

## **Building Bridges Across Disciplines: Organizational and Individual Qualities of Exemplary Interdisciplinary Work (Excerpts)**

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Exemplary interdisciplinary workers as embodying a disposition toward curiosity, risk-taking, open mindedness and humility. We identify the particular skills that allow researchers to navigate the interdisciplinary terrain (analogical thinking, common languages and metadisciplinary views).

Decisive shifts in knowledge production permeate the turn of the 21st century. Advances in computer science, biology, and psychology have propelled unprecedented breakthroughs like the cloning of the human genome and the creation of “affective machines.” The alliance of medical doctors, engineers, computer scientists, and molecular biologists is revolutionizing medical care through new, minimally invasive surgery technologies and artificial human tissue development. Working together, artists, architects, computer engineers, and anthropologists are developing early prototypes of computer-enhanced environments, which range from intelligent homes to electronic paper. In the arts, avant-garde exploration by new media artists draws on scientific and computational insights to celebrate and critique our times.

Each of these examples of knowledge production and product development has been born from interdisciplinary enterprises. In each case, traditional disciplinary boundaries are crossed and redefined, with increased borrowing and lending across disciplinary frontiers. The task of carrying out interdisciplinary work is intrinsically complex. It involves developing a meaningful dialogue among professionals who embody distinct disciplinary cultures (e.g., with regard to paradigms, values, and tools). It requires bringing together domains like computer science and art that often seem incompatible or respond to contrasting validation criteria. How do individuals and institutions organize their work to advance generative dialogue across disciplinary lines? What are the intellectual dispositions and cognitive strategies that serve interdisciplinary thinkers? What obstacles do organizations and individuals confront as they attempt to produce exemplary interdisciplinary work?

In the interdisciplinary institutions that we studied, people's expertise is gathered in one of two forms. One form is collaboration between two or more individuals who are specialists in different disciplines. The other form is found in the work of people whom we have termed "hybrids," individuals who have mastered two or more disciplines. Predictably, the researchers we interviewed varied in how they carried out their work. Each institution presented a particular blend of collaborators and hybrid thinkers.

### **Collaboration: Positive Attributes**

**1. *Informed problem definition.*** Some of the researchers we interviewed argued that in collaborative work, individuals benefit from each partner's familiarity with current questions and concerns in their respective fields and can steer the collaboration toward those issues.

**2. *Efficient blending of disciplinary expertise.*** Once an appropriate problem has been selected, a new issue arises: how can one cover all the disciplines necessary to provide a solution?

### **Collaboration: Questions and concerns**

**1. *Egotism and cross-disciplinary condescension.*** One obstacle that arises when individuals collaborate is unsurprising: individuals from different disciplines often are condescending to one another. Over and over again, subjects at institutions which rely heavily on collaboration cited individuals' egos as a barrier to joint work.

**2. *Lack of a common language.*** Researchers from different disciplines who can shelve their egos are quickly faced with a second problem: they must find a way to get past their specialized languages. Each discipline has its own jargon, designed for any number of reasons.

**3. *Different intellectual tools.*** Collaborations are formed because researchers believe that their backgrounds and skills, though different, are complementary. Sometimes however, the differences end up outweighing the similarities. Occasionally two researchers can arrive at a common language and still have difficulty working together because of drastic differences in their mental toolkits.

## Hybridization: Positive attributes

**1. *No need to find a common language.*** Hybrid researchers have certain advantages over pairs of specialists when facing the challenges of interdisciplinary work. Rather than laboriously seeking a common vocabulary to communicate effectively and work productively with other experts, hybrids can mentally translate back and forth between different disciplines.

**2. *Deep integration made more plausible.*** In addition to having specialized languages, each discipline also has its own set of goals, methodologies, and history. All of these can be barriers to cross-disciplinary communication. Many organizations have decided to surmount these barriers by having people from the different disciplines work together. As detailed above, sometimes this works well. However, a counter-argument to the benefits of collaboration can also be made: a hybrid who understands the intricacies of two complex disciplines will sometimes have an easier time forging a meaningful synthesis than a pair of specialists will.

## Hybridization: Questions and concerns

**1. *The risk of superficial coverage.*** Researchers in both camps, hybrids and collaborators, referred to the risk of superficiality as an important challenge faced by hybrids.

**2. *The challenges of developing good hybrids.*** Some of our interviewees explained that it takes a great deal of time and energy for an individual to become a hybrid, and that time and energy might be more efficiently and effectively used in another manner. In this section we focus on individual qualities that our subjects associated with interdisciplinary workers. We begin by addressing a set of four *dispositions*: broad ranged curiosity, open-mindedness, risk-taking, and humility. We propose three *epistemological strategies* that individuals used to organize and integrate knowledge and skills gleaned from multiple disciplines: fluid thinking, translation, and explicit integration. Finally, we identify three *cognitive skills* that play a central role in subjects' interdisciplinary initiatives: analogical thinking, developing a common language, and holding a metadisciplinary view.

## Dispositions

Interdisciplinary workers seemed to display certain personality traits or dispositions that attracted them to ventures that cut across disciplinary boundaries and made them valued members of interdisciplinary projects. They exhibited a particular sensitivity for ideas and modes of thinking embedded in multiple disciplines. They showed an ability to use a broad-ranged knowledge base effectively in embracing risky research projects. Furthermore, their life stories revealed an inclination to intertwine bodies of knowledge recurrently over time. Four of the most prominent dispositions that our study revealed could be described as *broad curiosity*, *a willingness to embrace risk*, *disciplinary-rooted open-mindedness*, and *humility*.

**1. *Broad curiosity.*** Curiosity in multiple areas of knowledge was a mobilizing force for the interdisciplinary workers in our study. Curiosity emerged implicitly in their accounts of professional growth as well as explicitly as a driving force of interdisciplinary work.

**2. *Disciplinary-rooted open-mindedness.*** Open-mindedness is the second trait repeatedly attributed to interdisciplinary workers and collaborators. Newbower includes it, along with interest in a wide variety of things and an eagerness to grab ideas from wherever they might occur, as characteristic interdisciplinary dispositions. Newbower states that open-mindedness is most often the result of feeling secure in one's own discipline; it is the counterbalance to knowing the discipline well. The confidence one gains from accomplishment in a discipline helps to feed intellectual exploration rather than to hinder it.

**3. *Willingness to embrace risks.*** To engage in interdisciplinary study or work, one not only has to be confident enough within a discipline to explore outside of it, one also needs to be willing to participate in areas that are often unexplored and difficult. Interdisciplinary projects are often time consuming. Since validation standards are often ambiguous, areas of intersection are ill-defined, and areas of expertise are multiple, interdisciplinary projects are sometimes also prone to failure. In a professional and academic world that is largely defined by disciplines, an interdisciplinary worker or collaborator must take on a degree of risk.

**4. Humility.** The desire for professional recognition and success can breed intense competition in fields like medicine and science, as well as in the highly publicized world of art. The struggle for and achievement of success can foster egotism and territoriality.