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# Land-Grant Hybrids

## *From Art and Technology to SEAD*

KARI ZACHARIAS AND MATTHEW WISNIOSKI

ABSTRACT

The authors explore the role that public and land-grant universities play in sciences, engineering, arts and design (SEAD). They combine a networked institutional history of art and technology collaborations with an ethnographic study of SEAD initiatives. They use the notion of *land-grant hybrids* to describe widespread entanglements between research, teaching and public engagement. Their study identifies three “matters of concern” that aid in rethinking the origins, current practices and possible futures of SEAD: disparities in sponsored collaboration, the need for hybrid practitioners to demonstrate measurable impact and the ambiguities of what counts as appropriate art and reputable research.

“When tillage begins, other arts follow.” The American statesman Daniel Webster’s 1840 speech provides the motto for the remarkable Grant Wood murals at Iowa State University (ISU). The “arts” that follow—agriculture, home economics and engineering—formed the curriculum at the United States’s first land-grant university. About 80 years after ISU’s founding, Wood and an interdisciplinary team of artists, historians and scientists spent two years studying local wildflowers, sketching antique farm equipment and arguing over the proper way to portray farmers felling trees and drinking from stoneware jugs [1].

In November 2014, a different group gathered beneath the murals’ dynamos, checkered aprons and hog vaccinations to articulate a new vision for the interaction between sciences, engineering, arts and design (SEAD) (Fig. 1). The occasion was the second national conference of the Alliance for the Arts in Research Universities (azru), a network promoting transdisciplinary arts research, teaching and creative practices in American higher education. Its diverse members, including university administrators and faculty from around the country, had come to Iowa to promote work ranging from

multidimensional data visualization and sonification to politically inspired community theater.

While azru’s meeting theme “Edge Effects” evoked the avant-garde, its participants felt at home in Wood’s rotunda. Most were employed by public or land-grant universities. Speakers stressed the need to engage a much broader segment of society in SEAD. They also voiced a set of institutional and epistemic challenges, ranging from concerns about funding to anxiety that transdisciplinarity will “necessarily lead to a loss of focus and a consequent lack of rigor and authority” [2]. References to the tripartite land-grant mission—discovery, education and engagement—were embedded in their calls for art and design to become the “fuel” of American research universities.

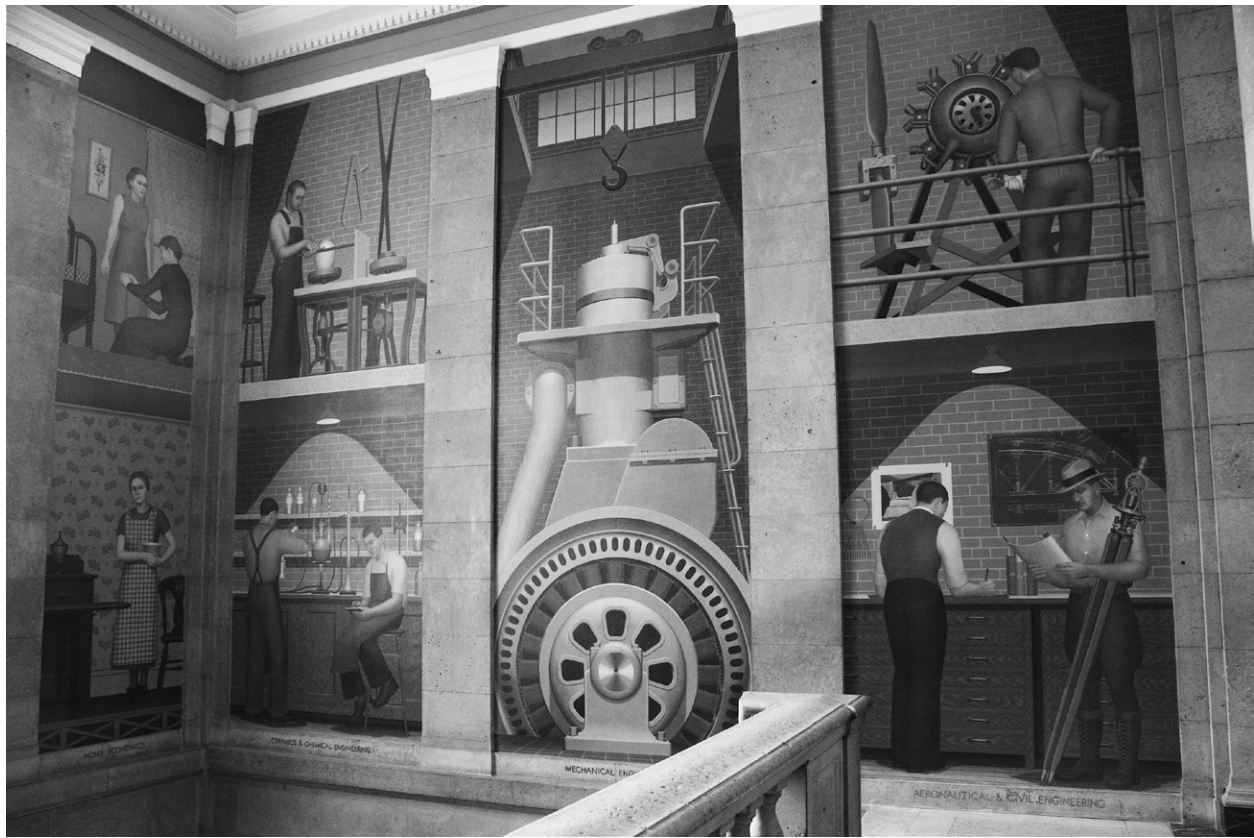
azru is one effort to coordinate an international proliferation of transdisciplinary SEAD work that has grown dramatically over the past 15 years. Key players in this movement include artists, technologists, scientific researchers and design practitioners working in universities, creative industries, museums and nonprofit organizations. The movement’s growth has prompted calls for critical studies of its emergent, hybrid practices [3]. With the support of azru and other cross-institutional networks, analyses of SEAD organizations, practitioners and products have begun to yield synthetic insights [4].

Land-grant institutions and values, despite their invisibility in studies of art and technology collaboration, are defining features of SEAD work today. In this article, we explore the role that public and land-grant universities play in SEAD. We combine a networked institutional history of art and technology collaborations with three years of ethnographic observations at Virginia Tech’s Institute for Creativity, Arts, and Technology (ICAT) [5]. We use the idea of *land-grant hybrids* to describe widespread entanglements between research, teaching, and public engagement across disciplines. Calling attention to the specific goals and inherent challenges of this hybridity aids in rethinking the origins, practices and possible futures of cross-fertilization among the arts, sciences and technology.

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**Fig. 1.** Grant Wood, detail of *When Tillage Begins, Other Arts Follow*, oil on canvas, 1934. (© Grant Wood. Photo © Carole Gieseke. Courtesy of the Art on Campus Collection, University Museums, Iowa State University, Ames, Iowa.) Commissioned as a joint project from the federal Works Project Administration (WPA) and Iowa State College for the University Library.

## FROM “ART AND TECHNOLOGY” TO SEAD

### Art and Technology

The dominant narrative of the rise of the technological arts is one of collaboration among avant-garde artists and elite technological organizations. The U.S. military-industrial complex and its Vietnam-era discontents created unique circumstances that fostered Experiments in Art and Technology (E.A.T.), MIT’s Center for Advanced Visual Studies (CAVS), the Los Angeles County Museum of Art (LACMA) artist-in-residence program and a variety of smaller collectives [6].

E.A.T. and CAVS in particular formed in and around Boston and New York—world cities with vibrant arts communities—at two major technological organizations of the twentieth century. Bell Laboratories and MIT supported aesthetic investigations into sound, vision and motion for several reasons: They wanted to cultivate a creative research culture, there were distant promises of commercialization and, not to be underestimated, their administrators were cosmopolitan thinkers who admired innovations across fields [7].

While containing wide-ranging motivations about the use-value of the arts, E.A.T. and CAVS put artistic direction in control of individual collaborators with the goal of advancing the arts. Although it drew on Bell Laboratories for staff and early projects, E.A.T. was an independent nonprofit designed to put technology in the hands of artists and to reinvigorate the creativity and human values of scientists and engineers. CAVS similarly reinforced the role and identity of the artist: Fellows came from the art world and measured success in

terms of exhibitions and reviews, while MIT provided the equipment and the experts to realize artists’ interpretations in technological media [8].

These rarified settings notwithstanding, MIT received a land grant from the U.S. government in 1866 and remains a member of the Association of Public and Land-Grant Universities (APLU). Resonating with such outreach ideals, CAVS came to exist in part through arts courses for undergraduate engineers and with the intention of “humanizing” MIT’s local and national image through civic art [9]. Similarly, within E.A.T. there were conflicting themes of “high art,” instrumental ends and arts extension, manifest especially in its artists matching program [10].

### Research and Innovation

In the 1980s and 1990s, art and design became integral to new kinds of innovation centers, led by the MIT Media Lab. The location and value of the arts inside universities, arts venues and corporations shifted accordingly. Many of these transformations were technological, such as the emergence of ubiquitous computing and graphical user interfaces. Others were discursive and ideological, aligning technological arts with design and entrepreneurship amid debates about education’s role as a driver of national productivity and competitiveness [11]. Strands of political activism and community engagement that had shaped the technological arts in the 1960s and 1970s were still present, but these increasingly moved toward the institutional margins [12].

There also were a growing number of sites for the communication, development and promotion of hybrid practices, including Austria's Ars Electronica and the Association for Computing Machinery's Special Interest Group on Computer Graphics and Interactive Techniques (SIGGRAPH). SIGGRAPH, begun in the 1970s to serve computer scientists, engineers and commercial vendors, established a formal Art Show in 1981 [13]. SIGGRAPH experienced explosive growth—by 1985 the conference had 27,000 visitors—with a strong emphasis on scientific applications and commercial production alongside purely aesthetic projects [14]. It attracted established technological artists from CAVS and E.A.T., but also a wide range of participants from Arizona State University (ASU), Purdue University, University of Wisconsin and other public and land-grant institutions [15].

These changes fostered new practitioner identities. The ability to represent complex mathematics graphically, for example, spawned the idea of a “visual research artist” who combined arts practices with scientific research [16]. Fields such as human-computer interaction and game design expanded the career possibilities for students trained in the arts. By the early 2000s, Intel envisioned hybrid graduates as designers testing “prototypes” and gathering “valuable end-user feedback,” but also as communicators bringing “research ideas to the public quicker than larger corporations” [17].

### Coordinating SEAD

Today, centers, schools and institutes of art and technology are regular features of American universities. Degree programs in “arts, technology and the business of innovation” [18] expand on the language of commercialized innovation, holding that complex problems can be solved through

collaboration among the sciences, engineering, arts and design [19].

A distinctive feature of the SEAD movement is the rise of coordinated networks. While such networks have existed internationally since at least the early 2000s, funding and support for this work in the United States was slower to develop [20]. Recently, however, faculty and administrators across American universities have formed two related networks for promoting and advancing SEAD.

One network, a2ru, grew out of the University of Michigan's ArtsEngine in 2012 and has expanded to include 35 partner institutions, most of which are public and land-grant universities (Fig. 2). While a2ru's actions are grounded in efforts to promote arts integration, its mission invokes interdisciplinary engagement. The organization invites SEAD stakeholders to help solve “pressing, complex and open-ended challenges,” and supports the creation of a series of reports on best practices, funded by the Andrew W. Mellon Foundation [21,22]. a2ru also coordinates advocacy efforts through an online portal, annual conferences and “emerging creatives” events for students.

The other, the SEAD Network, combines research goals with economic development and education. It formed following two workshops, jointly sponsored by the National Science Foundation (NSF) and the National Endowment for the Arts, in 2010 and 2011 (Fig. 3). The workshops led to separate but related NSF-funded initiatives: the Virtual Exchange for Sciences, Engineering, Arts and Design (XSEAD) and the Network for Sciences, Engineering, Arts and Design (NSEAD). These groups have since coalesced into the SEAD Network, which aims to connect and support a distributed community built around “products, methods and questions that are *fundamentally hybrid*” [23].



**Fig. 2.** a2ru Emerging Creatives Winner's Circle team, 2014. (© The Alliance for the Arts in Research Universities. Photo © Yuto Watanabe.)



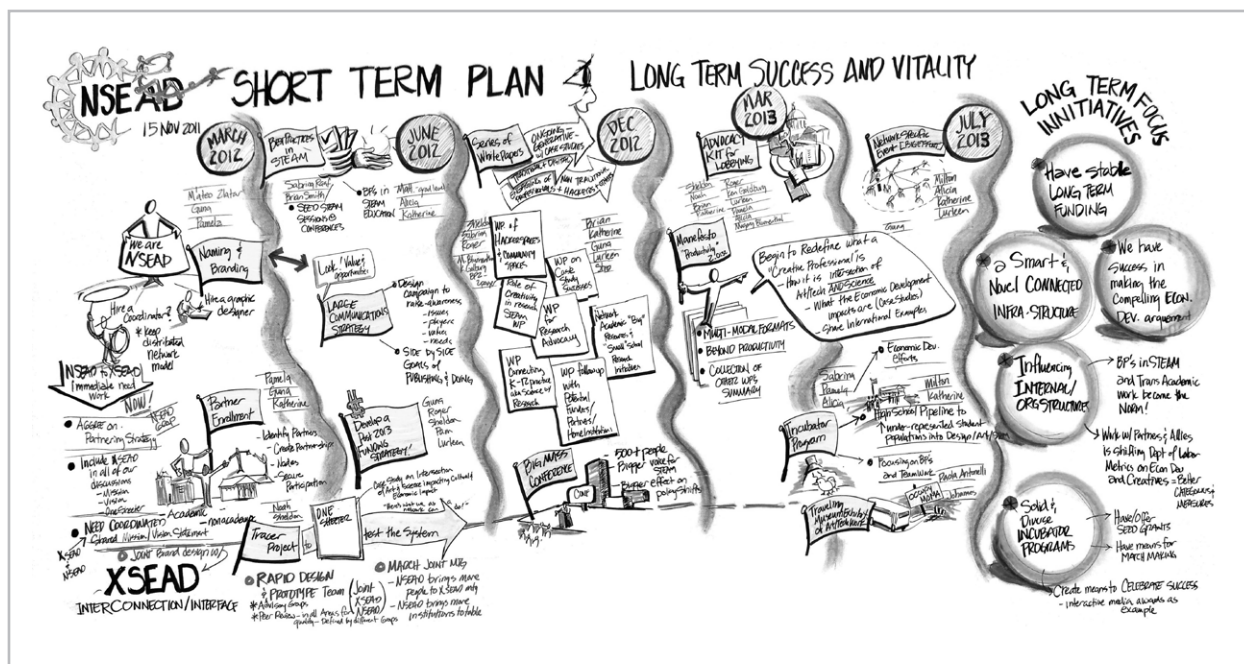


Fig. 3. NSEAD November 2011 game plan, marker/chalk on paper, 4 × 8 in, 2011. (© The Grove Consultants International.)

## LAND-GRANT HYBRIDS

### SEAD and Hybridity

When *Leonardo* triumphantly declared “the hybrids have arrived!” in 2013, it celebrated an emergent, networked community of shared ethics, values and institutional strategies [24]. But what exactly does this hybridity entail?

Within science and technology studies (STS), the term “hybrid” describes complex, sometimes unseen relationships between science, technology, politics and culture. Hybridity explains the simultaneous making (and study) of natural and social phenomena [25] and looms large in discussions of cyborgs and cybernetics, conflicting modes of expertise, and management of boundary objects and organizations [26]. In these cases, “hybrids” are situations, networks or practices involving multiple elements commonly understood as separate or existing at different scales.

Collaborations between art and technology have always been hybrids in this sense. Large-scale cultural and political motivations are evident in E.A.T.’s 1967 statement of purpose “that an industrially sponsored, effective working relationship between artists and engineers will lead to new possibilities which will benefit society as a whole” [27]. Decades later, Stephen Wilson reiterated the connections between SEAD and society in his description of both art and science as “cultural acts” [28].

An exploration of the special role of land-grant and public universities in SEAD refines and specifies this hybridity, highlighting the complexity of the challenges its stakeholders face. The rise of SEAD in American higher education, we argue, is intrinsically related to a growing emphasis on engagement and interdisciplinary problem-solving that parallels the evolution of these institutions’ missions.

### SEAD and the Land-Grant Mission

The Morrill Act of 1862 established the U.S. system of land-grant universities, awarding eligible states saleable land with which to finance new colleges. Rather than providing education for the elite, Congress charged the Act’s recipients with promoting “the liberal and practical education of the industrial classes,” with most coursework devoted to agriculture and the mechanical arts [29]. In addition to providing teaching and research opportunities, land-grant universities were designed to extend knowledge into their communities [30].

From an initial group of 20, land-grant universities have grown dramatically in number and diversity. After the Civil War, the system was extended to the former Confederate states. The 1914 Smith-Lever Act further expanded these institutions’ outreach mission through cooperative extension services. In the mid-twentieth century, many land-grant universities burgeoned into comprehensive public universities as World War II and the subsequent GI Bill produced a demand for engineering research and a massive influx of students [31]. These structural changes came with shifts in scale and purpose, as most land-grant universities looked outward to constituencies beyond the state [32].

By the 1980s, critics feared that land-grant universities had lost their relevance by moving too far from their original priorities [33]. Citing the widening gap between society and cutting-edge knowledge, along with steep declines in state funding, they lamented the temptation for such institutions to follow research money into an academic world increasingly removed from local contexts [34]. Scholars argued that entrenched disciplinaryity was antithetical to the land-grant mission and that the land-grant universities were singularly positioned to provide the kind of “liberal, comprehensive and

humane learning” that could produce students who would fill the knowledge-society gap [35].

In the 1990s, the APLU proposed meeting the economic and societal deficits of its member institutions with commercialization, community engagement and interdisciplinary research. The APLU’s Kellogg Commission on the Future of State and Land-Grant Universities promoted “engagement” as a reinterpretation of “extension,” recommending that universities reestablish community and industry partnerships. This strategy promoted investment in interdisciplinary research to help close the gap between universities and a changing society [36]. “Although society has problems,” the commission wrote dismissively, “our institutions have ‘disciplines’” [37].

Over the past 15 years, interdisciplinary centers and institutes have skyrocketed at public and land-grant universities, often focused on SEAD (Table 1). These initiatives echo the Kellogg Commission’s call to action. ASU’s School of Arts, Media and Engineering, for example, trains students to become “thought leaders” in a complex digital world [38]. The Institute for Applied Creativity at Texas A&M University explores critical societal problems through collaboration [39]. Louisiana State University’s Laboratory for Creative Arts and Technologies has established an animation festival that

is both an economic development project and an outreach initiative [40].

This deliberate integration of research, teaching and engagement extends beyond public and land-grant institutions. Private universities such as Carnegie Mellon University (CMU) also produce SEAD work that adheres to such values. In 2015, for example, CMU’s Frank-Ratchye STUDIO for Creative Inquiry hosted the p5js Contributors Conference, at which participants worked on outreach and diversity issues related to an open-source programming environment [41].

The cross-institutional networks that promote art and technology collaboration amplify this land-grant ethos. azru advocates arts practices and integration as a method of developing the creativity and flexibility required to deal with “open-ended challenges” [42]. Chief stakeholders in the SEAD Network, including NSEAD PI Carol LaFayette, state that multidisciplinary approaches and new modes of knowledge creation are necessary to better understand an increasingly complex world [43]. These arguments build on the work of the International Symposium on Electronic Art, *Ars Electronica* and *Leonardo* itself. As they disseminate their results and expand the scope and visibility of SEAD initiatives, these networks reorient existing ideas about what counts as

**TABLE 1.** A nonexhaustive list of SEAD organizations at public and land-grant universities.

Center or Institute	University	Founded
School of Arts, Technology, and Emerging Communication	University of Texas at Dallas	2016
OpenGrounds	University of Virginia	2012
Digital Art and Textuality Alliance	University of Colorado Boulder	2011
Institute for Creativity, Arts, and Technology	Virginia Tech	2011
ArtsEngine	University of Michigan	2010
Emerging Digital Research and Education in Arts Media Institute (eDream)	University of Illinois at Urbana-Champaign	2009
Center for Design Innovation	University of North Carolina	2005
Creative Campus	The University of Alabama	2005
School of Arts, Media and Engineering	Arizona State University	2004
Laboratory for Creative Arts and Technologies	Louisiana State University	2003
Institute for Applied Creativity	Texas A&M University	2002
Digital Worlds Institute	University of Florida	2001
California Institute for Telecommunications and Information Technology (Calit2)	University of California, San Diego and University of California, Irvine	2000
ATLAS Institute	University of Colorado Boulder	1997
Center for Research in Computing and the Arts	University of California, San Diego	1992 [50]
Advanced Computing Center for the Arts and Design	The Ohio State University	1987
The Center for Research in Electronic Art Technology	University of California, Santa Barbara	1986

art and technology collaboration, relocating the focus of the discussion on socially engaged problem-solving.

### Matters of Concern in SEAD

Challenges persisting since the earliest art and technology collaborations become increasingly clear when seen in a land-grant context. To develop critical scholarship that offers useful input for SEAD stakeholders, we describe several of these challenges as “matters of concern” [44]. Matters of concern are unsettled and persistent problem spaces where people, institutions, objects and ideas coalesce. They are inherent fruits of hybrid interaction. Rather than prescribing a set of best practices for SEAD, exploring such themes invites practitioners and critics to become more aware of the contexts of their work. Such an approach encourages shared understanding and widespread but local engagement in the construction and maintenance of hybrid spaces.

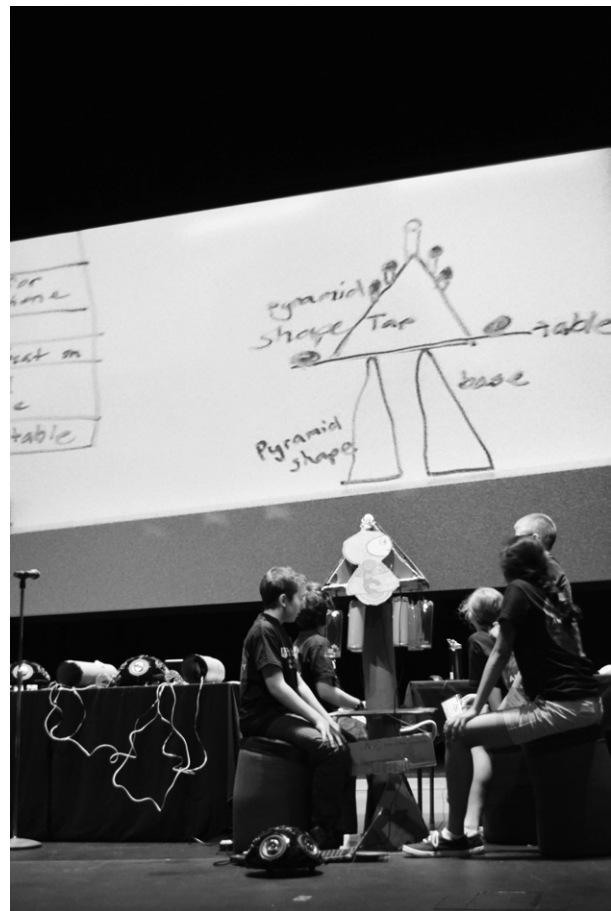
Matters of concern in SEAD include ambiguous motivations and practices resulting from sponsored collaboration, pressures to demonstrate the measurable impact of state and federal investment, and struggles among practitioners and their evaluating committees to determine what counts as appropriate art or reputable research. We illustrate these broad concerns with examples drawn from our work at ICAT. The

three cases name the most significant and pervasive themes that we have observed in SEAD projects at local and national scales.

*Sponsored collaboration* refers to relationships between funding and the processes and products of SEAD work. Funding organizations outside of researchers’ own disciplines offer new opportunities but also create alliances with varied, often unfamiliar stakeholders. A representative case at ICAT is *SeeMore*, a kinetic sculpture and parallel cluster computer that resulted from a partnership between artist Sam Blanchard and computer scientist Kirk Cameron [45] (Fig. 4). *SeeMore* was successful in terms of financial return on investment (\$25,000 of Virginia Tech seed funding resulted in a \$200,000 NSF grant and public reception (featuring prominently at SIGGRAPH, SXSW and an exhibit at NSF headquarters)). Such collaborations often embody disparities: Well-funded engineers seek artists to represent some aspect of their work to the public, or artists exploring alternative funding sources use scientists in place of a technical literature review [46]. In *SeeMore*’s case, pursuing NSF funding required emphasizing the project’s potential as an educational tool over its artistic value. Furthermore, praise for *SeeMore*



**Fig. 4.** Sam Blanchard and Kirk Cameron, *SeeMore* at Maker Faire, 2015. (Photo © Alex J. Froelich.)



**Fig. 5.** Students perform with the *Harmonious Melodious Jellyfish* instrument that they designed and built during Maker Camp 2014 at the Institute for Creativity, Arts, and Technology. (© Institute for Creativity, Arts, and Technology)





**Fig. 6.** Carol Burch-Brown, *Salt Marsh Suite*, 2014. (© Carol Burch-Brown. Photo © Steven Williams.) Detail from “Third Movement: Crabs” with dancer Rachel Rugh.

came predominantly from hybrid audiences. As Blanchard points out, *SeeMore* is “not an efficient computer” and “may not stand up on its own as an art object.” However, it succeeds as a hybrid piece that reflects parts of both creators’ aims and sensibilities.

Another key element of developing successful SEAD projects is the imperative to demonstrate *measurable impact* to administrators and external partners. This demand is evident in ICAT’s Maker Camps for local middle-school students, which exemplify an ongoing shift in STEM education toward the integration of arts practices and design methods via “STEAM” (Fig. 5). In an assessment-focused culture tied to state funding, the importance of evaluating these programs is critical, but the question of how they constitute success is fluid. Maker Camps represent a move from “skill-based” to “fluency-based” education that is central to the land-grant engagement mission [47]. They emphasize experimentation, encouraging students to focus on process rather than product. Where this approach meets the realities of assessment, however, researchers struggle. Establishing a process-oriented learning environment is difficult, devising a metric for identifying transdisciplinary thinking within it even more so. Researchers tend to use readily measurable outcomes: Did the campers build a simple circuit? Did they have a good time? Are they considering a STEM career? Responses to these questions at Maker Camps have been consistently positive; however, the connection between assessments and whether campers “harnessed their creativity” remains unclear. More critically, in reflective moments, participants wonder if it is possible to programmatically foster creative thinking without standardizing it to the point of meaninglessness.

One of the most difficult issues in SEAD is defining and recognizing quality work, particularly when projects span or blur disciplinary boundaries: What counts as *appropriate art* or *reputable research*? Researchers in SEAD must create work that is both relevant to their institutional settings and recognized within their disciplinary communities. Moreover, because SEAD practitioners test the limitations of traditional review processes in both art and science, they rightly worry about the impact of their decisions on their careers. These inherent challenges in evaluating transdisciplinary projects were a main motivation behind the founding of XSEAD and peer review efforts sponsored by a2ru [48].

At ICAT, we have seen collaborators withdraw from the institute in frustration, as well as one tenure denial. Nonetheless, we also see practitioners manage these challenges in highly regarded projects. The creators of *Salt Marsh Suite*, an intermedia installation and performance inspired by a North Carolina salt marsh, earned praise for harnessing ICAT’s Cube facility—equipped with 128 speakers and multiscreen display—in a blend of natural observation, sonic immersion and human performance (Fig. 6). *Salt Marsh Suite* subsequently traveled to regional art museums and science festivals. The artists who spearheaded the project, Ann Kilkelly and Carol Burch-Brown, had previously produced outreach-oriented work in technological media, including an original theater performance about Charles Darwin. As senior faculty, they were removed from tenure and promotion concerns. Moreover, *Salt Marsh Suite* directly reflected integration of discovery, education and engagement of the land-grant ethos.

Sponsored collaboration, measurable impact and reputable research are part of a range of matters of concern in



SEAD. For example, we consistently witness stakeholders question the emotional and political labor of building “transformative institutions.” Our ongoing research will expand on these matters of concern and the evolution of organizations and identities accompanying them. This work aims to help SEAD stakeholders develop an improved understanding of challenges such as how to best define success and how to balance institutional demands with artistic and intellectual curiosity.

## CONCLUSION

Adjacent to the Grant Wood panels in the ISU library where azru members gathered in 2014, there is a second mural representing the reinvigorated land-grant mission. Commissioned for the university’s 140th anniversary in 1998, *Unlimited Possibilities* places ISU “within the global community as it relates to technology and technology transfer” [49] (Fig. 7). During speeches that called for the integration of SEAD into all aspects of university research, curriculum and creative practice, the eyes of the azru audience frequently strayed to the mural’s minor nods to the fine arts—including a woman sketching onto a circuit diagram.

Viewing the evolution of SEAD as a kind of land-grant hybrid resituates the historical locus for—and understanding of—collaborations between art and technology. Despite avant-garde origin stories, elements of today’s focus on institution-building and spinoffs have been present from the very beginning of the arts and technology movement. The notion of land-grant hybrids also calls attention to the impetus behind SEAD’s emphasis on practicality and societal impact. While engagement has long been among the goals of such collaborations, it has only recently become a central concern. The rise of SEAD parallels cross-institutional policy initiatives among land-grant and public universities toward the integration of research, teaching and engagement. Networks, a prominent feature of the SEAD landscape, reinforce and disseminate these practices and ideals.



**Fig. 7.** Doug Shelton, *Unlimited Possibilities*, oil on canvas, 1997. Commissioned by the University Museums. Funded by The University Museums, Office of External Affairs, the Fisher Representatives System Artist-in-Residence Fund at the ISU Foundation, the Estate of Alice Davis, Marjorie Morrison, and Cornelia and William Buck. In the Art on Campus Collection, University Museums, Iowa State University, Ames, Iowa. (© Iowa State University Museums. Courtesy of the Art on Campus Collection, University Museums, Iowa State University, Ames, Iowa.)

The hybrids have indeed arrived, and more are on their way. As SEAD initiatives grow, new jobs and new frameworks for sponsorship, collaboration and review are developing alongside them. Hybrid individuals are not only able to forge new transdisciplinary identities for themselves, they are increasingly welcomed in organizations and networks built to accommodate and promote their work.

Stakeholders rightfully celebrate their successes, but questions persist about the direction and emphasis of SEAD’s development. Is there a danger that sponsored collaborations will become less equitable, with scales tipping toward more moneyed collaborators? How can researchers balance open-ended innovation with meeting assessment targets? If hybrid practices are a productive way forward, will traditional art forms no longer be valued as “appropriate”? Understanding the origins and evolution of matters of concern in SEAD can serve as a valuable resource for those who till in today’s land-grant hybrids.

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