Window blinds, curtains, and other coverings can be used to control sunlight glaze and provide privacy at night	$$	Moderate
All rooms in a house should have direct natural light	$$$	High
Artificial bright light (2,000 lx) is necessary for parts of the house with limited access to natural light (light can be either blue or white)	$$	High
Where possible, have openings with nature exposure	$$	High
Use white light to have spacious and comfortable rooms	$	High

Table 1: Light and openness-related design recommendations.

COLOUR

Colour is one of the easiest and most inexpensive ways to alter the feel and look of interior design. Recommendations of this section are generally lowest in cost and highest in their efficacy regarding improved outcomes. These research experiments report that the colour of an interior space evokes physiological and psychological responses. Colour recommendations in this document are generated as a tool to convey the

desired message and create the required ambiance and feeling. This gives users the freedom to choose their favorite colour from a range of colours with different hues and saturations. A study by Yildirim and Hidayetoglu [11] reported on the effect of interior colours on moods and preferences. They surveyed and interviewed students in two experiments about their feelings for two virtual reality rooms with different colours. Findings of this study suggest that cooler colours should be used for the perception of spacious, restful, calm spaces. If it is desired that interiors be seen as more arousing, exciting, and stimulating then warm colour should be used.

Yildirim, Akalin, Baskaya, and Hidayetogulu [5] investigated the same concept in a real-world environment of a restaurant. They painted restaurant walls in both yellow and violet, and interviewed the long term users of the cafeteria. They observed that overall cool colours are more pleasant and preferred than warm colours.

In addition to perceptions associated with colour tones, each colour evokes a distinct feeling. Sroykham [12] examined the effect of colours on emotions, pulse rate, oxygen saturation in blood, and brain activity with brain topographic mapping. In this research, participants were asked to answer the emotional questionnaire after being in a coloured room for 5 minutes. According to the results "Red and yellow colours in a living environment significantly stimulated anger and confusion… green colour in a living environment stimulated vigor more than any colour". As with natural environments, interior spaces require some variety of colour hues, saturation, contrast, light, and texture to provide balance, stress relief and enhance a sense of wellbeing, according to the Green Building Council (2016). First of all, the colour recommendation facilitates the creation of an environment which would help to boost the mental health of residents. Secondly, it still leaves the room for personalizing and having the feel of power over each resident's place.

WARM COLOURS
Arousing, exciting, stimulating

COOL COLOURS
Spacious, restful, calm

Good for kitchens;
Favourable to young children;
Can be accent colour for living spaces.

Good for cold rooms;
Can be accent colour for living spaces.

Can be warm and welcoming in hallways;
Good for dining rooms;
Good for north-facing and cold rooms.

Stimulates vigor in living spaces;
Make rooms feel larger

Good for concentration areas;
If used dominantly, can be cold and lonely.

Evoke restful, warm feelings;
Associated with luxury and creativity.

Figure 5: Colour wheel and the meaning and perception of each colour.

Recommendation	Cost	Level of Impact
Do not use dark colours excessively	$	Low
Balance between variety and unity (use warm + cool + and the complementary of the dominant colour	$$	Moderate
Use weaker contrast and saturation to convey calmness	$	High
Use stronger contrast and saturation to convey activeness	$	High
If it is desired that interiors be seen as more arousing, exciting, and stimulating, the warm colours should be used	$	High
It it is desired that interiors be seen as spacious, restful, calm, and peaceful, then cool colours should be used	$	High

FORM & SIZE

Form and Size contain recommendations that refer to the shape of the rooms or building. Therefore, actions need to be taken mainly in the initial phase of the project like design and construction. Some of these actions are high cost. Nevertheless, we can make some recommendations that cost less and refer mainly to decorative objects and add-on additions that can be implemented after the construction process.

In 2017 a group of researchers led by Avishag Shemesh investigated the connection between the geometry of space and human emotions [13]. Using virtual reality, they created four types of spaces: square, round, sharp, and curvy (Figure 6). Volunteers were asked to walk towards each space, explore it, and then rate their feelings on a questionnaire (Figure 7).
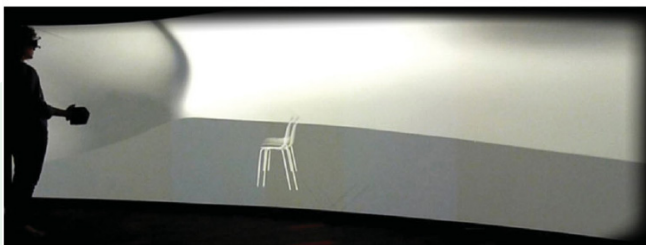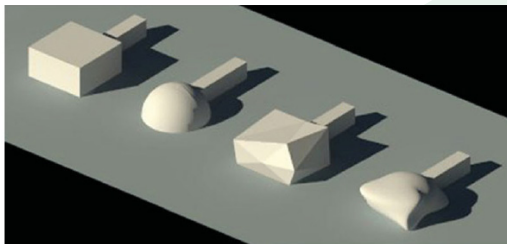
As you can see, the shape of the room has an effect on various perceptions. The researchers concluded that "symmetry seems to have no influence over the users' overall preference, while the curvature of the space was found to be influential". Participants with no expertise in the field of design showed a tendency to prefer curvy-shaped spaces and take significant interest in these spaces. Participants with a background in design displayed a tendency to prefer sharp-angled

spaces. Later, the researchers also had participants go through the spaces while hooked up to an electroencephalogram (EEG), which measures levels of brain activity. Shapes with gentle curves were preferred as opposed to a sharp point, which was correlated with stronger neuronal activity in the brain.

Another feature that influences the form of a room is height. Vartanian et al.(2015), examined the effect of ceiling height on aesthetic judgments and approach-avoidance decisions in architectural design [20]. They noted that spaces with high rather than low ceilings were more likely to be perceived as beautiful; however they were less likely to be entered.

Figure 6: A schematic figure visualizing application of recommendations in the Lighting and Openness Section
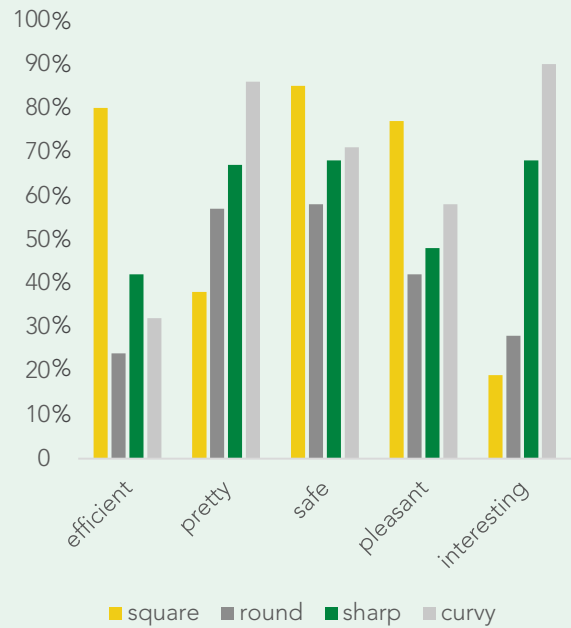

Figure 7: Shemesh et al. used four types of buildings in VR to document the responses of participants to different forms

Participants agreeing to statements

Figure 8: Shemesh et al. used four types of buildings in VR to document the responses of participants to different forms

Recommendation	Cost	Level of Impact
Ceiling 2 feet higher than normal (10 ft) are perceived to be more beautiful than regular height	$$$	Low
High ceilings can be used in spaces for activities that require creativity to take place	$$$	Low
Use decorative objects with gentle curves	$	Moderate
Horizontal mirrors help make the room seem lower but wider	$$	Moderate
Vertical mirrors and mirrors mounted to the ceiling create the effect of a bigger room with added height	$$	Moderate
Use slightly curved shapes to create a better perception of beautiful space	$$$	Moderate
Use forms that express user's meaning and preference	$	High

Table 2: Form and size-related design recommendations

INTERIOR

Interior touches consist of personalization of a place, through decoration or beautification. Apart from the ambiance that these elements create, they can promote mental well-being. Ulrich (2001) stressed in his article the importance of positive distractions in the physical environment on promoting wellness and dealing with stress [15]. He argues that "the most effective positive distractions are mainly elements that have been important to humans through millions of years of evolution" these elements include positive emotions (smiling faces), animals, and natural elements. Also, some other articles emphasize the importance of plants in living spaces and their efficacy in creating pollution-free air quality. If having a view of a pristine landscape or nature elements is not possible, hanging some realistic nature images offers a suitable replacement. A group of researchers working out of East Alabama Hospital were curious whether merely the presence of natural landscapes - as art - could reduce the incidence of psychiatric events [16]. Not only did they find that pictures of natural landscapes effectively reduced the number of these events compared to no art, but natural landscapes were even more effective than abstract art. The study concluded that positive distractions, like visual art depicting restorative nature scenes, could help to reduce patients' anxiety and agitation in healthcare settings. It also makes a case that the environment can have a powerful impact on healing.

Roger Ulrich, in 2001, published his theory regarding the sense of control in your living space. It recommends that since our homes are for security as well as shelter from the elements, maintaining a sense of control can provide stability and power over your home environment. This leads to lower amounts of stress hormones such as adrenaline and cortisol. Part of this sense of control can come from smell. Two studies in recent years have pointed towards a link in olfactory sensitivity and depression. People suffering from depression have a desensitivity to smell. Thus, changing or adding smells could be a boon to a living space for three reasons: strong but pleasant smells could stimulate those with even mild mood changes, adding scents is cheap and easy to address, and by allowing individuals to have control over the specific smell, they can help gain control of their environment. Not to mention it can also help control unpleasant smells in the environment that may be present.

According to Folio, there are also smells that can change a person's perspective of a room. Apple and cucumber scents, for example, make a room feel bigger and more airy.
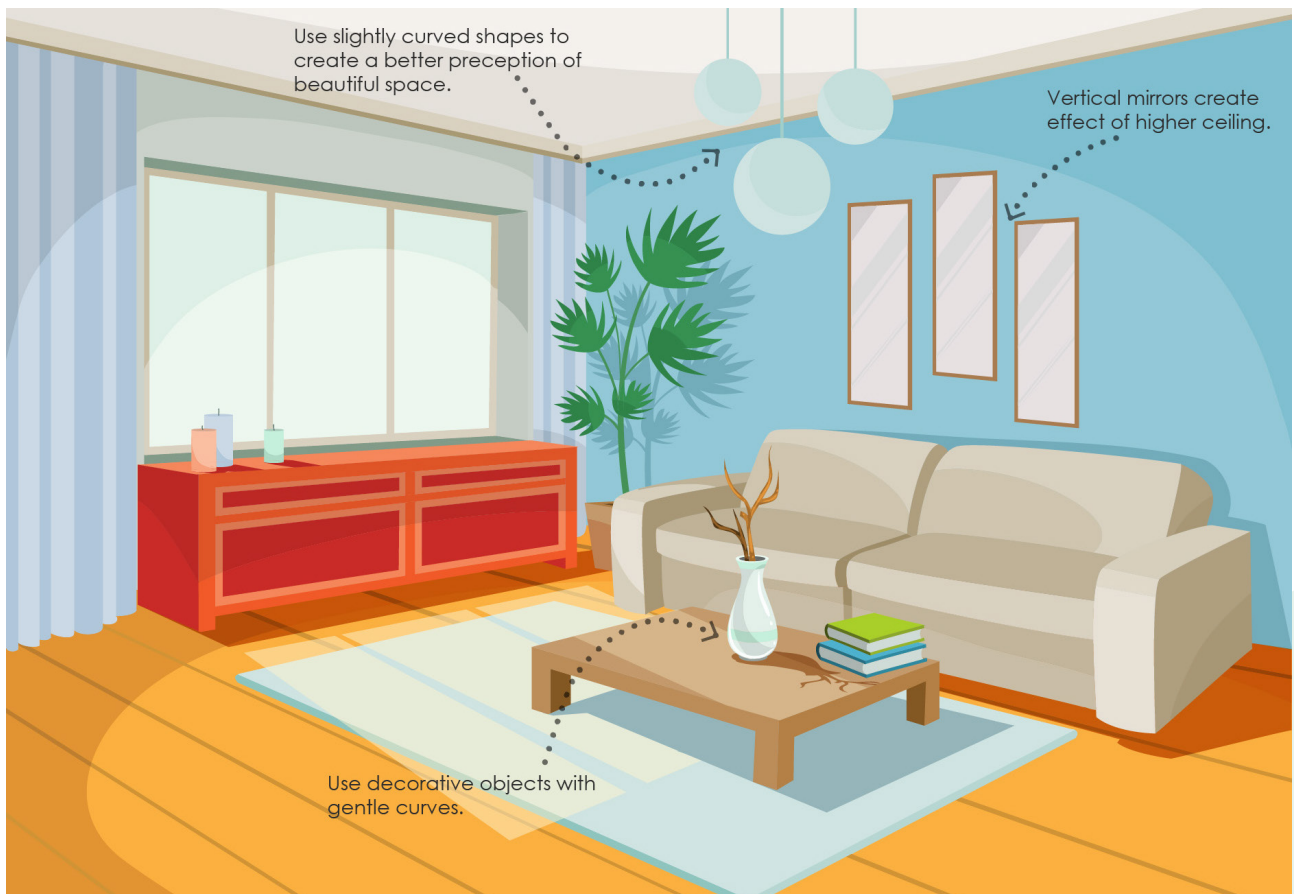
Use slightly curved shapes to create a better preception of beautiful space.

Vertical mirrors create effect of higher ceiling.

Use decorative objects with gentle curves.

Figure 9: A schematic figure visualizing application of recommendations to the Interior Design section.

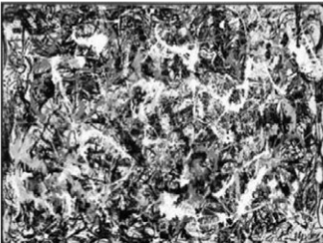**Different art conditions, artists and number of days**

Type	Abstract	Abstract-representational	Realistic nature	No art
Artist	'Convergence' by Pollock, 1952	'The Fields' by Van Gogh, 1890	Savannah image, stock photography	Control condition
#days	(19 days)	(16 days)	(16 days)	(21 Days)
Image				

Figure 10: Nanda et. al recorded the recovery of patients in rooms with no paintings, abstract paintings, abstract representational paintings, and realistic nature paintings. They found that patients recovering in rooms with realistic nature pictures were less than any other kind.

Recommendation	Cost	Level of Impact
Use scents to enhance the kind fo feeling you want to arouse in a room	$	Low
Do not create clutter by over-accessorizing or using too many throw pillows	$	Low
Reduce noises inside home by choosing the right mechanical or electrical system components to avoid any attention-catching features	$	Moderate
Create positive elements of distractions using elements of nature such as water and plants to boost your mood and improve air quality	$	High
Use positive distractions like realistic nature images rather than abstract images	$$	High

Table 4: Interior design-related recommendations

CONCLUSION

Using secondary research and evidence based research, we have developed a guide that relies on both the accuracy of the findings, and the feasibility of the recommendations. Our review of different peer-reviewed publications has proven that some design-related facts have been studied more than others and have proven to be more accurate of statements, and we have based our guide on such statements. Some aspects of home design, particularly lighting, colour and scents, have proven to have significant impact on the mental well-being of dwellers with minimal cost.

According to our findings, the built environment has a significant influence on our mental and physical health. This is especially true considering the amount of time spent indoors. We believe that the affordable housing build considering the proposed recommendations in this guide will overall increase self-esteem, resilience and a reduction in depression, anxiety and other measures of stress. Recommendations are categorized in a way that they compare the most effective vs dollar spent. In other words, users can easily understand which aesthetic elements are going to have the most meaningful impact and which ones need more investment. Also, recommendations are in a way that each user can follow it while adding their personal preferences to it. In other words, two users can opt to use the guideline for two identical units, however the option for personalizing each recommendation remains.

This guide will be made freely available on both the Alberta Real Estate Foundation and Alberta Rural Development Network websites. At the end of the day, it's important to remember that the well-being of the tenants themselves is most important, and any change to design, however small, can have a significant impact and give people a place to live that they're proud to call home.

AUTHORS

Scott Travis is the Director of Research and Programs at the ARDN. He is also pursuing his PhD in Neuroscience from the University of Alberta, where he specializes in brain structural changes in major depressive disorder. He has 12 years experience working and training in mental health research, and he is an author on over a dozen peer-reviewed studies regarding brain and behaviour.

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Dr. Peter Silverstone is a Professor of Psychiatry at the University of Alberta, where he is also an Adjunct Professor at the Faculty of Business. He has over 140 peer-reviewed publications, and has held grants from multiple national and international organizations.

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