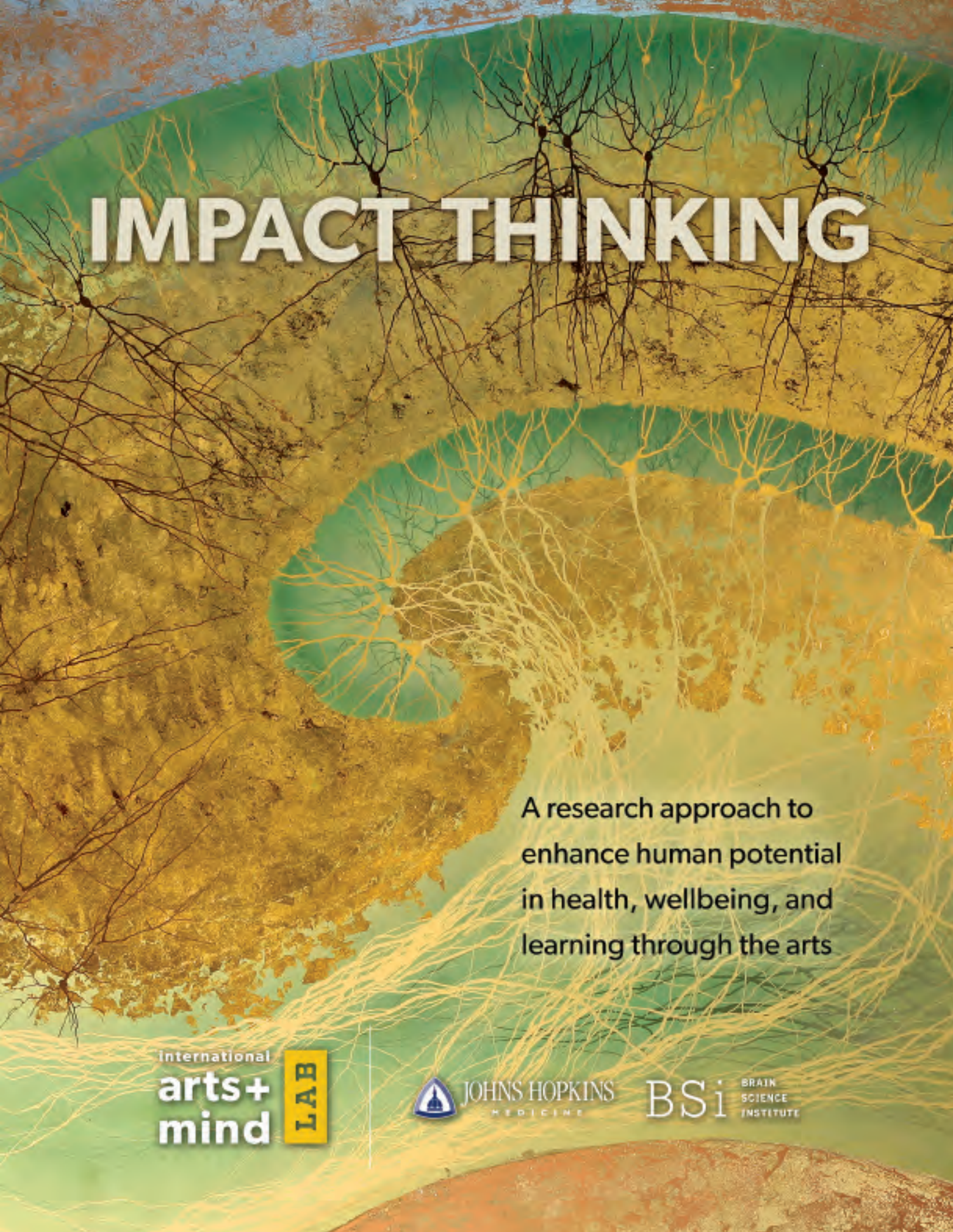
IMPACT THINKING
A research approach to
enhance human potential
in health, wellbeing, and
learning through the arts
international
arts+
mind
LAB
JOHNS HOPKINS
MEDICINE
BSi
BRAIN
SCIENCE
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Cover art: "Hippocampus II" by artist Greg Dunn

Who We Are

International Arts + Mind Lab (IAM Lab) is a multidisciplinary research-to-practice initiative from the Brain Science Institute at Johns Hopkins University accelerating the field of neuroaesthetics. Our mission is to amplify human potential.

What We Do

IAM Lab is pioneering impact thinking, an outside-in approach to health, well-being and learning.

How We Do It

IAM Lab brings together brain scientists and practitioners in architecture, music, and the arts to collaborate in multidisciplinary research, foster dialogue, and spur continued innovation by sharing these findings with a broader community.

international arts+ mind LAB

SUMMARY

Everything is aesthetic. The environments in which we live and work, the sounds we hear, sights we see, and smells we encounter are the pathways through which we experience the world around us. And aesthetics is so much more than enjoying beautiful things. The uniquely human response to aesthetics constantly influences our mental and emotional states. We know more than ever before about the sensory systems that enable us to process and decode the world around us. Still, we are just on the cusp of understanding the potential of aesthetics to maximize those systems for improved health, wellbeing, and learning.

Today, as the incidence of chronic disease and depression, anxiety, and stress rise, and the gaps in health, wellbeing, and learning outcomes expand, we turn most frequently to the medical profession for traditional and pharmaceutical solutions. Despite great advances, these approaches still fall short in offering preventive, non-invasive, timely, and sustainable solutions. What if we could incorporate other interventions that are engaging, empowering, and affordable?

There is much promising evidence that a variety of arts approaches work to improve mobility, mental health, speech, memory, pain, and learning, potentially improving outcomes and lowering the cost and burden of chronic disease and neurological disorders for millions of people. These approaches, including visual arts, dance and movement, music, and expressive writing are timely, responsive, and cost-effective. Moreover, research suggests that other types of aesthetic experiences, including immersive and virtual reality and architecture are also associated with improved health, wellbeing, and learning outcomes.

To date, neuroscientists, social scientists, and practitioners interested in these topics have largely operated in isolation, lacking high-quality data sets, standardized measures and implementation protocols, and statistical power to make any causal claims regarding impact or influence evidence-based practice broadly. With rising acknowledgement of the limitations of this disparate effort, researchers and practitioners are calling for an approach that brings together studies of the behavioral outcomes of arts experiences with biological markers to map the neurological bases for various aesthetic experiences. This approach would enable researchers and practitioners to document, refine, replicate, and scale successful interventions.

For this shift and collaboration to take root, research questions must be defined across diverse disciplines. The growing and interdisciplinary field of neuroaesthetics is a logical home for this work, exploring the role of the arts, music, architecture, and natural environments as they alter and shape individual brain responses. Beyond a disciplinary base and theoretical frame, this work needs an organizing mechanism that facilitates collaboration across disciplines and sectors, builds a common research vocabulary and approach, houses a centralized database for researchers and practitioners, and leads field-building and dissemination efforts.

As such an interdisciplinary hub, the International Arts + Mind Lab at the Johns Hopkins University School of Medicine's Brain Science Institute proposes a research translation approach to fill these gaps and unify a field around impact. We believe that together with our partners, we can use neuroaesthetics to solve intractable problems related to health, wellbeing, and learning for diverse populations. Through much collaboration we have developed Impact Thinking: an eight-step consensus framework that applies rigorous, evidence-based brain science research methods to arts, architecture, and music interventions by engaging a broad and multidisciplinary team. Beginning with a problem identification workshop and collaborative discovery process and concluding with dissemination and scaling, Impact Thinking is designed to build open-source capacity and expertise and a research-to-practice pipeline for neuroaesthetics focused on impact.

With this paper, we lay out the rationale and initial building blocks for a long-term approach to improving health, wellbeing, and learning through neuroaesthetics. We recognize that the challenges are many, but are encouraged by the convergence of ideas and degree of consensus found in our outreach and research to date.

The State of Health, Wellbeing and Learning

While globally we continue to make great advances in technology and research, a variety of social, environmental, and biological factors continue to limit equitable access to health, wellbeing, and learning among the populace. As people live longer and diagnoses of diseases continue to improve, and as assessments of wellbeing and academic progress continue to become more sensitive, so grows the ranks of people in need of new forms of care, prevention, intervention, and support. What follows is a review of key health, wellbeing, and learning indicators and a discussion of disparate outcomes based on socioeconomic and demographic factors.

Health

The World Health Organization defines "health" as a state of complete physical, mental, and social wellbeing. Extending beyond the mere absence of disease or illness, this definition acknowledges the importance of the patient's holistic care experience and the social and environmental determinants of health.[1] Still, most people experience a separation of health and wellbeing in practice. Diseases are treated by different industries, practitioners and approaches than those that promote holistic wellbeing.

The past decade has seen many transformative advancements in health and wellbeing. New "cocktail" treatments for HIV make the patient's drug protocol more manageable and effective, and pre-exposure prophylaxis provides the first-ever protection from the virus. Targeted cancer therapies and immunotherapy are dramatically improving the prognosis for many cancer patients. Additionally, rates of smoking have dropped considerably after 25 states banned smoking in all workplaces.

Yet for every advance, there are many intractable global health and wellbeing issues. Non-communicable diseases, long the most common cause of death in developed nations, are now the leading cause of death and disability in developing countries[2] Such diseases caused 37 percent of deaths in low-income countries in 2015, up from 23 percent in 2000.[3] With increasingly early onset, treatment of non-communicable diseases lasts many years, is costly and affects not just patients but their caretakers and families, too.

Specifically, there is ample evidence that neurological disorders are one of the greatest threats to public health and account for a significant proportion of the global burden of disease.

In 2010, mental and behavioral disorders comprised 7.4 percent of the global burden of disease. Neurological disorders comprised 3 percent, and stroke alone accounted for an additional 4.1 percent of the burden. Among mental and behavioral disorders, unipolar depressive disorders, anxiety disorders, and drug and alcohol use disorders account for 76 percent of the burden. Migraine, epilepsy, dementias, and Parkinson's disease account for 72 percent of the burden of neurological disorders.[4]

Millions of people are living with chronic neurological diseases and disorders

Globally, an estimated 300 million people are affected by depression.[5] In 2015, an estimated 43.4 million adults in the United States reported a mental illness in the previous year, representing 17.9% of all adults.[6]

Worldwide, 47.5 million people have dementia and there are nearly 10 million new cases every year.[7] Alzheimer's disease is the most common cause of dementia and may contribute to 60–70% of cases. The Alzheimer's Association (AA) estimates that 5.5 million people in the U.S. have Alzheimer's disease, and with an aging population, this number is predicted to grow sharply as the baby boomer generation reaches old age. By 2050, the AA estimates that between 11 million and 16 million Americans will have the disease, with one new case appearing every 33 seconds.

More than 10 million people worldwide are living with Parkinson's disease. As many as one million Americans live with Parkinson's disease, and approximately 60,000 Americans are diagnosed with Parkinson's disease each year.[8]

According to the Centers for Disease Control and Prevention (CDC), about 1 in 68 children in the U.S. has been diagnosed with an autism spectrum disorder. Boys are about 4.5 times more likely to have the disorder than girls. Studies from other parts of the world have confirmed similar prevalence.[9] Developmental disorders usually have a childhood onset but tend to persist into adulthood, causing impairment or delay in functions related to the central nervous system maturation.

The economic and social costs of brain disorders are large and growing

The economic costs of brain and mental health disorders are large and growing, in line with the scope and duration of affliction. "These include not only the cost of treatment, but also the lost productivity of patients and their caregivers, for whom looking after chronically disabled family members can represent an enormous source of emotional, practical, and financial burden."[10]

"The total economic burden of mental depressive disorder is now estimated to be $210.5 billion per year, representing a 21.5 percent increase from $173.2 billion per year in 2005. Of particular interest is that nearly half of these costs are attributed to the workplace, including absenteeism (missed days from work) and presenteeism (reduced productivity while at work), whereas 45-47 percent are due to direct medical costs (e.g., outpatient and inpatient medical services, pharmacy costs), which are shared by employers, employees, and society. About 5 percent of the total expenditures are related to suicide."[11]

The global costs of dementia have grown from an estimated $604 billion in 2010 to $818 billion in 2015, an increase of 35.4 percent. Direct medical care costs account for roughly 20 percent of global dementia costs, while direct social sector costs and informal care costs each account for roughly 40 percent.[12]

In the U.S. alone, costs of care for people living with Alzheimer's was estimated at $226 billion in 2015, with Medicare and Medicaid paying 68 percent of the costs. Without a new treatment, costs are projected to increase to more than $1.1 trillion in 2050.[13]

Treating the chronic pain associated with chronic disease and illness also comes at a tremendous economic cost. Estimates of the total incremental cost of health care due to pain range from $261 to $300 billion. When combined with lost productivity from missed work, lost work, and lower wages, the estimate of total financial cost of pain to society ranges from $560 to $635 billion (in 2010 dollars).[14]

Pharmaceuticals are only part of the solution

NIH will spend more than $17 billion on clinical research and clinical trials in 2017.[15] Pharmaceuticals play a critical role in preventing, managing, reversing, and curing diseases, but with prohibitive costs and adverse side effects, they alone will not address the epidemic of chronic neurological diseases.

Many people with chronic diseases are prescribed multiple drugs, leading to confusion, adverse side effects, and financial concerns. Nearly 1 in 10 Americans report not taking drugs as prescribed because they can't afford them,[16] and 1 in 4 report having difficulty paying for prescriptions. Estimates of the proportion of people who can't afford their drugs range from 1 in 10 to 1 in 4.[17]

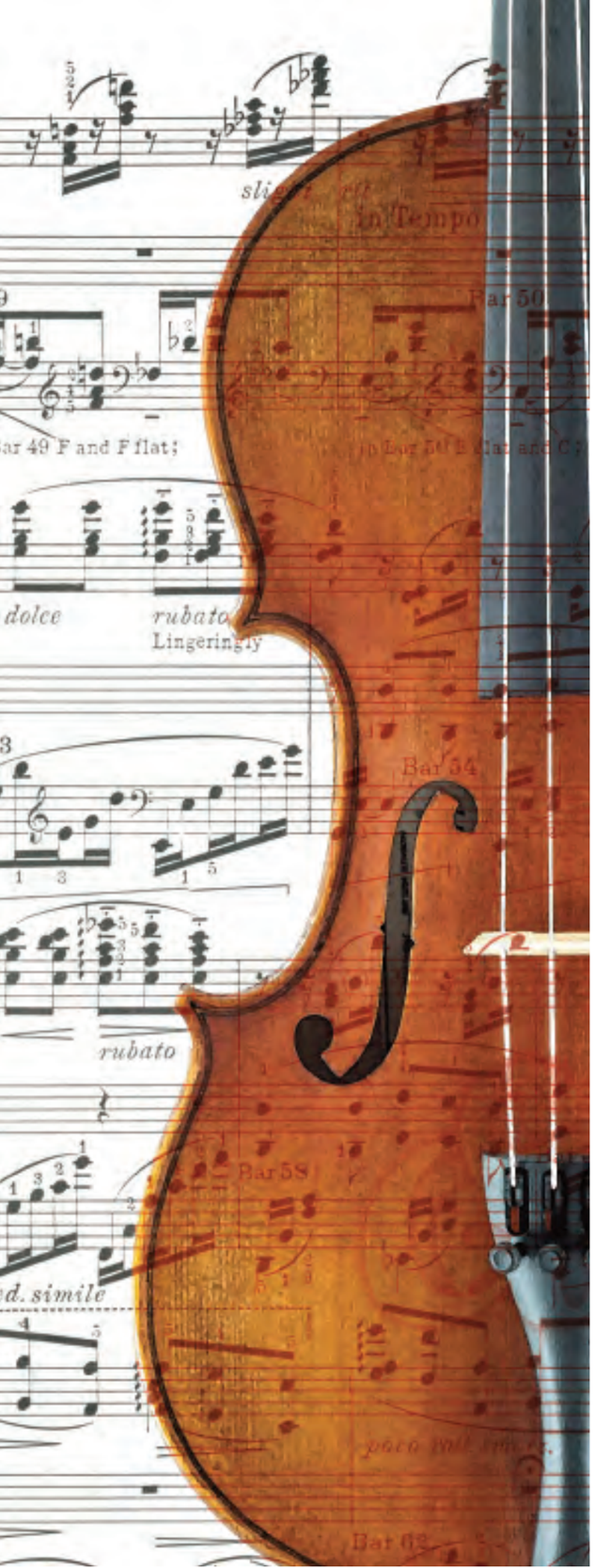
Additionally, drugs don't always work. In 2016, after a decade of trials, Eli Lilly announced that solanezumab, its experimental drug for Alzheimer's, failed to improve cognition in a large clinical trial.[18] Lilly's drug is not alone. Many other drugs designed to prevent the formation of the amyloid plaques that are seen in the brains of patients with the disease failed in trials. Solanezumab, like most drugs seeking FDA approval, was in development for a decade, potentially leaving the millions of people suffering with Alzheimer's to wait 10-15 years for their next best hope for a treatment or cure.

Wellbeing

While pharmaceuticals may help patients manage their symptoms, they alone do not provide the "complete physical, mental and social well-being" described by the WHO in its definition of health. Moreover, they do not often offer a strategy for prevention. Accordingly, in addition to health care system interventions and epidemiology and surveillance, the CDC also calls for environmental approaches and community programs linked to clinical services as a four-part strategy for preventing or lessening chronic disease.[19]

Expanding on environmental and community programs, according to the National Conference of State Legislatures, "wellness policy options also include promoting health and wellness programs in schools, worksites, and communities, enabling healthy choices and environments, ensuring access to a full range of quality health services for people with chronic conditions, eliminating racial, ethnic, and socio-economic health disparities, and efforts to educate the public about their health and how to prevent chronic disease."[20]

This vision of holistic health and wellbeing is aspirational, but not unattainable. Wellness is as much about prevention as it is about intervention. Many more people today are accessing wellness programming through their employers and accessing complementary or integrated medicine. Still, living with a chronic disease or caring for someone with a chronic disease puts a strain on many facets of quality of life. Being sick or caring for a sick family member while working full-time or struggling to make ends meet adds an additional layer of stress. Even without a diagnosed illness, a number of studies, discussed in the following section, demonstrate that living in or near poverty



comes with its own set of health and wellbeing challenges and disparities. In short, we have a lot of work to do to realize this vision of holistic wellbeing for people of all ages across the income spectrum.

Stress is a barrier to wellbeing and prevention

The American Psychological Association's (APA) annual Stress in America survey shows trends in stress over time. In 2016, stress factors included work, money, the economy, health concerns and family responsibilities. More Americans reported experiencing "extreme stress" at 24 percent in 2016 compared to 18 percent in 2014. Seventy percent of adults reported they experienced discrimination, such as unfair treatment by police, being unfairly fired or denied a promotion, or receiving poor treatment from health care providers.[21]

Work-related stress is the leading workplace health problem and a major occupational health risk, ranking above physical inactivity and obesity.[22] Two-thirds of both men and women say work has a significant impact on their stress level, and one in four has called in sick or taken a "mental health day" as a result of work stress.[23] Sixty-eight percent of workers say that their employer should offer a program that helps build resilience to stress.[24] According to the U.S. Bureau of Labor Statistics, workers who must take time off work because of stress, anxiety, or a related disorder will be off the job for about 21 days.

While workplace wellness programs are becoming more and more common as a way to reduce absenteeism, presenteeism, and employer-sponsored healthcare costs, these opportunities are often limited to those in average- and high-paying jobs.[25]

Access to a healthy lifestyle is inequitable

Since its inception in 2007, money has been the top reported stressor in the APA's Stress in America survey. In 2015, almost one-third of respondents said that lack of money prevented them from living a healthy lifestyle.

Young people, particularly those in inner cities, are also living with increasing stress. The America's Promise Alliance conducted a survey of youth in five urban cities to assess barriers to wellbeing. In all five cities, respondents described employment concerns, race relations, violence, lack of community resources, and other environmental challenges as meaningful barriers to their wellbeing. Young people reported feeling unsafe in their communities, citing stereotyping and racial bias as reasons they feel unsafe and unwelcome.[26]

A growing body of research shows that the stresses associated with living in poverty affect brain function. A new study assessed the long-term impact of such environmental stress. Researchers found that "test subjects who had lower family incomes at age nine exhibited, as adults, greater activity in the amygdala, an area in the brain known for its role in fear and other negative emotions. These individuals showed less activity in areas of the prefrontal cortex, an area in the brain thought to regulate negative emotion."[27]

These findings translate into the classroom.

Learning

There is a growing gap between the academic performance of higher and lower income students.

The National Assessment of Educational Progress (NAEP), known as the nation's report card, is a nationally representative standardized test given every year to fourth, eighth, and twelfth graders in subjects including reading, mathematics, science, writing, the arts, civics, economics, geography, and U.S. history.

Across the NAEP sample from 2015, 40 percent of fourth-grade and 33 percent of eighth-grade students perform at or above the proficient level in mathematics. In the aggregate, these levels of proficiency are not impressive for the richest nation in the world. However, disaggregating the data by income tells an even more nuanced story: 58 percent of fourth graders who do not qualify for the national school lunch program are at or above proficient, compared to 24 percent of students who do quality for the national school lunch program, a proxy for low-income households, who meet the proficiency benchmark. For eighth graders, those figures are 48 and 18 percent proficient for higher income and lower income students, respectively. Results for reading are similar, though with an overall lower proficiency rate in the subject when compared to mathematics.[28]

The 2016 NAEP music assessment, administered in the eighth grade, also shows differences by income level, with a 26-point gap (out of 300 points) in average score between lower and higher income students. Results also show statistically significant gaps between male and female students, city and suburban schools, and public and private schools, with the former at a deficit in each case. The same significant gaps were present in the results of the visual arts assessment as well. The assessment showed that 63% of 8th graders took a music class and 42% took a visual arts class, slightly down from 2008.[29]

Whereas income achievement gaps have grown, racial achievement gaps have narrowed in core academic subjects and arts assessments in recent years.[30] Nationally, high school graduation rates are up for all students, including those with disabilities.[31] Still for youth with an autism spectrum disorder (ASD), postsecondary employment and education outcomes are low. A recent study published in Pediatrics found that of high school graduates with an ASD, 35 percent had attended college and 55 percent had held paid employment during the first 6 years after high school. More than 50 percent of youth had no participation in employment or education two years after completing high school. Those from lower-income families and those with greater functional impairments were at increased risk for poor outcomes.[32]

The Case for the Arts

Bearing high economic and social burdens, the millions of people suffering from chronic neurological diseases and stress don't have years to wait for new pharmaceutical advances, therapies or cures, nor should they have to. They shouldn't have to pay out of pocket for expensive therapies that improve their quality of life, functioning, and life outcomes when there is a ready solution: the arts. There is much promising evidence that a variety of healing arts and creative arts therapies can improve mobility, mental health, speech, memory, pain, and learning outcomes, not only improving life for chronic disease sufferers, but for those experiencing stress associated with work, poverty, war and inequity. These therapies are timely, responsive, and cost effective.

Brain on Art

Interacting with the arts, either as beholder or maker, provides powerful experiences which in turn help build our brain's complex and vast neural network. We know that the brain constantly changes how it passes information between its neurons. This plasticity is a result of the brain's constant responses to its internal and external environment and experiences. This agility of the brain underlies our ability to learn, remember and heal. Exposure to the arts, including the visual arts, creative writing and poetry, music, architecture, dance, and theatre, creates interconnectivity between different areas of the brain. Brain regions do not work in isolation—the strengths of the connections build cognitive skills, predict long-term outcomes in resiliency, social-emotional health, executive function, learning, and memory. The arts engage the whole brain and researchers seek links between specific brain areas and the practice or perception of art.

There is promising yet incomplete evidence for arts-based therapies

While indigenous societies have acknowledged the healing power of visual art, dance, music, drama, and storytelling for millennia, the western world's recognition of the therapeutic benefits of the arts is more recent. Its core purpose is far from foreign to medicine, however. Hippocrates wrote, "The natural healing force within each one of us is the greatest force in getting well." The arts tap into that natural healing force by unifying the mind and body and addressing both biological and psychological symptoms of disease—managing patient symptoms while improving quality of life.[33] A 2005 report by the Rand Corporation about the visual arts argues that experiencing the arts does more than improve an individual's life. Rather, it "can connect people more deeply to the world and open them to new ways of seeing," increasing global understanding, social bonds, and cohesion.[34]

In a recent review of the literature on the use of arts-based therapies in medicine published in the Journal of the American Medical Association, Khan and Moss (2017)[35] describe a wide range of studies that demonstrate its "significant influence" on improving the health care outcomes and experience of a variety of stakeholder groups, including patients, medical students, and hospital staff. Therapies most commonly used include music, visual arts, dance and movement, and writing. Broadly, creative arts therapies have been used with a number of patient populations, including patients dealing with pain, psychiatric issues, and neurological disorders as well as military veterans with PTSD and traumatic brain injury (TBI).

Research points to a number of benefits of arts-based therapies, including managing chronic pain, reducing anxiety, improving social functioning, mood, memory and concentration, reducing fatigue, and improving emotional wellbeing and understanding.[36] Khan and Moss (2017) focus in particular on music therapy:

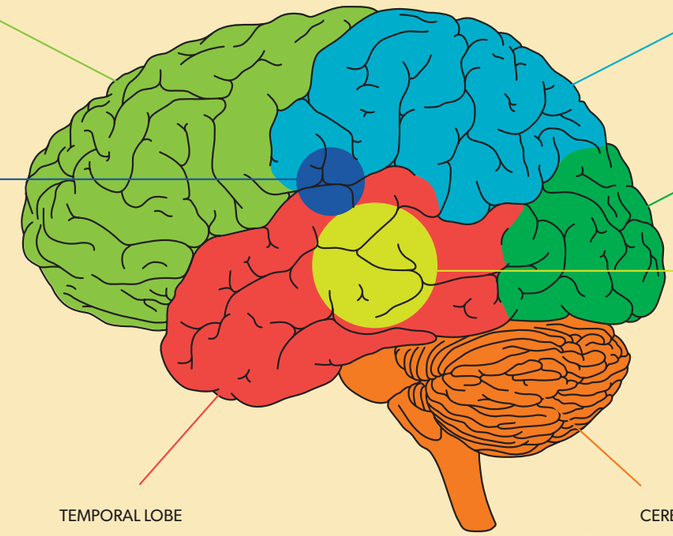
"Music therapy programs have been found to reduce anxiety, pain intensity, fatigue, and opioid use in patients with cancer. For patients with coronary heart disease, music listening may have a beneficial effect on blood pressure, heart rate, respiratory rate, anxiety, and pain control. For patients with depression, music therapy can not only reduce their depressive symptoms but can stimulate social engagement in patient groups. Neurologically, music therapy helps improve gait ability, timing of upper extremity function, communication outcomes, and quality of life for patients who experienced a stroke. For patients with dementia, music therapy has been shown to encourage recall of autobiographical memory while reducing agitation and aggressive behaviors. Art-centered experiences provide patients with dementia and their caregivers a meaningful vehicle for nonverbal emotional expression while these individuals develop a state of concentration and pleasure derived from a rewarding activity that creates a sense of well-being."

Studies have also examined the role of dance/movement therapy (DMT) in treating a variety of brain disorders. In one meta-analysis, researchers found that DMT is effective for increasing quality of life and decreasing clinical symptoms such as depression and anxiety. Positive effects were also found on the increase of subjective well-being, positive mood, affect, and body image.[37]

While there are many studies on DMT, fidelity of program implementation and rigor of research are issues in furthering the field. Researchers conducting a Cochrane Review on the impact of DMT on dementia initially identified 102 studies, screened 80 at title/abstract level and then reviewed 19 full papers, none of which met the inclusion criteria.[38] A second Cochrane Review on DMT and depression cited "low number of studies and low quality of evidence" in finding it was not possible to draw firm conclusions about the effectiveness of DMT for depression.[39]

In their "Systematic Review of the Evidence for the Effectiveness of Dance Therapy," Strassel, Cherkin,

Mapping the Brain and Aesthetic Experiences



Recent advances in brain imaging have accelerated our understanding of neural processes. This explosion of knowledge has been deemed the most exciting intellectual period since the Renaissance.

We can now describe the brain as having one hundred billion neurons, and each of those neurons has up to one hundred thousand connections, changing in response to our experiences from nanosecond to nanosecond. Brain imaging allows us to assign specific functions to many areas of the brain.

Neuroscientists have charted an equivalent map of the brain's outermost layer — the cerebral cortex — subdividing each hemisphere's mountain- and valley-like folds into 180 separate parcels. But neuroscience is just brushing the surface still: Ninety-seven of these areas have never previously been described, despite showing clear differences in structure, function and connectivity from their neighbors. Meanwhile researchers have been able to correlate various aesthetic perception/ functions to specific parts of the brain.

Stuten, Sherman and Vrijhoef (2011) recommended well-performed RCTs and observational studies were needed to "determine the real value of dance therapy."[40]

Studies examining the role of visual arts and expressive writing are more limited, but have been shown to help elderly or chronically ill patients and patients with cancer. These patients learn to express experiences often too difficult to put into words while reducing stress and anxiety.[41]

Promising approaches aid service members

Military personnel currently receive creative arts therapies in a number of inpatient and outpatient military treatment facilities as well as in connected community-based settings. Creative Forces, a unique partnership of the National Endowment for the Arts, the Department of Defense and the Department of Veterans Affairs, incorporates creative arts therapies into an interdisciplinary care program for service members suffering from PTSD and TBI, as well as their families. Creative Forces recently commissioned a research synthesis and gap analysis to inform a research agenda with an emphasis on understanding the biological and psychosocial benefits and comparative cost–effectiveness of these interventions.[42]

Much of the extant research cited in the report hinges on self-reported outcomes from service members and veterans, which include improvements in cognitive function, such as increased concentration, attention, memory, and organization, as well as reductions in nightmares and trauma–related arousal. Service members participating in creative arts therapies also report increases in positive emotion, emotional self–efficacy, and self– esteem, as well as improvements in social relationships, including with spouses and children.

While research on the use of creative arts therapies to treat PTSD and TBI has existed for several decades, report authors concede "it is difficult to draw firm conclusions about the impact of creative arts therapies in treating TBI, PTSD, and co–occurring conditions for service members and veterans based on current published literature, given the variability in creative arts therapy models, treatment protocols, and research methodologies."

Broader behavioral and learning outcomes are noteworthy

Beyond creative arts therapies, aesthetics enhanced by architecture and design are also important to health and wellbeing. Research has shown that patients have less stress and anxiety, reduced need for analgesia, and are ready for discharge earlier when their health care facility provides them with views of natural and urban scenery.[43]

The health care experience of patients and staff is also enhanced with arts-based therapies. Studies show that exposure to the arts can offset the stress of working in a health care environment, including building rapport among staff and patients and improving surgical accuracy and speed. Accordingly, medical schools and teaching hospitals are beginning to incorporate expressive writing, drama, visual arts, and music therapy into their curriculum as a way to improve communication, empathy, and clinical observation, among other benefits.[44]

Hundreds of studies demonstrate the link between arts approaches and improvements in academic and social-emotional outcomes.[45] Students who are highly involved in the arts receive better grades, have more positive attitudes about school, and are less likely to drop out of high school. Importantly, given the growth of income-based achievement gaps, the differences are most significant for economically disadvantaged students.[46]

In 2004, the Dana Arts and Cognition Consortium convened cognitive neuroscientists from across the United States to discuss and debate why arts training is associated with higher academic performance—questioning whether higher performers are simply drawn to the arts or if the arts indeed cause changes in the brain that enhance aspects of cognition.

Findings published in a subsequent report of the participating scientists' research programs included links between: high levels of music training and the ability in both working and long-term memory; practicing music and geometry skills in children; music training and reading acquisition and phonological awareness; and acting training and memory improvement.

As the report's title, "Arts and Cognition: Findings hint at a relationship," previews, report editors conclude that there are many opportunities for further investigation:

"Many of the studies cited here tighten up correlations that have been noted before, thereby laying the groundwork for unearthing true causal explanations through understanding biological and brain mechanisms that may underlie those relationships."[47]

A 2017 report from the Brookings Institution echoes this call for more research nearly a decade later. Report authors acknowledge that while research on the relationship between arts education and a variety of academic and non-academic indicators is expansive, studies are mostly small in scale and lack the quality data sources necessary to make strong statements about impact and inform practice. Whereas arts education was deprioritized during the No Child Left Behind era because of a stringent focus on math and reading, the authors frame a new opportunity under the 2015 Every Student Succeeds Act for states to establish a new definition of a well-rounded education, which should include a focus on measuring the impact of arts education.[48]

A call for consensus

Across health, wellbeing and learning domains, researchers, practitioners and advocates alike have called for a more coordinated and rigorous research agenda on the connection between arts and mind. We know based on promising evidence that there is a connection between arts experiences, health, and learning. Now, we must interrogate the neurological underpinnings of observed changes to better document, refine, replicate, and scale these responsive and affordable treatments and programs. Because creative arts therapies enable biological, psychological, and psychosocial benefits, research must examine both behavioral markers and biomarkers together. The field of neuroaesthetics is well positioned to play this role.

History and Definition of Neuroaesthetics

How does the brain process aesthetic experiences? How does our knowledge of basic brain mechanisms inform our understanding of these experiences? These questions are at the heart of neuroaesthetics, an emerging discipline focused on exploring the neural processes underlying our appreciation and production of objects, art, and experiences including perception, interpretation, emotion, and action.[49]

Neuroaesthetics explores the role of the arts, music, architecture, and natural environments as they alter and shape individual brain responses. The field has deep roots in cognitive neuroscience and the humanities, but it is evolving as a highly interdisciplinary opportunity for research-to-practice applications in the areas of architecture, education, health, and wellbeing.

The newness of neuroaesthetics is exemplified in the fluidity and variety in the definitions of the discipline. Overall, researchers are concerned with understanding the basic science of the aesthetic experience. Yet for some, aesthetics does not necessarily involve beauty. “Aesthetics to me as a biologist involves responding to objects, events in the external world, with emotion, not necessarily positive. It has an emotional impact on you, and I'll call that aesthetics,” says V.S. Ramachandran,[50] who has been described as the “Marco Polo of neuroscience.”[51]

According to researcher Anjan Chatterjee, definitions are complicated. "Philosophers spend a lot of time talking about that. I would define aesthetics as a set of experiences that occur typically when people respond to beauty, but not only to beauty. There are other institutional ways in which aesthetic context can be provided, where even typically non-pleasurable emotions can become aesthetic. For example, people will go to movies that are scary, even though in the real world, they wouldn't approach those kinds of scary experiences. Given an institutional context, which is in this case, a movie theater or a play or even looking at a horrific painting in a museum, in those contexts, there is something about that experience that then becomes an aesthetic experience."[52]

Neuroaesthetics received its formal definition from Semir Zeki in 2002 as the scientific study of the neural bases for the contemplation and creation of a work of art.[liii] This definition has expanded through interdisciplinary study of the intersection of the arts and mind, drawing neuroscientists and cognitive scientists, architects, artists, designers, musicians, psychologists, philosophers, clinicians, educators, art historians, and digital media.

In recent decades, advances in the imaging and mapping of the brain have galvanized neuroscience and its sub-discipline of neuroaesthetics. Coburn, Vartanian & Chatterjee (2017) succinctly describe the major recent milestones in the field:

"Around 2004, neuroaesthetics arrived at a pivotal point in its development both empirically and theoretically. The first papers using fMRI to identify neural responses to art and to critically review the neuropsychology of art were published. In concert, and perhaps more importantly, early models outlining key cognitive and neural systems involved in aesthetic experience were set forth. Previous research had been primarily descriptive in that most studies generated qualitative observational claims relating facts of the brain to aesthetic experiences. The pivot initiated a shift from descriptive hypothesis-generating research to empirical hypothesis-testing studies and helped launch the discipline into the mainstream of scientific investigation."[53]

Another marker of the newness of this discipline is that its pioneers are alive, working, and collaborating. The many innovators in this broad multi-disciplinary field are too many to list, but represent fields including neuroscience, cognitive science, psychology, psychiatry, public health, humanities, music, and education.

Timeline

40,000 BC — 01

Cave paintings

Evidence of humanity's instinct to create art

1404 - 1518 — 02

Alberti and Leonardo

Define the biological basis of Renaissance aesthetics

1801 - 1887 — 03

Gustav Theodore Fechner

Pioneers the use of psycho-physics to study aesthetic appreciation

1852 - 1934 — 04

Santiago Ramón y Cajal

Groundbreaking drawings of the brain exemplify the marriage of art and neuroscience

1950s to present — 05

Accelerated neuroscientific discovery

New imaging techniques including CAT and PET scans, MRI, fMRI, EEG, and MEG

1988 — 06

Semir Zeki

Writes "Art and the Brain" and coins term "neuroaesthetics"

2003 — 07

Academy of Neuroscience for Architecture

Founded

2010 — 08

JHU Brain Science Institute

Hosts "The Science of the Arts" conference

2016 — 09

International Arts + Mind Lab

Founded

Growing Applications of Neuroaesthetics

Interest in the study of neuroaesthetics has grown swiftly over the past 15 years, as is evidenced by new organizations, conferences, and academic research focused on the subject. In 2003, the Academy of Neuroscience for Architecture (ANFA)[78] was formed to build collaboration among architects and neuroscientists to explore the design and development of environments based on human responses. In 2010, The International Network for Neuroaesthetics[79] was established to expand and share empirical research in the field. In 2016, the Brain Science Institute (BSi) at Johns Hopkins University (JHU) School of Medicine embarked on an initiative to further accelerate the field of neuroaesthetics through the creation of the International Arts + Mind Lab (IAM Lab).[80]

Not surprisingly, neuroscience and aesthetics fascinates the public and the media. Today, newspapers, magazines and blogs are full of examples of applications of neuroaesthetics principles: architects improving housing for the health and wellbeing of the elderly, homeless and imprisoned; museums and advertisers using brain research to make their exhibits and products more engaging and appealing; cities building natural playgrounds made of recycled trees and boulders; and universities launching programs to prepare students for careers in computer games and virtual reality.

New media and technology are making adaptive and immersive design and aesthetic experiences more accessible. Brain research is becoming more abundant and applied in new ways all the time. There are many opportunities for neuroaesthetics to grow as a field. But we ask, to what end, and how?

IAM Lab and the Landscape of Arts and Science Collaboration

IAM Lab exists to help shape and grow the neuroaesthetics field through increased collaboration and research among brain scientists and practitioners in architecture, music, and other fine arts. At the core of IAM Lab's mission are multidisciplinary research-to-practice efforts focused on investigating impact across the areas of health, wellbeing, and learning.

Since 2007, BSi has led this type of joint intellectual endeavor at Johns Hopkins, creating the working group model that is now used for research across the JHU School of Medicine and hosting the seminal "The Science of the Arts" conference in 2010. BSi also promulgated the Drug Discovery translational program, taking its basic discoveries from the bench to pharmaceutical applications.

IAM Lab carries that tradition of translational research forward through a lens of broader social change and impact. To accomplish this mission and help frame the appropriate research questions, IAM Lab is reaching out to researchers, clinicians, architects, artists, musicians, schools, associations, and others interested in research at the intersection of the arts and brain science and is building a robust interdisciplinary community.

IAM Lab's institutional roots at Johns Hopkins make possible the convergence of studies and field-leading advancements in brain science, medicine, public health, education, public policy, and music cognition. In the broader Baltimore community, the Maryland Institute College of Art, American Visionary Arts Museum, and Baltimore Museum of Art, among others, enrich the IAM Lab with a corps of collaborating designers and artists.

Globally, our approach includes collaborating with leading art, architecture, and music organizations that are spearheading their own research agendas to document and evaluate the impact of their programs. We are learning from their ideas, but also their common challenges.

How can we use neuroaesthetics to solve intractable problems related to health, wellbeing and learning for diverse populations?

IAM Lab is working with the following organizations to answer questions that have lasting impact across a number of disciplines. Their research questions include:

Can making art help service members with post-traumatic stress disorder and traumatic brain injury?

National Endowment for the Arts: As previously referenced, Creative Forces: NEA Military Healing Arts Network is a partnership of the National Endowment for the Arts, the Department of Defense and the Department of Veterans Affairs that includes a creative arts therapist as part of a team approach to helping heal service members and veterans who are confronting the wounds of war. Creative Forces is seeking better evidence of the impact of its programs on post-traumatic stress disorder and traumatic brain injury and a scalable model for its promising mask-making program.

Can immersive, entertaining therapy help stroke patients recover faster?

Johns Hopkins Brain, Learning and Animation Lab (BLAM): BLAM makes movement more motivating and rewarding by combining what we know about learning and brain plasticity with what we know about what people love to watch for fun, like Pixar movies, to promote faster recovery for stroke patients. BLAM puts stroke patients in a dolphin simulator and enables them to "swim" through a blue ocean world to regain their mobility. BLAM's goal is to understand whether/how this art-enhanced approach improves recovery over traditional therapies.

Can the arts advance global understanding?

Silkroad Ensemble: Inspired by the exchange of ideas and traditions along the historical Silk Road, cellist Yo-Yo Ma established Silkroad in 1998 to create music that engages difference. Silkroad musicians are also teachers, producers, and advocates. Off the stage, they lead professional development and musician training workshops create residency programs in schools, museums, and communities of all sizes to share Silkroad's model of radical cultural collaboration.

Can the design of a hospital for children with developmental disabilities enhance their health and learning outcomes?

The Kennedy Krieger Institute (KKI): Kennedy Krieger offers patient care, research, and training and a number of school and community-based programs for individuals with developmental disabilities. KKI is building a healing room and seeks to apply neuroaesthetics research to its design to aid in better outcomes for patients and families.

Can the architecture of hospitals, prisons, and schools improve health, wellbeing, and learning outcomes?

Academy of Neuroscience for Architecture: The mission of the Academy of Neuroscience for Architecture is to promote and advance knowledge that links neuroscience research to a growing understanding of human responses to the built environment. The Academy benefits from the expanding body of research that has evolved within the neuroscience community in the last two decades, and the promise of even more in the coming century.

Can music restore speech function for people with Parkinson's or Alzheimer's?

Johns Hopkins Center for Music and Medicine seeks to integrate music and rhythm into medical care and improve the health of musicians worldwide. More than 80 Johns Hopkins faculty members across dozens of disciplines have affiliated themselves with the center. The Center seeks to extend research on music's impact on anxiety and dementia to understand its impact on Parkinson's and Alzheimer's diseases.

While renowned in their fields, each of our partners is seeking support from a new organization like IAM Lab to lead, conduct, commission, and/or apply the kind of rigorous neuroaesthetics research it seeks for translation into evidence-based practice and replicable and scalable programs.

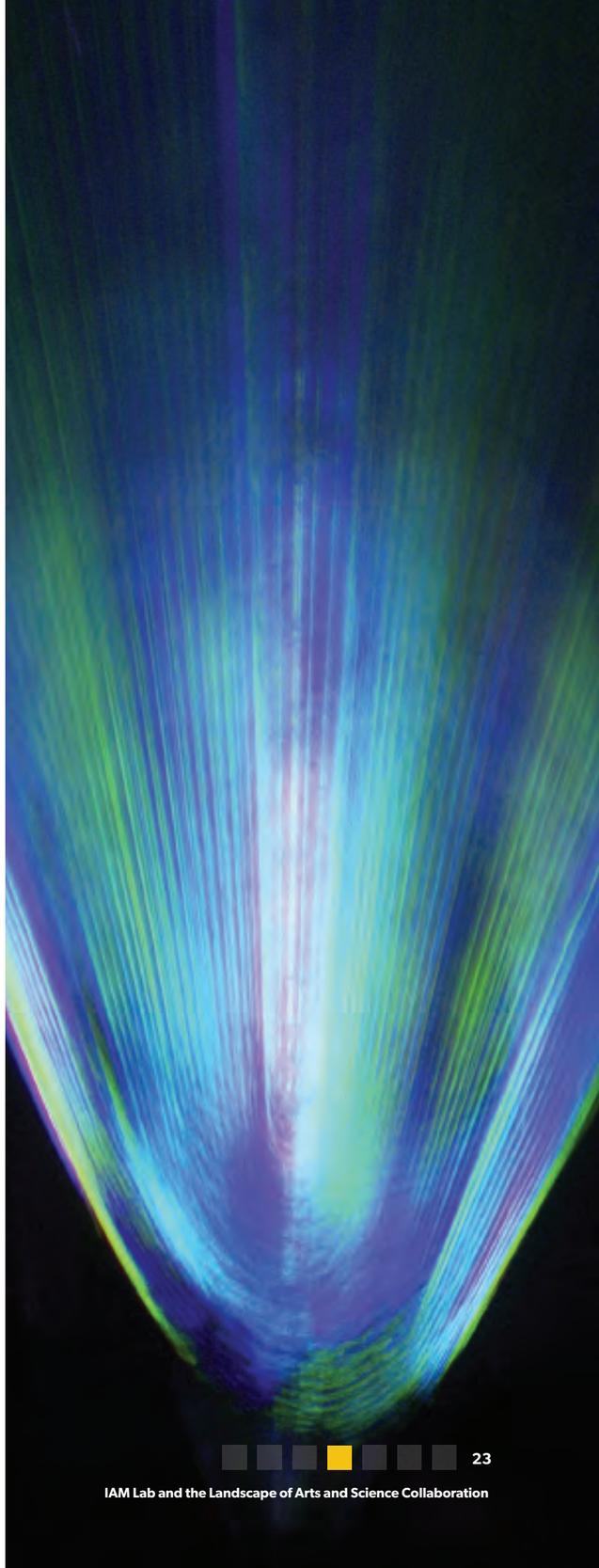
In addition to its global partners, IAM Lab is learning from other interdisciplinary research efforts across the country as it approaches its own research agenda and framework. Leaders in multidisciplinary research include:

The MIT Media Lab is focused on the study, invention, and creative use of digital technologies to enhance the ways that people think, express, and communicate ideas and explore new scientific frontiers. The Lab brings together product designers, nanotechnologists, data-visualization experts, industry researchers, and pioneers of computer interfaces to develop and test new technologies and has spun off many tech companies after incubation at the Lab.[81]

The Frank-Ratchye STUDIO for Creative Inquiry at Carnegie Mellon University is a "laboratory for atypical, anti-disciplinary, and inter-institutional research at the intersections of arts, science, technology, and culture." The STUDIO provides paid artist residencies and facilities and commissions work. It also provides its fellows with access to human and technical resources at Carnegie Mellon and throughout the Pittsburgh region and develops public venues for the presentation of work.[82]

Ideas42 uses behavioral science to design scalable solutions for social impact. The group educates policy-makers and practitioners on how to use behavioral science and partners with institutions to evaluate and improve existing models and create and test new solutions. They are focused on using behavioral insights to scale solutions.[83]

IDEO is a global design company that seeks to create positive impact through design. IDEO is known for using Design Thinking, a process that reframes problems in a human-centric way and uses interdisciplinary collaboration, empathy, and prototyping to design solutions and test them with actual users.[84]



The Need for a Rigorous Translation Approach

We see in the efforts of other multidisciplinary research centers much of what we hope to accomplish at IAM Lab: bringing together scientists and artists, focusing on research-to-practice, scaling and disseminating, aggregating funding, and creating a repository of scholarly papers and other resources for researchers. Still, expanding evidence-based practice and extending brain science applications to the arts disciplines is an endeavor that warrants its own consideration.

There is much to learn about the intricate intersections of the arts and our human brain. However, as previously discussed, the arts in general are not known for scientific rigor or evidence-based practice, though specific disciplines such as music therapy do benefit from a more rigorous research approach.

While a strong body of research shows the power of the arts to affect a wide range of issues, the absence of such rigor in most programs has limited its reach into scientific fields.

Researchers around the world are conducting studies in neuroaesthetics without a translational approach that properly validates the arts as interventions and solutions.

> **"You now appreciate the dilemma ANFA faces. There is evidence based on neuroscience animal research that a link should exist between the environment and human behavior, but due to lack of funding and the difficulty in pursing controlled studies, the data is not being collected (or cannot be interpreted when it is)."**
>
> Correspondence with Steven Henriksen, President of the Academy of Neuroscience for Architecture.

Despite broad interest, no American research programs focus on neuroaesthetics. As a result, even though aesthetics influences many decisions, big and small, little of their psychological and neural underpinnings is known. The few institutions that do touch on neuroaesthetics are not grounded in rigorous cognitive neuroscience methods. Moreover, solutions are not borne out of interdisciplinary collaboration and rigorous empirical research to develop guiding scientific research principles that translate into policy and practice. Therefore, the research on the impact of the arts is often anecdotal and underfunded with limited evaluation and dissemination.

While the arts need neuroscience, neuroscience also needs the arts. "Neuroscience has served and continues to serve as a descriptive tool used to shed light on the parts of the brain involved in decision-making, but cannot be used as a full-fledged predictive tool. In other words, while neuroscience techniques can explain how various parts of the brain interact during decision-making, and what that means, it has little predictive power with regard to the course of action taken."[85]

A consistent and rigorous approach to empirical research and translation that brings together basic science, cognitive neuroscience, and the arts would go far to produce reliable, reputable, and replicable findings for many disciplines. Beyond outcomes in health, wellbeing, and learning, a translational approach would build and formalize the field of neuroaesthetics in important ways. By establishing common research questions, tools, methodologies, training, and dissemination practices, we could collectively build a repository of comparable data and experienced researchers and practitioners from which to draw insights and advance the field. This is a long-term approach that needs a place to start and grow.

Finally, IAM Lab seeks to expand and extend the definition of neuroaesthetics to include a critical factor missing from current arts and mind research: impact. As previously introduced, understanding the impact of aesthetic experiences on the brain is more than a "nice to know" from a scientific perspective; it has tremendous implications for the health, wellbeing, quality of life, and academic and social success of millions of people.

Constructing a Consensus Framework

Developing an Approach

To solicit further feedback on the considerations for a translational research approach for neuroaesthetics, IAM Lab convened an interdisciplinary working group of neuroscientists, cognitive researchers, artists, architects, neurologists, video game designers, digital media developers, design thinking experts, engineers, computer scientists, philosophers, musicologists, social scientists, science of learning scholars, communications and implementation experts, and humanities scholars in April 2017 at the Brain Science Institute.

The working group considered whether a new approach to accelerating the translation, implementation, and dissemination of arts-based solutions in health, wellbeing, and learning was needed by reviewing existing research-based models including implementation sciences in public heath, action research, theory of change, empirical basic research models, science of learning, and design thinking. Using straw man impact-based neuroaesthetics research questions, working group members assessed the relative fit of various existing models.

Working group members recommended that an approach to neuroaesthetics research and translation should:

- Value exploration within a standard frame. Perhaps best defined as a kind of structured flexibility, this approach should move forward with an appreciation for the unexpected and openness to the idea that we don't already know the answer.
- Consider all the characteristics endemic to the problem (social, cultural, geographic) at the outset—the molecular all the way to societal. Then, convene the right interdisciplinary team of experts, including members of the communities affected by the problem. These questions are too complex to be addressed by anyone working in one discipline.
- Go beyond traditional efforts at dissemination. As a pre-condition, seek a practitioner partner with the ability to scale the intervention and receive training and technical assistance for ongoing implementation and sustainability of the work. Include key dissemination partners from the beginning.
- Train a team of facilitators or principal investigators to operate consistently in this approach. IAM Lab will create and benefit from a team of neuroaesthetics researchers and practitioners who understand the process and are able to shepherd various partners through the interdisciplinary approach.

Proposing a Translational Approach for Neuroaesthetics

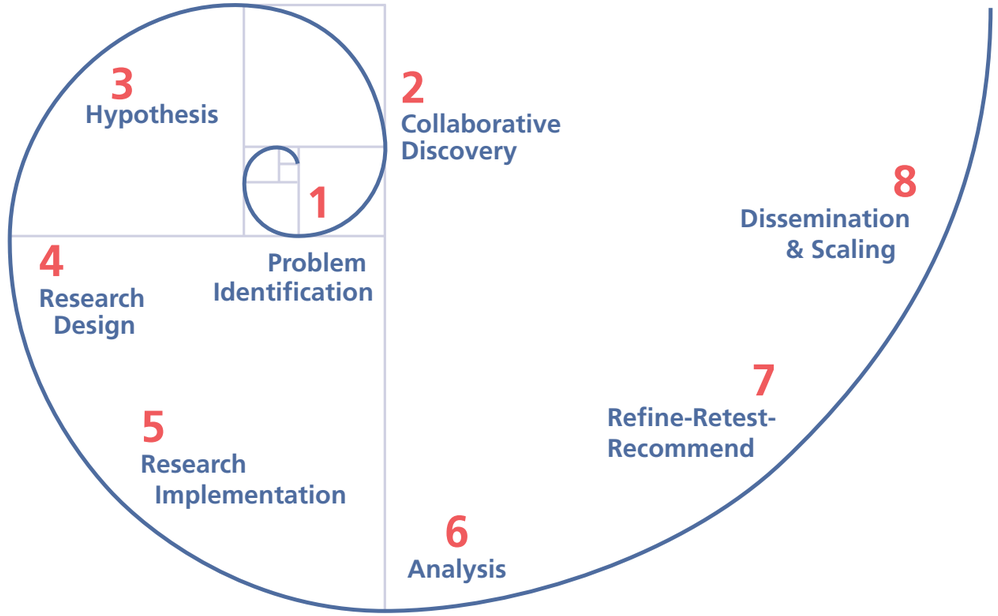
Based on the ongoing collaboration with the IAM Lab interdisciplinary working group, interviews with key partner organizations, and research on existing multidisciplinary research models, IAM Lab proposes the development of Impact Thinking for neuroaesthetics. Impact Thinking is designed to offer researchers and arts practitioners a rigorous, interdisciplinary, evidence-based process for identifying, quantifying, documenting, and disseminating solutions. The goals of Impact Thinking are threefold:

1. Provide a rigorous universal translational approach that can create measurable and scalable solutions.
2. Share and train professionals to apply this approach for use in all arts/mind-integrated research to practice solutions as a guide for efficacy and quality.
3. Demonstrate evidence that a transdisciplinary research-rich translational process will enhance outcomes in health, wellbeing, and learning.

Guiding Principles/Requirements

Impact Thinking:

- Creates a common language and framework for a variety of studies in neuroaesthetics.
- Is focused on increasing the impact of the arts, music, and architecture on health, wellbeing, and learning.
- Is applicable to the study of creating as well as beholding the arts, music, and architecture.
- Can be used to improve or evaluate existing programs/interventions as well as build and test new programs and interventions.
- Applies rigorous, evidence-based brain science research methods to arts, architecture, and music interventions.
- Engages a broad, multidisciplinary team.
- Is designed to get research to practice faster and with more fidelity.
- Includes a strong focus on communication and dissemination throughout the research project.
- Is initiated by an Impact Team of a brain scientist and a practitioner in an arts discipline or program.
- Is facilitated by an Impact Thinking Expert (ITE) who is trained in the eight-step approach and interdisciplinary studies and has an advanced degree that includes evaluation sciences. The ITE will support the Impact Team throughout the study, matching them with advisors and stakeholders as needed, implementing best practices in data management, and facilitating the iterative reflection, documentation, and communication process.
- Is supported by an Advisory Team of multidisciplinary experts, driven by the problem statement and research questions, as well as a Dissemination Team of experts in implementation sciences and communications. IAM Lab will maintain a database of experts. ITEs can make matches and staff key teams as needed.
- Is reviewed by a broader group of Stakeholders.



Impact Thinking Steps

The eight proposed steps of Impact Thinking are derived from the guiding principles and are best visualized as a spiral.

1. **Problem Identification:** At the outset, an ITE convenes a problem identification workshop, bringing together a group of interested scientists and practitioners who study the general topic. This facilitated workshop enables practitioners and researchers to expand their thinking beyond their particular interventions or areas of study to questions with broader societal implications, including an initial review of data related to the scope and characteristics of the problem as well as related research and case studies. At this stage, the

questions may be broad, though it is assumed that the problems are documented by evidence and that an arts-based intervention with a measurable health, wellbeing, or learning outcome is a feasible solution. At the conclusion of the workshop an Impact Team is formed, and together with the ITE they narrow to a particular set of research questions or problems to solve.

It is important to acknowledge that an unanswered question in this stage of Impact Thinking is exactly who comprises the Impact Team and whether or not a practitioner can serve as a principal investigator, which is an expressed desire from the field that IAM Lab would hope to accommodate without compromising the rigor of the research.

2. **Collaborative Discovery:** In the second step, the Impact Team is matched with a multidisciplinary Advisory Team (research and practice) and Dissemination Team to expand the discovery process in search of potential solutions and applications. Collaborative Discovery is a formalized process facilitated by the ITE and designed to answer questions such as: What do we know about the problem and potential solutions from a range of fields, including basic science, and what additional information do we need to know that is accessible? Who else do we need to bring into this group? What is the universe for this intervention? What are the applications? Who else could learn from this study? How do we reach them? The team might find they require additional information in the form of surveys, focus groups, or administrative data to answer these questions. The end product is a discovery map and report that lays the groundwork for hypothesis development and outreach and communication throughout the Impact Thinking process. The discovery map and report will become publicly available documents in the Impact Thinking database to build field knowledge and common approaches.

3. **Hypothesis:** In the third step, the Impact Team develops and tests the face validity of a number of hypothesized solutions, considering impacts at the individual, organizational, field, and even societal levels. In the case of an evaluation of an existing intervention, the Impact Team will seek to distill the components of the intervention that contribute to the desired outcome, based on the multidisciplinary discovery process. The hypothesized solution must include a measurable change in skill, knowledge, behavior, or attitude/disposition. The Advisory Team reviews hypotheses and provides feedback to the Impact Team. The ITE facilitates this process.

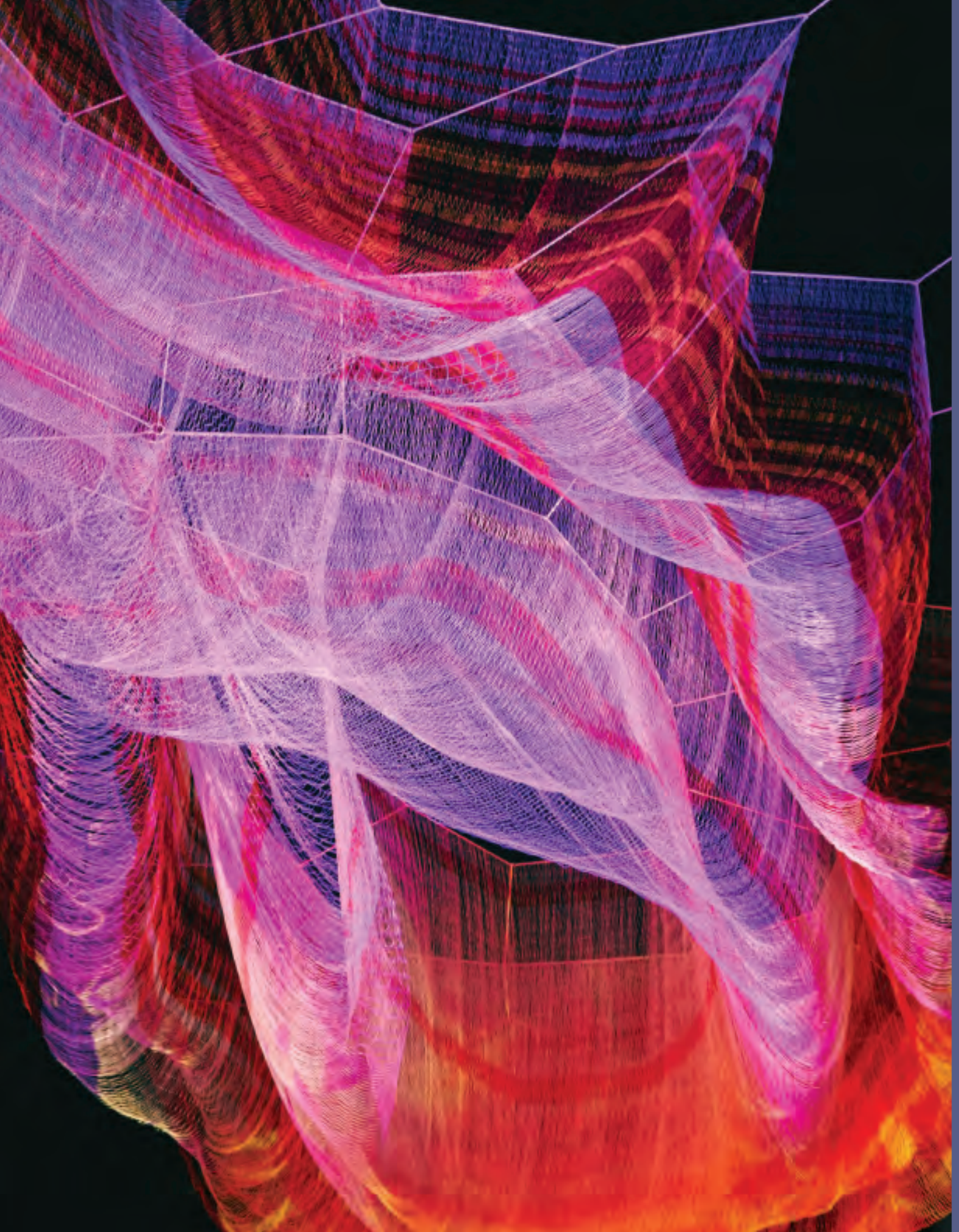
4. **Research Design:** In the fourth step, the Impact Team develops a proposed research design to test the hypotheses. The ITE will present methodologies used in previous neuroaesthetics research as options for the Impact Team, and designs, including measurement tools/assessments, will vary based on the discipline and proposed solution. Essential to Impact Thinking is a truly collaborative research design with involvement at all stages from both the brain scientist and practitioner. Research designs may include qualitative and quantitative methods and are assumed to include human subjects research. Impact Thinking has a bias toward rigorous, controlled studies, and IAM Lab will support Impact Teams to achieve adequate statistical power to produce both causal and correlational findings to the degree possible. The duration of research will vary based on the hypothesized solution and intended outcomes. In the case of a multi-year study, the research design will include plans for mid-stream interpretation, analysis, and reporting to continue to build the research-to-practice pipeline of information. The research design will be reviewed by the Advisory team to ensure validity, viability, and independence.

5. **Research Implementation:** In the fifth step, Impact Thinking brings a variety of supports to the Impact Team. The ITE and Advisory Team act as independent reviewers. The ITE supports logistics in the study and best practices in data management and use with a goal of cataloging data in a way that might be useful for other research teams. The Dissemination Team observes the research process to document and translate for a wider audience. Throughout research implementation, Impact Team members and the ITE are documenting steps, struggles, and reflections in the Impact Thinking workbook to capture lessons learned for future teams.

6. **Analysis:** Once the intervention and data collection are complete, the Impact Team conducts an initial analysis of data and shares findings with the Advisory Team. Depending on the findings, the Impact Team may decide more data collection is necessary or move on to report writing and recommendations.

7. **Refine, Retest, Recommend:** If initial analysis warrants, step seven includes refining and retesting the solution to increase impact or understanding. Once any retesting and subsequent analysis is complete, the Impact Team writes its full report, drawing from its discovery map and report and Impact Thinking workbook to detail the process and collaborative research methods and include recommendations for practitioners, researchers, and policymakers. The report should include any features or conditions of the intervention that are correlated with better outcomes with an eye toward practitioner implementation. At this stage, a broader Stakeholder Team is brought into the process to review and provide expertise in areas such as public policy.

8. **Dissemination and Scaling:** As a research-to-practice approach, Impact Thinking culminates with a multi-faceted dissemination effort. While publishing may be part of the dissemination plan, efforts must go beyond academic journals to practitioner and policy-maker focused media, events and networks. In the initial discovery phase, the Advisory and Dissemination teams helped to identify a broad group of stakeholders and applications for the study. The ITE will partner with the Impact Team and Dissemination Team to implement an appropriate dissemination plan to these various groups that may include developing interactive technology, digital tools, presentations, and print materials. If the intervention is deemed successful, a critical task for the Impact Team will be assessing the opportunities for scaling the solution. ITEs will be trained in scale strategies, including associative strategies such as training others/capacity building; multiplicative strategies such as replication through a proscribed approach; and expansion strategies which include serving more people in the same way. The Impact Team will work together to recommend and plan for an appropriate scale strategy.



Where We Go From Here

Opportunities

One of the primary opportunities inherent to a common approach to neuroaesthetics translation is building shared definitions and language and a repository of experts, data, and references for the field. IAM Lab does not expect to get Impact Thinking right the first time. Still, over time, as the process takes shape and gains buy-in from researchers and practitioners, there is a tremendous opportunity to tap into IAM Lab's network to expand the use of Impact Thinking to a number of institutional partners through a coordinated training and professional development program. Solidifying such a working group model will accelerate interdisciplinary research in many settings. IAM Lab is considering Impact Thinking fellowships across a number of disciplines focused on health, wellbeing, and learning to access the sizable graduate student community to build expertise, career pathways, and capacity for Impact Thinking.

Challenges

Funding for arts research is thin. IAM Lab and its partners will work to change the culture and expectations of arts funders toward impact and rigor. While Impact Thinking is a fit for traditional funding for brain science research from the National Institutes of Health and National Science Foundation, IAM Lab and its partners also have the opportunity to engage the world of private philanthropy that is granting hundreds of millions of dollars to arts and education programs every year with little focus on their impact. Finding institutional support to develop, test and refine Impact Thinking will be essential to success. Demonstrating the return on investment of evidence-based arts interventions will be necessary for long-term sustainability.

Impact Thinking Proofs of Concept

IAM Lab is also pursuing proof-of-concept projects in for Impact Thinking with six organizations, including Kennedy Krieger Institute, Silkroad, The Creative Alliance, Port Discovery Children's Museum and John Hopkins University. These proposed projects explore aesthetics across different art forms, settings, and intended audiences and outcomes, providing an opportunity to test the viability of a consensus framework against the diversity of the field. Moreover, these proof-of-concept projects will enable IAM Lab to calibrate team member roles, responsibilities, and capacity with the duration and scope of various projects. Ultimately, these projects are an important first step to building a common language and approach and understanding the costs of the Impact Thinking approach.

Outreach and Education

The IAM Lab is also eager to move into development of a training program for Impact Thinking Experts, the facilitators and translators across projects. To do so, we must assess and document the required knowledge, skills, and competencies for this important role and determine the best methods to build the same. Beyond research and practice expertise, Impact Thinking Experts may require training and support to hone their equity lens, ensuring that their projects advance efforts to level the playing field for outcomes across socioeconomic and demographic factors.

Community Building

Finally, IAM Lab has many plans to build a connected and informed community for Impact Thinking. With widespread interest, we must find ways to share project updates while building a repository of research, case studies, best practices, and experts for neuroaesthetics stakeholders around the world.

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