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Mission of the *Academy Journal*

As the official journal of the AIA Academy of Architecture for Health (AAH), this publication explores subjects of interest to AAH members and others involved in the fields of health care architecture, planning, design, and construction. The goal is to promote awareness, educational exchange, and advancement of the overall project delivery process, building products, and medical progress that affect all involved in those fields.

About AAH

AAH is one of 21 member communities of The American Institute of Architects (AIA). AAH is unique in the depth of its collaboration with professionals from all sectors of the health care community, including physicians, nurses, hospital administrators, facility planners, engineers, managers, health care educators, industry and government representatives, product manufacturers, health care contractors, specialty subcontractors, allied design professionals, and health care consultants.

AAH currently consists of approximately 7,000 members. Its mission is to provide knowledge which supports the design of healthy environments by creating education and networking opportunities for members of – and those touched by – the healthcare architectural profession.

Please visit our website at aia.org/aah for more about our activities. Please direct any inquiries to aah@aia.org.

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About the journal

As we start the 23rd year of the Academy Journal, published by the AAH Knowledge Community, this edition includes articles that support the enhancement of the built environment for health care.
As the official publication of the Academy, the Journal publishes articles of particular interest to AIA members and the public involved in the fields of health care architecture, planning, design, research, and construction. The goal has always been to expand and promote awareness, educational exchange, and advancement of the overall project delivery process, building products, and medical progress that affects all involved in those fields.

Articles are submitted to, and reviewed by, an experienced, nationally diverse editorial review committee (ERC) of medical and architectural professionals. Over the years, the committee has reviewed hundreds of submissions, responded to writers' inquiries, and encouraged and assisted writers in achieving publication. In its over 20-year history, the Journal has provided valuable opportunities for new and seasoned authors from the architecture and health care professions, including architects, physicians, nurses, other health care providers, academics, research scientists, and students from the US and foreign countries.

Published articles have explored a broad range of medical topics, including research trends, the future of health care architecture, cardiac care, future and evolving technology, patient rooms and patient safety, lighting design for health care, psychology, workplace design, cancer care environments, emergency care, women's and children's care, and various health care project delivery methods.

We encourage graduates who have received health care research scholarships and others involved with research within the health care architecture field to submit their research to the Journal for publication consideration. We will continue to develop a cross-referenced article index and a broader base of writers and readers. The deadline for the 2021 call for papers is May 27, 2021.

Since the late 1990s, this free publication has expanded to include worldwide distribution. And we are proud to report that as our readership continues to grow, it also expands internationally. Readers have viewed the Journal online from the US, Canada, Europe, the Caribbean, Asia, Africa, India, and Saudi Arabia, just to name a few. The Journal is available to the 94,000 AIA members and the public on the AIA website at aia.org/aah.

Special thanks to AIA for its continued support and hard-working staff and to the many volunteers who have contributed to our growing and continued success including Doug Paul and Southern Ellis for their leadership on behalf of the AIA and AAH. I would especially like to thank the other members of the 2020 ERC: Donald L. Myers, AIA, NCARB; Angela Mazzi, AIA, ACHA, EDAC; Sharon Woodworth, FAIA, FACHA; Dale A. Anderson, AIA, NCARB, LEED AP BD+C, CSBA, EDAC, MBA, GGP, ACHA; and Erin Mcnamara, EDAC. As always, we appreciate your feedback, comments and suggestions by emailing aah@aia.org.

Letter from the editor

2020 has been a difficult year.

The COVID-19 global pandemic has impacted our lives in a profound way. Collectively, people have gained a new appreciation for the power of a virus and its potential impact to our hospitals, economy, and social networks. Our friends and colleagues in healthcare have been tested in a manner that will have meaningful consequences on the industry and what it means to dedicate one's life to care for another. Many of us have waited on news from scientists, cheered for progress, and followed FDA trials with great anticipation and awareness for the enormity of the pursuit. Never have I felt so appreciative of the people, networks, supply chains, and infrastructure that support our healthcare system.

As this journal goes to print, the dealth toll, in the United States, for COVID-19 stands around 300,000 and the first vials of vaccine are being administered to people on the frontline. There is great hope that we are at the beginning of the end of this saga, but still reeling from the exposed vulnerabilities to both the healthcare industry and society at large. We have learned so much and yet there is so much left to understand about the last ten months.

I look to 2021 and the years to follow as an opportunity to both celebrate our successes and learn from our missteps so that we are better and more prepared for future generations of frontline workers, patients in need, and vital equipment suppliers. There is great promise at the juncture between healthcare, design, and research. I applaud Orlando Maione for his vision to foster this journal and thank him for his many years of leadership and service as The Academy Journal Editor. We close out this year with an appreciation for the work accomplished and excitement for what is to come. I look forward to exploring with and learning from you in the years to come.

Cheers to a happy new year.

Regan Henry, RA, PhD, LEED AP, LSSBB
Editor, *Academy Journal*

Using choice-based design to improve health

Avani Parikh, MCP, AIA, and Debajyoti Pati, NIHD, PhD, FIIA, IDEC, LEED AP
Principal, Avani Parikh Architecture, New York, NY 10021
Professor and Rockwell Endowment Chair, College of Human Sciences, Texas Tech University

ABSTRACT

Using a new framework from the 2018 award-winning book Choice Architecture: A New Approach to Behavior, Design, and Wellness, we show how understanding human choice and action in architectural settings can reorient health care design from cure to prevention. Choice-based design can induce healthy actions in users via principles of rational choice and behavioral economics. The paper presents a way to design environments in a systematic and scientific way so as to influence a more holistic set of health-promoting behaviors in people.

The changing culture of health: caring for the mind and body

Could health-promoting and safe human behavior be influenced through physical design? Could the perceptual response to a designed environment be engineered to also influence spontaneous user choices? Could the perpetual gap between design intent and observed usage/behavior be narrowed? Does physical design have a role to play in enhancing population health? Despite spending about one-fifth of its national GDP on health, and having the largest health care spending in the world at an estimated $4.01 trillion in 2020[1], the US economy is under continual pressure to expand health services. A focus on human choice and agency offers the possibility for promoting human well-being and reducing health costs by shifting the focus from treatment to preventive health for individuals and communities.

Considering that our genetic contribution to health is roughly 30% and our social/behavioral/environmental contribution is roughly 70%[2], designers can have a deep impact on prevention if design is approached in the right way. Choice Architecture, a new framework, claims the emphasis should be on how people experience and interact with the built environment because our experiences and actions influence healthy choices, which in turn can improve our health. Its original and key idea is that the way to realize this orientation is to apply the principles of choice from economics to architecture.

The mainstream approach to choice in consumer economics since the 18th century has been rational choice based on costs and benefits. However, it turns out that people do not always choose rationally. The foundations of a broader behavioral approach to human decision-making were laid by Amos Tversky and Daniel Kahneman in the 1970s, for which the latter won the Nobel Prize in economics. Rational choice sometimes involves deliberation—an explicit analysis of net benefits—and is context-free; whereas, behavioral choice is often spontaneous and contextual. In some situations, the former appropriately describes a person's decisions regarding behavior and action, and in others, the latter appropriately describes the response. In fact, it could be argued that other than major life decisions, few conscious human choices follow a rational cost-benefit analysis. It is the unique strength of Choice Architecture to extend both sets of ideas to architectural environments.

It is well-known that architecture influences our moods and behavior and, therefore, our health. But people do not always make healthy choices, and it has seldom been clearly demonstrated exactly how this influence is realized.

Understanding this process can help architects design in ways that promote health. It is different from existing design approaches, which miss the importance of the choices people inevitably make when they experience the built environment. These choices impact their well-being in positive or negative ways. More specifically, while the connection between design and health has been well researched, decision-making in architecture, interior design, urban design, and landscape architecture has generally been founded on the belief that users always conduct comprehensive cost-benefit analysis using some rational framework. Encoded guidelines and codes, as well as designers' hypothesized outcomes, are founded

1. Advisory Board. (April 3, 2020). CMS: US health care spending will reach $4 trillion in 2020. Advisory Board Daily Briefing. https://www.advisory.com/daily-briefing/2020/04/03/health-spending
2. Schroeder, S. A. (2007). We can do better: Improving the health of the American people. *The New England Journal of Medicine, 357: 1221-1228.*

on a framework of rational choices and ideal behavior. Owing to this fundamental belief, designers have traditionally depended on observation data in predicting/measuring use of spaces, and its conformity or not with design intents. The fact that in many cases the actual use of spaces does not reflect those intended in design underscores the role of choice-making outside of the rational choice framework. The Choice Architecture framework can be used in all settings and with all users, individuals, or groups. It does not offer stand-alone isolated design and health solutions or design prescriptions, but components of a holistic response. The attention to human choice and agency offers the potential for reducing health costs as well as wholesome overall life experiences for individuals and communities. Simply put, the Choice Architecture framework can help designers create better engineered solutions with more precise predictions to reduce stress, improve well-being, enable human relationships, and promote safer settings in a self-sustaining way.

Choice-based design

Experience is a key concept that mediates the relationship between choice-based design and health. This model leads to a scheme where the built environment influences human agency to act in a needful way.

The scheme:
design element → experience/choice → action → health

Design induces experiences and choices from which individuals choose an action that affects health positively or negatively.

There are several rational and behavioral principles that govern how people make choices developed by economists. These can be extended to a deeper understanding of architecture.

While rational choices are made by optimizing net benefit as applied to users' own health (should I climb the stair or ride an elevator?), behavioral choices (should I linger or move on?) are spontaneous and reflect ideas such as relativity, status quo bias, nonlinearity, framing, availability, anchoring, representativeness, reference point shifts, and others.

A Choice Architecture framework offers an added layer of information during design decision-making that enables positive effects on health. For example, the presence or absence of factors in a specific context that influence user choices leading to the use of an attractive and accessible stairway or a light-filled room can drive precise design decisions to improve health/well-being. The key is in understanding the factors that influence rational and/or spontaneous decisions in the use of designed spaces. The table below lists some behavioral choice principles. The section following it will show two examples using choice principles in architectural settings.

TABLE 1

Behavioral Principles	Empirical findings on choices made when people are spontaneous in their actions
Framing	Choices change based on how the same information is presented in different ways.
Nonlinearity	People's actions are nonlinear.
Availability	Make the easy choice.
Representativeness	Jumping to conclusions based on a few representational cues.
Anchoring	Subsequent actions are anchored to initial actions.
Cost of zero cost	People inflate the positive value of free items and ignore the hidden cost.
Relativity	Choose between things that have comparable attributes.
Status quo	A preference for the existing situation at the reference point.
Reference-dependence	When value is defined by the gains and losses of an item relative to a reference point.

Applying choice-based design

Example 1: Rational choice—Take stairway or elevator
A hospital environment offers an attractive lobby with an easily accessible stairway for visitors and staff to promote their health and elevators for patients who need them. The underlying idea is to design rational choices for staff and patients to motivate them toward healthy actions.

Hospital lobby with stairway and rear elevators

Here are two scenarios, one with a hypothetical staff user and another with a hypothetical patient user.

Unlike other approaches, the rational choice model makes user preferences, the available choices, and the connection between them explicit. This allows different users to have different preferences and different available alternatives to choose from with different resulting actions in the same architectural environment.

The choices the lobby provides are to use the stairway or the rear elevators to the upper floors.

Staff scenario:
A staff member has the option to take the stairway or the elevator. She sees the stairway and the elevators daily and chooses to climb the stairs and improve her health. Here is how the rational choice between these two lobby elements can be made.

- Staff member evaluates climbing the stairway:
  - Benefits of climbing stairway = 6 units (e.g., reduction of blood pressure, reduced risk of stroke, increase in endorphins, views, improved mood, etc.)
  - Costs of climbing stairway = 2 units (e.g., added time, effort, etc.)
  - Net benefits = 6 – 2 = 4 units

- Staff member evaluates riding the elevator:
  - Benefits of riding elevator = 3 units (e.g., faster, less effort, etc.)
  - Costs of riding elevator = 1 unit (e.g., waiting in line, multiple stops, crowded, etc.)
  - Net benefits = 3 – 1 = 2 units

The stairway and elevator can be given utility numbers (using choice theory) that capture the overall user benefits. The staff member represents her more preferred actions with higher utility numbers and less preferred actions with lower utility numbers.

The staff member makes a list of actions, picks a range of numbers, such as -10 to +10, that are arbitrary at an overall level but reflect her relative preference for each action. It is then possible for the staff member to (consciously or unconsciously) do a cost-benefit analysis, identify highest net benefit, and consequently make her best choice.

The net benefit of the stairway is greater than the net benefit of the rear elevator. Therefore, the staff member rationally chooses the stairway.

Applying the framework:
- design elements → experience → choice → action → health
- stair → active living + views → climb stair → physical activity/improved mood

Patient scenario:
The patient must also choose between the lobby stairway and elevator. This person sees the stairway and the elevators for the first time. The patient takes the elevator, which is better for his health in his present state. Here is how a different rational choice may be made—as opposed to the standard understanding in the field of design and health without a model of agency.

- Patient evaluates climbing the stairway:
  - Benefits of climbing stairway = 4 units (e.g., reduced health benefit as he is unwell, etc.)
  - Costs of climbing stairway = 9 units (e.g., current condition, patient fall, etc.)
  - Net benefits = 4 – 9 = -5 units

- Patient evaluates riding the elevator:
  - Benefits of riding elevator = 5 units (e.g., patient safety, faster, less effort, assistance, conducive to patient state, etc.)
  - Costs of riding elevator = 2 units (e.g., walking to rear, multiple stops, etc.)
  - Net benefits = 5 – 2 = 3 units

The net benefit of the rear elevator is greater than the net benefit of the stairway. Therefore, the user rationally chooses the rear elevator, a different action.
Applying the framework:
- design elements → experience → choice → action → health
- elevator → no falls, safety → ride elevator → less risk, less stress

Assigning utility numbers: The patient also makes a list of actions and picks a range of numbers, such as -10 to +10, that are arbitrary at an overall level but reflect his relative preference for each action. The patient does a cost-benefit analysis for his best choice.

This is how rational decision-making works for different persons in the same situation, yielding different outcomes that are favorable to each person's well-being. Such rational choice is ubiquitous and can be used by designers for many settings.

Example 2: Behavioral choice—Add hallway or not
An existing senior home has to be renovated for healthy aging in place. The project team examines a resident's spontaneous daily choices using the behavioral method. The goal is to design choices in the home that are advantageous to the senior's aging in place.

Two options for the floor plan are considered: (a) living space connected by a hallway and (b) enlarged living space eliminating a separate hallway.

The scenarios are developed from the point of view of the resident's goals to improve his wellness by design. The design aims to enhance the user experience of the environment to induce desired actions. The example shows how behavioral choice and the status quo work.

Scenario one:

An existing floor plan has a hallway connected to a living space. The resident uses the hallway as an easy, attractive means to connect to the space. If asked, the resident claims he is active 40% of the time and is social 60% of the time. Hence, the resident's reference point that characterizes his existing situation is (active, social) = (40%, 60%). This is also called the status quo. Such reference points and contexts are always present in human decisions. In a number of commonly occurring situations, like the resident in this example, the reference situation makes all the difference.

Scenario two:

In time, the resident's family plans for him to age in place. They propose an environment to promote wellness at home with balanced physical, mental, and social activity. The plan allows for future home health care needs.

The new floor plan presents an option where the two spaces get combined into an enlarged open living space. This eliminates the hallway and enlarges the living space for multipurpose functioning and reduced need for physical mobility.

The design also enhances social uses with seating nooks, bookshelves, and artwork for interactions, alongside shorter movement paths, and is thus a gain for the user. But it would also eliminate the resident's hallway space and reduce his physical activity and so is a loss for him.

The resident must choose between the two options of (a) hallway and a living space and (b) no hallway and an enlarged living space.

In the second scenario, the resident would enjoy physical activity in another space only 20% of the time but increase being social within one enlarged space 80% of the time. In this situation the resident is (active, social) = (20%, 80%). The drop in physical activity in the enlarged room from 40% to 20% is a loss as measured from the resident's original reference point. Likewise, the increase in being social in the enlarged room, from 60% to 80%, is a perceived gain from the same reference point.

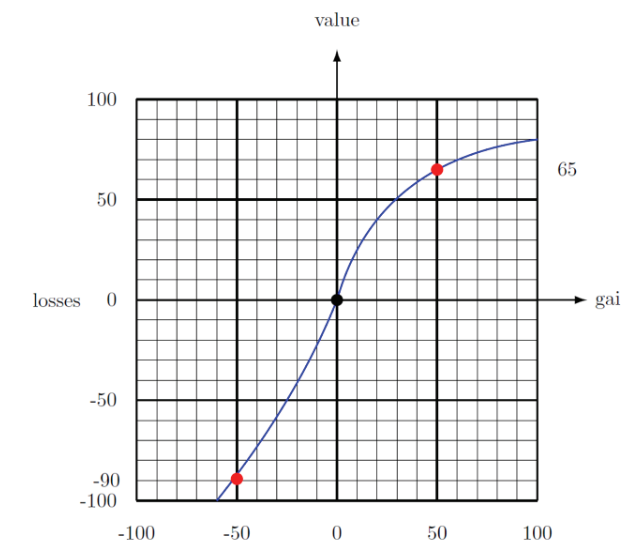
When a user evaluates the floor plan in each situation, he tries to see how his current situation would change relative to his existing situation. He does not compare scenario one with scenario two, the two absolute options before him, but assesses the relative differences between the two given his current reference points.

Hallway and living space

An enlarged single living space w/o hallway

In scenario two, the increased socialness in the enlarged room is a gain and the drop in physical activity is a loss relative to scenario one. If his gains and losses are assumed to be roughly equal, the gain could be represented as +50 and the loss could be represented as -50.

The graph below indicates that the value of a gain of +50 from the larger room is 65, shown by a large red dot at (50, 65) in the first quadrant. The value of a loss of -50 from physical inactivity is -90, shown by a large red dot at (-50, -90) in the third quadrant.



Thus, the value of a loss of 50 is -90 and is much greater than the value of a gain of 50, which is just 65. This is loss aversion, where a loss of a certain size looms larger (in value) than a gain of the same size.

Scenario two, an enlarged living space and no hallway, carries a positive value of 65 and a negative value of -90. Owing to loss aversion, the resident does not favor the second scenario plan and prefers the status quo.

Scenario one, the status quo with hallway and living room, can potentially be adapted to allow the resident to age in place, maintaining the health-promoting active days at 40%, and social activity at 60%.

Using the S-curve for analysis:
The S-curve is a tool that represents users' decision-making behavior. As Tversky and Kahneman showed graphically with the S-curve, a loss is felt more keenly than a gain. It uses two key concepts called reference point dependence and loss aversion—and can even predict user behavior. The shape of the curve (flatter with gains and steeper with losses) explains why the value of a loss is felt greater than the value of a similar gain. This tendency is called "loss aversion," and it means that people are averse to losses compared to gains.

The S-curve insight is that people value their gains and losses from a reference point (the status quo) and that losses are experienced as worse than equal gains. It shows how when the relevant gains and losses are roughly equal relative to a reference point, the losses will appear larger than the gains, and people will generally prefer the status quo. It allows prediction because people are assumed to choose what they prefer most among a set of alternatives.

For example, the graph shows gains from 0 to 100 and losses from 0 to -100 on the x-axis and the perceived value on the y-axis. The numbers—0 to -100 as losses and 0 to +100 as gains—are again somewhat arbitrary but capture the resident gains and losses experienced. The graph's proportions are based on the resident's (context-based) reference point and also matter. The current reference point of the user is at the origin (shown as a large black dot in the center), and his gains and losses are measured from the reference point. The value of the status quo choice is at zero, where the curve passes through the origin at the resident's reference point.

The graph represents the analysis that the value of a gain of +50 from the larger room is 65, shown by a red dot at (50, 65) in the first quadrant. The value of a loss of -50 from physical inactivity is -90, shown by a red dot at (-50, -90) in the third quadrant. The value of a loss of 50 is -90 and is greater than the value of a gain of 50, which is just 65. This is loss aversion, where a loss of a certain size looms larger (in value) than a gain of the same size.

We see how the experience of loss can lead people to choose the status quo, which is a preference for the existing condition.

In a status quo problem, there is an interesting further result. If the enlarged living space without a hallway, as in scenario two, had been the resident's reference point, and if he was considering a new design that adds a hallway and reduces the living space, as in scenario one, he would again prefer his status quo, which in this context is scenario two.

This time, the value of scenario two would exceed value of scenario one. Gains turn into losses and vice versa. In this reversed design scenario, there would be a less healthy physical activity outcome for the resident with scenario two = (20%, 80%) versus scenario one = (40%, 60%).

In other words, the status quo principle cannot be used blindly because in one direction it will improve health and in the other it will worsen health.

In terms of the framework, an architectural situation isn't "stable" and most often depends on the reference point, in addition to the choices it affords. This behavioral example has shown how subtle the problem of designing architectural choices for a home can be.

Status quo impact:
What does the status quo mean? In some situations, the status quo works to the user's advantage and in other cases to their disadvantage. It can be a useful concept that helps people hold their lives together near a reference point.

However, maintaining the status quo may determine that the outcome is disadvantageous. This is a truth and a challenge that practitioners deal with very often. Maintaining the status quo may not be in the best interest of a resident, or staff and patient. Using a Choice Architecture framework, can help designers overcome the significance of loss in the mind of a user.

In the status quo, where perceived losses are more powerful than perceived gains, this idea of loss aversion can be addressed using choice-based design. This framework has shown that built environment experiences impact user choices and actions to affect health. To detach from a reference point or status quo, designers should use their behavioral insight that it is the design of meaningful experiences that provide the key to how users reconcile choices with losses, gains and a reference point. Once separated from the status quo, given practical choices, the user converts easily to a different set of preferences. This could also suggest cost-effective solutions that the user would approve of as they would represent a pure gain with less loss.

Designers and owners can use this approach to drive innovation and further project goals based on understanding of how much of people's behavior is habitual and driven by cues in the environment. The approach provides a systematic way to predict human behavior to solve practical problems. It helps designers and owners determine when to depart from the "ideal" to offer users perceivable practical benefits.

The use of choice theory in influencing consumer behavior is not new in the design world. Product manufacturers have successfully used it to influence both rational and behavioral choices of customers in making purchase decisions. Incorporating such a theoretical framework in architectural decision-making means that the end product of a design process be presented like a consumer product having selective choice features that influence users toward making healthy choices.

Conclusion

What steps can or should be taken, then, to bring choice theory into mainstream design decision-making to create health-promoting experiences people feel better about converting to? Choice-based design has two major goals: to create enabling environments and experiences, and empower human choice and action toward health.

Among the key paradigm-changing concepts offered by Choice Architecture is the notion of "loss aversion" and "reference point." The extent to which the possibility that losses are perceived to have a greater weight than gains is considered in architectural decision-making is unknown. Similarly, the extent to which reference points are identified, examined rigorously, and defined in architectural decision-making is unknown. Incorporating these two concepts in decision-making could possibly narrow the gap between design intent and observed usage/behavior in significant ways. In essence, the fundamental discussion in the context of designing for health should be "behavior change"—from unhealthy to healthy, from risky to safe, from those invoking negative emotions to positive ones. The physical environment alone, or in conjunction with policies and programs, could be engineered to effect behavior change. Toward this end, Choice Architecture offers two starting points for architects and designers to consider—loss aversion and reference point. Once incorporated, other factors influencing behavioral choices could be systematically examined. Further incremental work remains until a robust information base can realize the true power of the framework, including in the domains of utility number scales and more detailed understanding of factors influencing behavioral choices in the designed environment.

Such details then should allow designers and owners to shape their projects' wellness outcomes with far greater precision than ever before.

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1735 New York Avenue, NW
Washington, DC 20006

aia.org