chapter 25

building bridges to new realms

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ABOUT THIS CHAPTER

This chapter is about collaboration within design practice. It is a major factor in almost all successful companies, consulting firms and start-up businesses today and is likely to become even more important in the future. In this chapter I'm going to illustrate its importance by referencing one key relationship in one key industry: the relationship between industrial designers and engineers in the design of vehicles and transportation systems. If this isn't your intended career path, don't stop reading! If you are going to be an excellent designer, you need to understand and apply good collaboration skills, and this chapter has something for all disciplines. Poor collaboration can be incredibly disruptive to the design process and will almost always compromise the final product. Collaboration isn't easy and it can take a little bravery, vision and creative thinking to achieve it.

A vehicle is one of the most complex products to design and put into production. The design process incorporates knowledge and expertise from many different disciplines, including colour and trim, materials science, parts suppliers and marketing. Through collaboration, design teams seek to absorb, reconfigure and apply this knowledge in many different ways, including creating a visual form, defining assembly and materials and generating effective marketing. The knowledge base of engineers and designers increasingly overlaps as today's design process requires more creativity and greater attention to science and technology. Input from both disciplines is essential, but achieving an appropriate balance at various points in the process is not straightforward. This chapter explores strategies for encouraging powerful interactions between industrial designers and engineers to produce successful, innovative products in vehicle design.

the need for collaboration: why silos don't work

Often groups of individuals may believe they are collaborating simply because they interact with one another or because their product passes through various departments. We might see this in a wide range of commercial or public-sector organizations. However, in reality, group members might work in their own silos, areas of safety where the problems of collaboration are not allowed to encroach. All teams are vulnerable to this silo mentality. At its worst, it leads to people adopting a strategy of completing their responsibility in one silo and passing work on to people in another silo, sometimes referred to as 'throwing it

Figure 25.1 Silos are independent spaces, even if they are connected. (Shutterstock 66675382)

over the wall' because it suggests that responsibility for decisions ends once an output is passed along to the next person. This is not collaboration and it's not teamwork.

True collaboration as a design team requires participants to engage with the problems of other participants throughout the design process. The benefits of such collaboration are not limited to design. Effective collaboration can energize all departments in an organization. When individuals step up to this challenge, and strive for excellence in team relations, there is usually a marked improvement in product quality plus the fostering of a culture of innovation across the whole organization. Team pride brings with it a new sense of satisfaction and integrity for the participants, and these can be powerful conduits for stimulating innovation.

"True collaboration as a design team requires participants to engage with the problems of other participants throughout the design process."

People involved in developing products generally want to work together in collaborative teams because they see potential they cannot achieve alone. However, despite seeing the potential gains, they may lack the understanding to lead or participate in

Convergent and Divergent Thinking

In the 1950s, the U.S. psychologist, J. P. Guilford argued that creative problem solving was related to a mental ability he called *divergent thinking.*[1] This enables people to diverge from what is known to produce novel ideas. He concluded that divergent thinking comprised separate abilities which he called fluency, flexibility and originality. *Fluency* is the ease with which individuals produce many different responses to a problem. *Flexibility* is the ability of an individual to alter his or her mental set and to produce ideas outside of the usual categories. *Originality* is the ability to generate novel, unusual or ingenious ideas.

Guilford contrasted divergent thinking with another mental ability that he called *convergent thinking.* He argued that both were essential to creativity. Convergent thinking is needed after divergent thinking has created many ideas. It employs logic and information in order to converge on a single idea or solution.

Divergent thinking has much in common with Edward de Bono's concept of *lateral thinking*—ways of breaking out of familiar patterns and solutions by thinking laterally or sideways.[2]

From: R. Roy, *Design and Designing* (T211), The Open University, Blk 3 (2010), pp. 43–44.

[1]J. P. Guilford, 'Creativity', *American Psychologist* 5 (1950), pp. 444–54.

[2]E. de Bono (1977), *Lateral Thinking: A Textbook of Creativity*, Harmondsworth, Penguin.

successful collaborations. Alternatively, an organization might lack the necessary cultural characteristics that allow team working to flourish. Establishing a culture for effective collaboration is not easy, and there are many instances in commercial practice where old practices still dominate. Even in today's unforgiving world of design, there still exist examples of the silo mentality, and designers can find themselves confronting obstacles to effective collaboration. Within the automotive industry, some teams work in collegial harmony and are able to effortlessly reach a consensus in problem solving. Other teams are hostile, egotistical and, in some ways, profoundly unethical. This behaviour creates a wake of missed opportunities. It can even encourage more positive and productive team members to leave an organization, which ultimately weakens both the team and the company further.

thinking styles

The construction of teams that can confront the design challenges of today and tomorrow is likely to bring together individuals with very different thinking styles. Some people have a developed ability to work amidst uncertainty and might even thrive where there is chaos. Others may prefer a thinking style characterized by order and strategy. Examining thinking styles or traits in the context of design and engineering can assist effective collaborative team working.

Some people are not put off by incompleteness; in fact, they might deliberately seek open-ended solutions. They can display a spontaneous, intuitive style of dealing with information that delights in the process of exploration and discovery. Design education has traditionally fostered this, combining it with strong visual skills. It's a thinking style that focuses on the qualitative, as opposed to the quantitative, and it suits some types of practitioners very well because it meshes with aesthetic inquiry and creativity. This thinking style is closely associated with *nonlinear* learners (Figure 25.2a), whose progress in education or early practice is characterized by periods of time with no apparent advancement interspersed with big leaps forward. Again, design education has been largely shaped both by and for people with this type of thinking style. They can bring novel approaches to a product development team or offer new conceptual visions. But remember we are talking about thinking styles here and not the professions of the people who possess these cognitive preferences. There are examples of creative, intuitive engineers who display nonlinear learning, as we shall see shortly.

Product design and development requires people who can conceptualize product potentials in a broad sense—who have command of 'blue sky' or 'outside the box' thinking. Such breadth of perception can lead to innovation, but of course it can also generate irrelevant or impractical ideas. This style of creative thinking has been termed *divergent* thinking. That is, from a given starting point, the practitioner tries different directions in order to generate many alternative ideas. Ideally the starting point will be a stimulating and provocative catalyst (Figure 25.3a). When this strategy is combined with a capacity for making visual images, the process can result in a diverse range of ideas that are easily communicated to others in the form of sketches or other quick, pictorial representations. Some have called this capacity 'design thinking', but real design thinking harnesses and integrates some very different capacities and thinking styles with the ones I've just introduced.

As noted above, there is also a very different thinking style that thrives on order and strategy. People who prefer this thinking style display characteristics of rational, systematic and objective ways of working. They frequently find roles in the analytical rather than the creative aspects of design and development and typically feel at ease with both quantitative and qualitative data. People with this thinking style are frequently *linear* learners (Figure 25.2b). It's easier to plot the path of their learning. It's steadier and less erratic than nonlinear learning. Significantly, nonlinear learning is more amenable to being examined by objective tests and exams. For people with this thinking style, new discoveries can

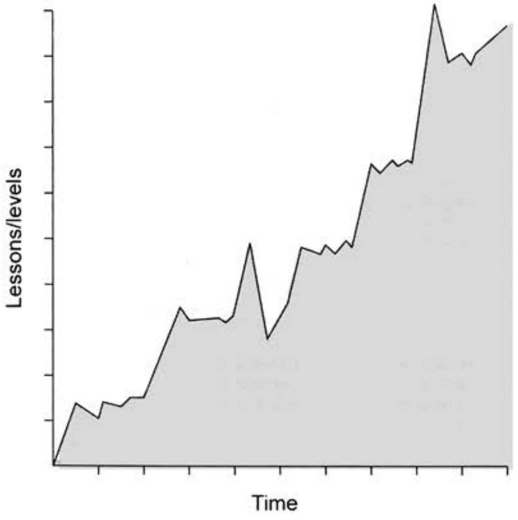

Figure 25.2a Nonlinear learning. (Copyright author)

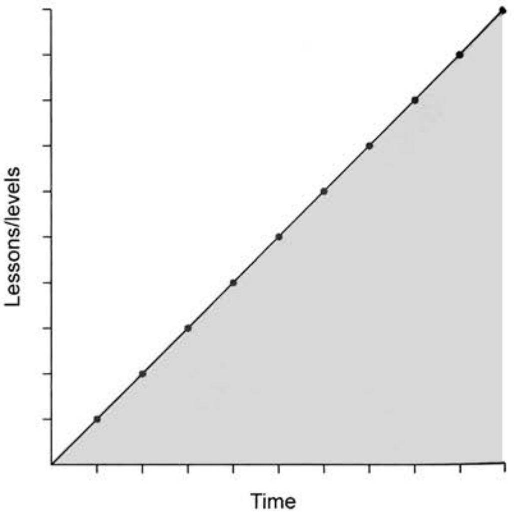

Figure 25.2b Linear learning. (Copyright author)

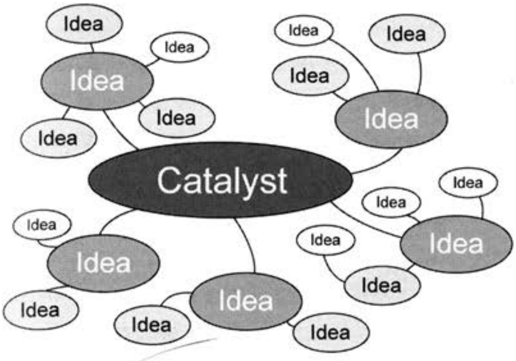

Figure 25.3a Divergent thinking. (Copyright author)

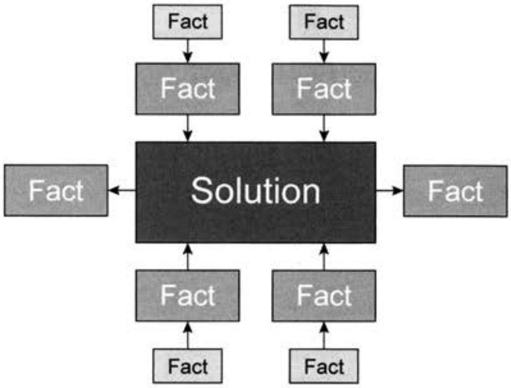

Figure 25.3b Convergent thinking. (Copyright author)

arise from outcomes that are not in accord with what was anticipated. In contrast to the potentially erratic process of divergent thinking, this seeks a direct path from problem to solution through the accumulation of information. This is the practice of *convergent* thinking (Figure 25.3b), which is rational, orderly, empirical and logical. Practitioners with this thinking style are more likely to focus on performance, technology, structure and manufacturing and frequently prefer specificity in communication by exploiting, for example, technical language or unambiguous images.

bridging perceptual gaps

Partly our preferred thinking style evolves from the education we are exposed to but it is also influenced by personal cognitive preferences and professional development. Our thinking style can be very strongly embedded in us. We have created cultures to justify and perpetuate thinking styles, but their existence can act as a barrier to collaborative working—particularly if we associate thinking styles with the domains or professions that must interact in many design projects today. In the creation of vehicles, for example, it's easy to imagine the two thinking styles as representing design and engineering. Design authors Jonathan Cagen and Craig Vogel suggest there exists a 'perceptual gap' between the designer and the engineer (Figure 25.4), and indeed there is in many industries today. They reveal a separation between what the engineer focuses on (e.g. cost, timing, quantitative ergonomics, manufacturing) and what the designer is more likely to be interested in (e.g. visual order, qualitative ergonomics, cultural trends). They define this perceptual gap as 'the differences in perspectives that team members have that stem from discipline-specific thinking'.[1]

Others who have studied modern industrial practice suggest that, increasingly, both thinking styles are found in design and engineering. The perceptual gap may still exist between people with different thinking styles, but, in contrast to Cagen and Vogel's visualization, the gap is as likely to be found within domains as between them. Despite such differences, modern industrial

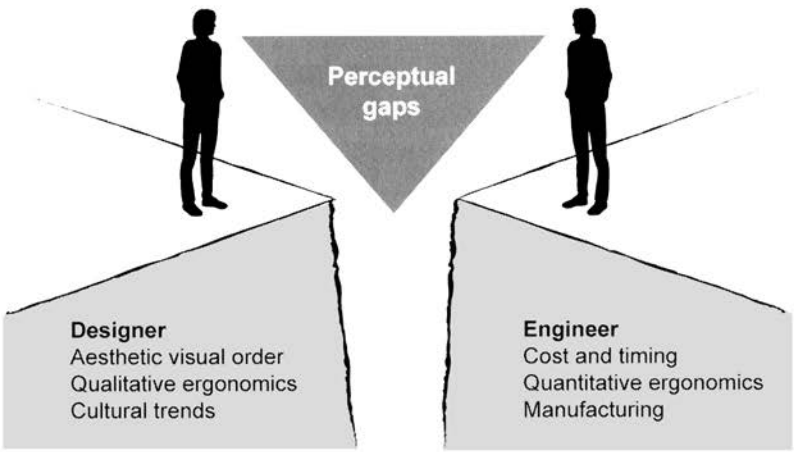

Figure 25.4 Perceptual gaps between designers and engineers. (Copyright author)

teams must embrace people with different thinking styles because they provide essential and complementary skills and practices. The differences between thinking styles can be very helpful in creating innovative products where team members constructively evaluate the product from their own perspective. Quite often the polarities in thinking bestow creative energy to the momentum of joint efforts. Productive collaboration is high-performance, and I have named such positive exchanges as *creative friction*.

An example of creative friction occurred at General Motors (GM), where the disciplines of design and engineering display evidence of the thinking styles. This example concerns the integration of light-emitting diode (LED) technology into vehicle headlights. Engineering initially created large components that had to be placed at the extreme corners of the vehicle, compromising the overall aesthetics. When designers made this problem known, the engineering team repackaged the components, enabling the repositioning of the headlights to the desired area. As a result, this repositioning actually improved some of the safety qualities of the headlights. Of course, differences between thinking styles can also be disruptive, resulting in major conflicts that negatively affect the overall quality of a product. At these times, collaboration is corrosive. It causes breakdowns in progress and compromises the goal. I refer to this nonproductive approach to collaboration as *uninspired friction*. It stifles the development process. For example when engineering the trunk (boot) of a car, a specific volume or interior space needs to be maintained depending on the vehicle category. In one case, to achieve this goal, engineering insisted that the deck-lid location needed to be higher. The designers adamantly opposed this because it changed the vehicle proportions. Engineering was unwilling to explore moving the inner walls of the trunk in an attempt to increase the volume while keeping the deck-lid in a lower position. So the end result was a vehicle that looked more stout and heavy. This was a direct compromise to the brand identity, which was described as being sleek and lean. Small adjustments such as these, if made repeatedly on parts of a vehicle, can dramatically alter its visual and other aesthetic qualities and potentially seriously diminish sales.

Understanding this perceptual gap between participants in design and development processes is critical to effective collaboration. Individuals who are aware of these differences learn to appreciate, respect and trust the unique contributions of fellow team members. While perceptual gaps can exist between any of a team's components, such gaps are still common between design and engineering. The *hairball* and the *cube* (Figure 25.5) is a playful representation of the differences between designers and engineers. This idea emerged from a conversation I had in 2007 with Wayne Cherry, retired vice president of design for General Motors worldwide. In Figure 25.5, designers are represented by the hairball and engineers by the cube. Introducing such a representation to a collaborative group can ignite lively conversations while opening channels of constructive communication. Such light-hearted and fun interactions can really help to stimulate innovation. However, it's not the hairball or the cube that's ultimately important here but the linking lines between them—the bridge between the two elements. This bridge is a vital metaphor to establishing a shared space for mutual understanding.

A bridge of understanding is a catalyst for dialogue; it encourages crossing over into other domains while establishing a home base. It offers a point of balance and a middle ground, and it enables team members to build relations. Distinguishing similarities, as well as differences, within multidisciplinary teams is valuable not only for balance but also for building team unity. Such a bridge can provide clarity by establishing a common language, ground rules and mutual respect. One of the first steps in establishing common ground is through shared learning experiences so that designers and engineers are able to understand and appropriately respond to differences in thinking. Examples of these kinds of experiences include workshops and off-site visits to compare competing products, experiences which are further discussed later in this chapter. Achieving shared knowledge and understanding

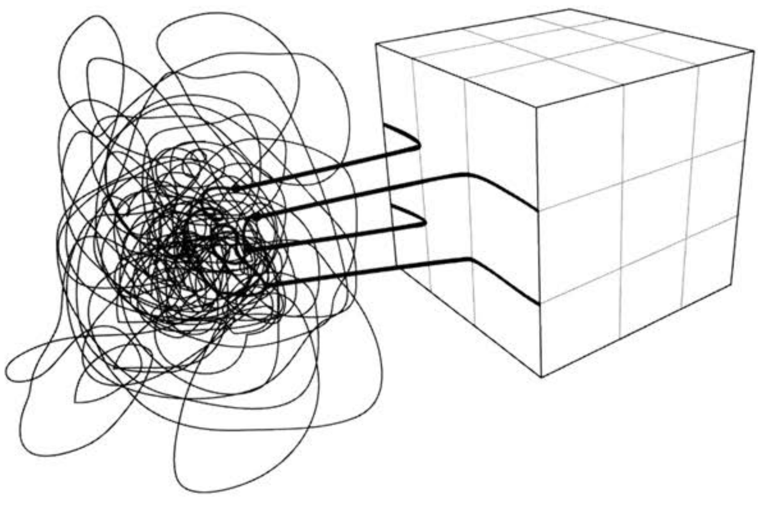

Figure 25.5 The hairball and the cube. (Copyright author)

can dramatically reduce the uninspired friction between the two disciplines and help create a strong bridge for effective collaboration.

finding common ground in the collaborative process

Creating conditions that can support the co-working of engineers and designers across all stages of the design process can be challenging since the process itself often goes through enormous transitions. However, such interaction is necessary to ensure that each discipline has continuous input influencing the product. Breakdowns in communication, or simply the failure to schedule it into the process, can be catastrophic in transport design. For example if engineers develop a vehicle package without input from designers, the overall vehicle proportions could be overlooked. Since proportion is one of the most important characteristics in market acceptance of new vehicle design, this oversight can lock in undesirable aesthetics from the earliest stages of the process. A recent discussion with Dave Lyon, executive director of interior design for North America at General Motors, revealed the importance of collaborative practice.[2] For years, the prevailing culture at the GM Design Center in Warren, Michigan, excluded designers from some key early stages in the creation process. Engineering would write vehicle specifications and find suppliers who could produce parts at low costs. Encouraging suppliers to minimize costs succeeded in reducing overall vehicle costs, but it also often yielded unattractive assemblies with poor quality. When designers were finally given the product brief detailing these specifications, it was usually too difficult, too costly or too late to make changes. This has been a common model in many industries where engineering and marketing make decisions based on short-term finance rather than long-term product quality. In this model, the concerns of design are not heard simply because they are not involved in decision-making early in the process. Take, for example, a vehicle interior door handle. This can be configured into door systems in many different ways. At one time, engineering at GM preferred to mount door handles on the door panels and then add trim around each one. This was a great way to engineer an inexpensive part that was easy to assemble, but this method resulted in visible gaps around the door handles—it was an unmistakable indicator of poor quality and design. Many competitors achieved consistent gaps of only one millimetre around their door handles, so GM had to examine why its product was so poor. It turned out that every time GM designers began a vehicle project, they were tied to one particular type of door handle assembly that had been specified by engineering. Since engineering and marketing could not understand why designers would want a door handle that was ten dollars more expensive than what they had already specified, their working relationship was characterized by frustration and dispute. Even today you can still find examples of such conflict in a wide range of industries, including manufacturers of consumer appliances, toys, luggage and numerous others.

In General Motors' case, this inability to confront problems in detail design went beyond the door handles. Some parts had to be given large radii, and feature lines were intentionally shifted from part to part to disguise alignment problems. Overall, this approach had a major negative impact on consumers' perceptions of vehicle quality. Design became a process of trying to disguise the flaws rather than a demonstration of harmony between process and product. While the story at GM is very different today, at that time the silos of design and engineering did not support the type of collaboration that could have addressed the problems of the vehicle assemblies. Anne Asensio was appointed executive director of design, interior design, quality and brand character with the mandate that the interior quality problem be fixed. Understanding the importance of collaboration, she met with her counterpart in interior engineering, John Calabrese, who was also concerned with the lack of quality. Collaboratively they had the ability to produce world-class interiors, and they understood that organizational changes were needed to bring this about. From that point, a collaborative culture was established. A new procedure for writing vehicle specifications was created, bringing together the expertise of designers and engineers. Both parties were willing to actively collaborate to improve quality and innovation in new vehicles, but it was the discipline and commitment to change that truly transformed the teams.

To achieve their goals design and engineering managers held weekly forums with project updates. Regular, structured meetings supported the necessary cultural change. They began to set new standards, create new processes, discuss concerns and make decisions together. One result of this collaborative activity was the collective agreement that mounting door handles to door panels was no longer acceptable. Together designers and engineers developed new definitions of requirements and innovative responses in the form of product ideas. Multiple examples of this kind of collaborative success rippled through entire vehicle platforms. New teams improved the fit between parts, minimized gaps, improved finish quality and added value through options to make vehicles competitive within specific market segments.

exploring the bridge

Good collaboration, such as that developed at General Motors, depends on successful navigation of the bridge between the hairball and the cube (Figure 25.5), but the story doesn't stop there. Figure 25.6 presents this bridge as having its own distinct character. It is a combination of the intuitive thinking of the hairball and the rational thinking of the cube. We might characterize bridge thinking as 'creative order'.

This creative order, or bridge thinking, is vital to product development. It may not be required continually, but at key decision points it is essential. Sometimes bridge thinking comes about through successfully integrating design and engineering. At other times, bridge thinking is a capacity of certain gifted individuals. I want to explore this in a bit more detail.

The erosion of the notion of silos and their replacement with a more unified model of collaboration reveals how the different styles of thinking introduced at the beginning of this chapter coexist today. Figure 25.7 presents four realms: the *creative designer's realm,* the *analytical engineer's realm,* the *analytical designer's realm* and the *creative engineer's realm.* These realms can only hope to caricature the real people the model seeks to portray, but it does illuminate some important qualities and strengths of participants within industrial processes. A healthy system embraces contributions from all four quadrants.

The creative designer is a design expert. He or she needs creative 'play' time, individually or as part of a group. The creative designer needs to

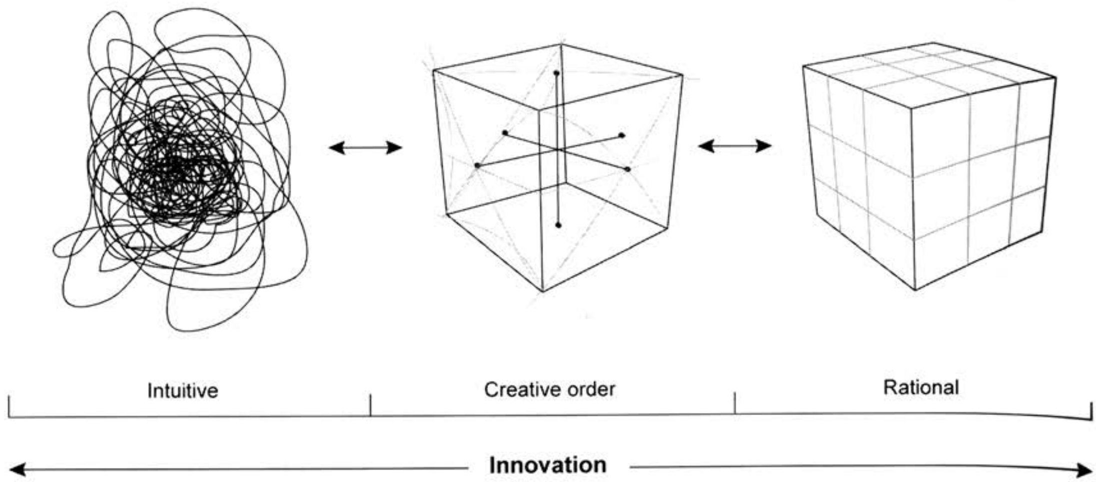

Figure 25.6 Thinking styles of the hairball and the cube, with creative order between. (Copyright author)

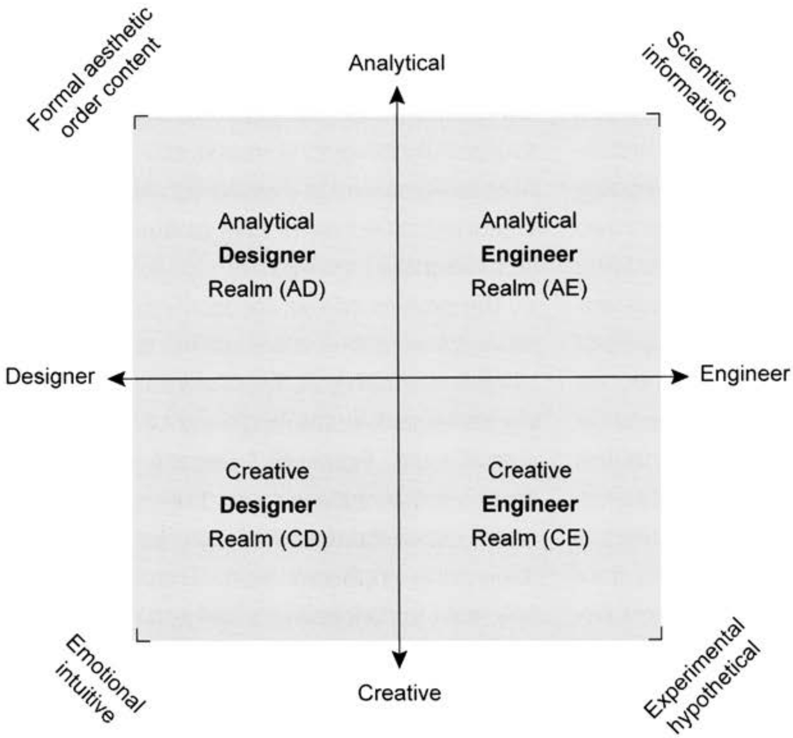

Figure 25.7 Different realms for engineers and designers. (Copyright author)

be able to disengage from aspects of engineering to explore the boundaries of the problem and the possible solutions. Harnessing creativity is the goal here. When successful, it can provide almost visionary outputs. The analytical engineer is an engineering expert. When working with extreme focus, he or she can display the same level of passion and inspiration as the creative designer.

This intense focus provides opportunities for technical invention and discovery that can inspire radical innovation. Both groups need command of their own realm but must be aware of the bridge across to the realm of the other. If creative designers continuously ignore analytical engineering, then difficulties will arise in bringing a product to production. Likewise, if analytical engineers work in complete isolation from creative designers, they might create products that are functional but less successful in the marketplace. When these two groups bring ideas from their particular quadrants to the team, their ideas are more likely to be accepted if a common ground for understanding is in place. They need buffer quadrants that support the type of creative order provided by the bridging stage in Figure 25.6.

Analytical designers and creative engineers provide this buffer of creative order. They are people who have a functional understanding of, and an interest in, design and engineering. They have the ability to see value and importance within each discipline and cross over from one discipline to the other with little or no effort. Theirs is a very valuable role today. Creative engineers and analytical designers are hybrids who cope with the creative application of information in modern product development. They usually do not possess the extreme characteristics of creative designers or analytical engineers, meaning they are neither a hairball nor a cube. However, these individuals help function as a bridge during collaborative efforts. Analytical designers and creative engineers are beneficial in many situations. They are translators, facilitating communication in diverse teams and bridging the gaps in understanding that can arise.

However, the team environment and the lure of interdisciplinary situations can distract the analytical designer or creative engineer. Ideally, these individuals should have an area of expertise either in

Figure 25.8 Some designers are interpreters or translators, bridging gaps in understanding. (Copyright Brigid O'Kane)

"Analytical designers and creative engineers are translators, facilitating communication in diverse teams and bridging the gaps in understanding."

design or engineering. Without such a focus, analytical designers who forget that they are designers can get wrapped up in technical aspects of the engineering and ultimately sacrifice advancements of design. Similarly, engineers can get sidetracked by visual details. There is a danger that hybrids will have too much flexibility and forget what they should be focusing on, neglecting their discipline-specific tasks.

workshops and team building

Activity workshops are one of the most effective ways to establish common ground between design and engineering. They can be tremendously empowering, even if the outcomes can be alarmingly unpredictable. Designer-hosted workshops for engineers can be structured in many different ways, perhaps offering insights to the design process, reviewing content in a project brief that is deemed important from the designers' perspective, examining criteria commonly used to judge excellence in design or engaging in model building or other hands-on activities. For example designers might demonstrate the fundamentals of drawing, giving engineers the tools to aesthetically design using traditional methods such as pencil and paper or more contemporary approaches using a graphics tablet and computer for digital sketching. These interactions stretch people's awareness. Such workshops expose engineers to the subtleties of, for example, using form, colour or line to visually unify assemblies. They foster an understanding of how aesthetics are important in vehicle marketing. Such workshops leave participants with a shared appreciation for design quality.

Engineer-hosted workshops for industrial designers also offer many possibilities. One approach is to engage designers with engineering software. Of course, this requires some investment in training, but it can reveal insights into engineering priorities and processes. Designers who participate might never again use the software, but the experience can foster an appreciation of the engineering workflow and can create a deeper understanding of what exactly engineers do. Designers get to see firsthand how seemingly minor changes can have significant consequences for time and resources. Such workshop experiences usually ease tensions and uninspired frictions that may have existed. During workshop activities, it is critical that team members interact. The main purpose of such workshops is to facilitate insights into the other's realm and to reveal how team members with different backgrounds can contribute to a shared goal. When working with designers and engineers, it is helpful to incorporate creative activities of exploration that would appeal to designers and activities that have a more rational approach to applied knowledge, which engineers will better relate to.

In my interview with Dave Lyon, he described how such workshops and other collaborative activities form an important part of team building at GM. Every quarter, designers and engineers travel to the GM proving grounds in Milford, Michigan, where together they spend time analysing competitor vehicles and conducting comparisons of

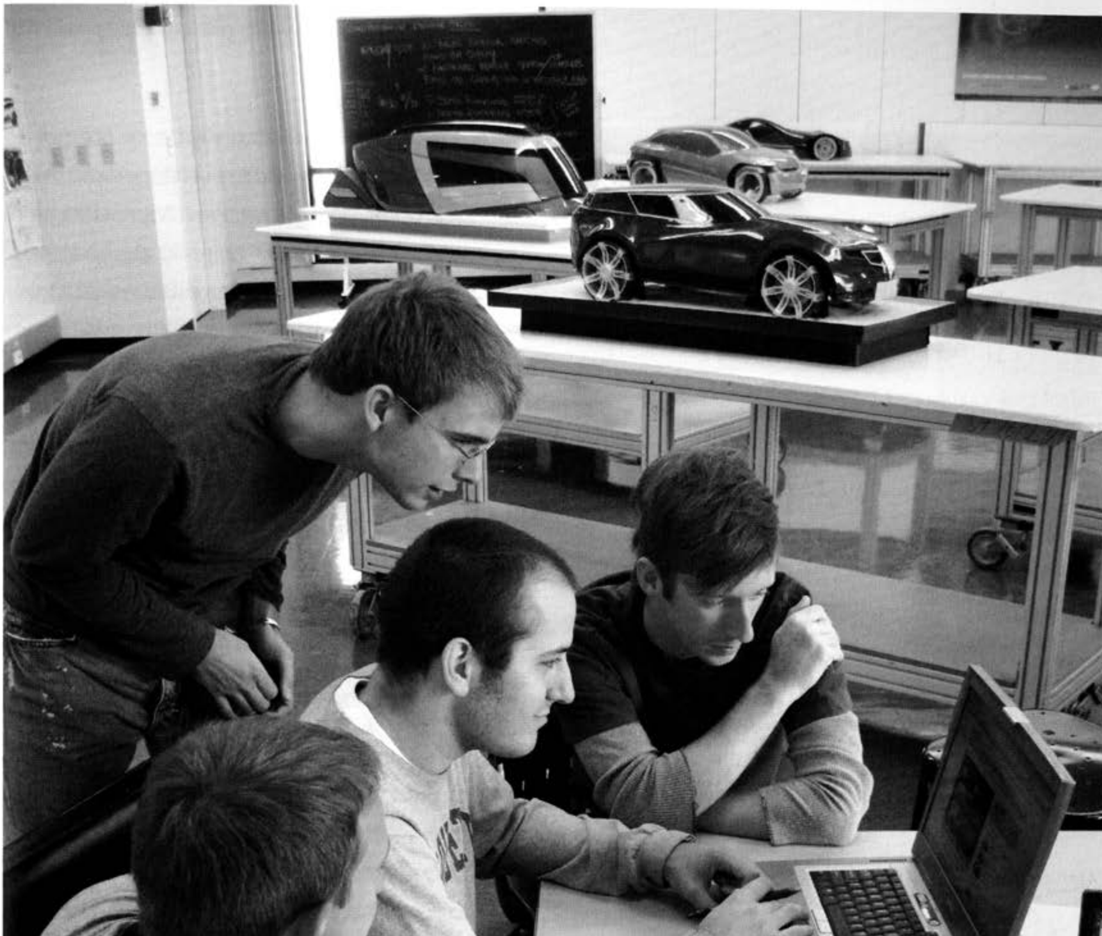

Figure 25.9 University of Cincinnati students from industrial design and mechanical engineering disciplines collaborating under the direction of Professors Brigid O'Kane and Sam Anand. (Photo copyright Brigid O'Kane)

Mass Customization

Henry Ford's innovation in production line assembly in the early twentieth century had one clear disadvantage: it reduced variety. It depended on each vehicle using the same set of components, so each Model T car, for example, was almost identical to the next. Since this time, the quest for manufacturing engineers has been to devise a system that has the advantages of Ford's principle whilst allowing a range of products to be assembled on a single manufacturing line. This has been the search for mass customization.

Mass customization offers the potential to personalize products to suit the specification of individual customers whilst still producing in large numbers. Mass customization of products allows customers to choose options from a suite of possible features, and the manufacturer can deliver these by selecting from a range of alternative components and subassemblies. In theory, it stimulates demand by allowing consumers to have a product tailored to their wishes and which is different to that purchased by others.

In adopting mass customization, a company has to be assured that there is sufficient consumer demand for an extended variety in product range to warrant the investment in the technologies and systems required to support mass customization. These include computer-controlled machines, quality control and computerised planning and scheduling of manufacture.

the projects they are working on. At one such meeting, the teams of designers and engineers returned to the problem of gaps such as those around headlights, trim panels and doors. It provided a focus for dialogue and creative thinking. Other sessions looked at how interior specifications were generated, how parts were purchased from suppliers and the basic pricing system for the entire vehicle. GM creates additional opportunities for team building at the North American International Auto Show, which has long been an annual event attended by those in the industry. For example designers and engineers are paired up to experience the exhibition together. While walking around the showroom floor, designers and engineers share their differing perspectives. It encourages a dialogue about issues of structure, product image, reduced mass, fuel economy or new visions for the future. Experiencing the show side-by-side develops shared perceptions that cannot be replicated simply by meeting afterwards. Spending time outside the immediate bubble of their normal work and looking at what is out there in the world is a great way to learn and, as Dave Lyon puts it, to 'share what we see'. In addition to the physical design of vehicles, electrical engineering is evolving at a rapid pace. In an effort to keep up with these advancements, General Motors' electrical engineers and designers attend consumer electronics shows together and return with different perspectives and ideas for new strategies. 'We come back from these shows and want to rework everything we are currently working on,' said Lyon. 'Designers could only make these kinds of significant changes because we walked through the show with engineering so they could see the value in adjusting the plans.'

the organic growth of innovation

Innovation is an increasingly powerful component of successful products. Without innovation, we are simply editing what has been done before or re-creating what already exists. Innovation is not to be confused with incorporating new technology or methods into the process. Innovation is looking at a product from a completely new point of view and from that creating a new product that is novel or unexpected. Striving to push the use of, for example, new software, within the development process may result in better methods, but it may mask a need for real innovation. Often the root of this is close at hand, as Thomas Walton points out. 'Technology makes a difference, but it is the human dimension that ultimately determines the nature and extent of that direction.'[3] Bridging the differences in individuals and facilitating communication forges a common ground that can be infused into collaborative teams to establish and cultivate a culture of creativity that is ultimately manifest in innovation. Once this common ground is established, it takes work, planning, open channels of communication and continuous effort to bring about effective results.

Healthy collaborative systems embrace the four design and engineering realms presented in Figure 25.7. They can unite organizational expertise into one vibrant organism. This system naturally fosters the *organic growth of innovation* (Figure 25.10). One way to achieve this arrangement is to organize the design development process to allow appropriate opportunities for *team-specific activities* and *discipline-specific activities.* Team-specific activities would include both designers and engineers, while discipline-specific activities would include only designers or only engineers. In either case, activities would vary depending on the stage of the design development process. Creativity should be encouraged for all team members when working collaboratively and individually. When team members anticipate and expect creative input from each other, regardless of discipline, the prospect for innovative thinking increases.

Feedback loops within the design process are critical for evaluating teams and products. Powerful team working can develop when feedback mechanisms constructively capture and utilize information from team interaction. Such mechanisms should be compatible with group dynamics but do not need to be elaborate or costly. Sometimes all that is needed is a simple survey, a conversation between collaborative partners or acknowledgement for a job well done.

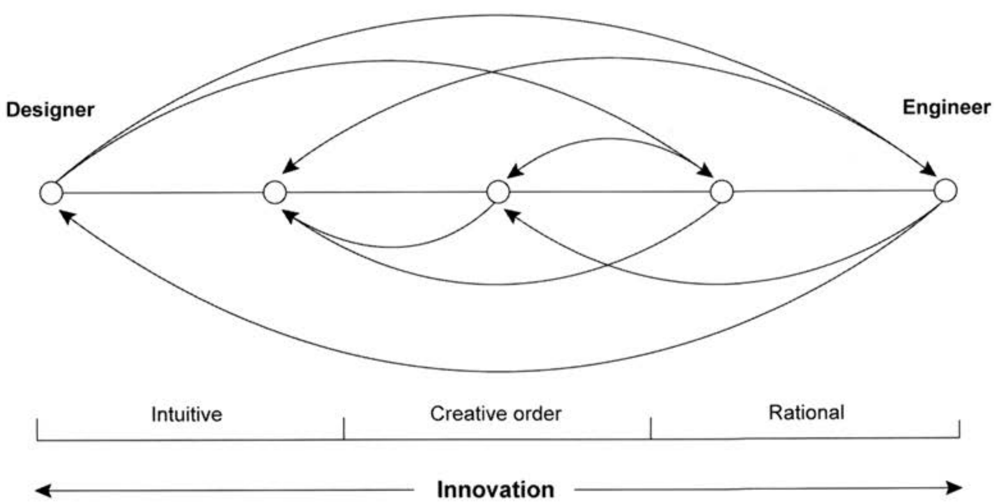

Figure 25.10 Organic growth of innovation. (Copyright author)

the importance of leadership

The greatest challenge in collaborative practice is overcoming the many differences between disciplines. These differences provide some of the most significant difficulties in managing today's design processes. Good communication between disciplines is key and should be grounded in a solid understanding of oneself and others. Hopefully, this chapter has alerted you to begin this inquiry. Comprehending the characteristics of designers and engineers helps you avoid misconceptions and aids communication. But probably the most important lesson is the need for good leadership. This is vital if people are to navigate between the thinking styles referred to earlier. There's a desperate need for leaders who are also bridge thinkers.

Leaders of collaborative teams must be flexible, giving teams opportunities to change and adapt to unexpected situations and outcomes. These unpredictable happenings are more likely to occur when individuals have different ways of thinking and operating. Vision and courage are needed to preserve what works and to eliminate or change what does not work. An effective leader of collaborative teams must be mindful that methods of distributing information can influence how it is received. When leaders distribute documents to team members, they should present the information in formats that suit the different styles of thinking. Leading collaborative teams can be refined through experimenting with different approaches. Empowering team members to contribute information is vital. Note that General Motors' designers are now involved in development from the earliest stages. They contribute to specifications and use images to convey subtle visual characteristics that might otherwise be overlooked when others apply the specification. These detailed images aid understanding of the specifications and lead to their complete fulfilment, thus contributing to product quality. The ideas of collaboration, communication and leadership incorporated in this chapter are synthesized in Figure 25.11. This figure represents a new and desirable process model for collaborative team working. It suggests an environment that fosters regular interaction between members. It values the realm of individuals and the unique contributions they might be able to make, but it also represents balance and leadership. It seeks to bring about a workable, creative mix of disciplines, stimulating crossover and a movement of individuals outside their comfort zones. Such a continuum of expertise powerfully supports interdisciplinary teams and drives excellence in innovation.

solutions to new challenges

Transportation designers and engineers are addressing challenging issues facing humanity. Solutions for current and future challenges cannot be developed in isolation. Interdisciplinary teams of engineers and designers, as well as representatives from a multitude of different fields, are key. We are inextricably linked. The support infrastructure may be present, but can organizations and individuals grasp the opportunity? As David Muyres and Geoff Wardle pointed out recently: 'The working culture of design offers unrivalled levels of facilitation that allow multi-disciplinary teams to develop valid solutions for the future.'[4]

In addition to the contrast in thinking styles previously discussed, designers and engineers face other challenges to the collaborative process. When developing products in transportation and many other disciplines, team members will face barriers presented by different cultures, lifestyles, time zones, attitudes and behaviours.

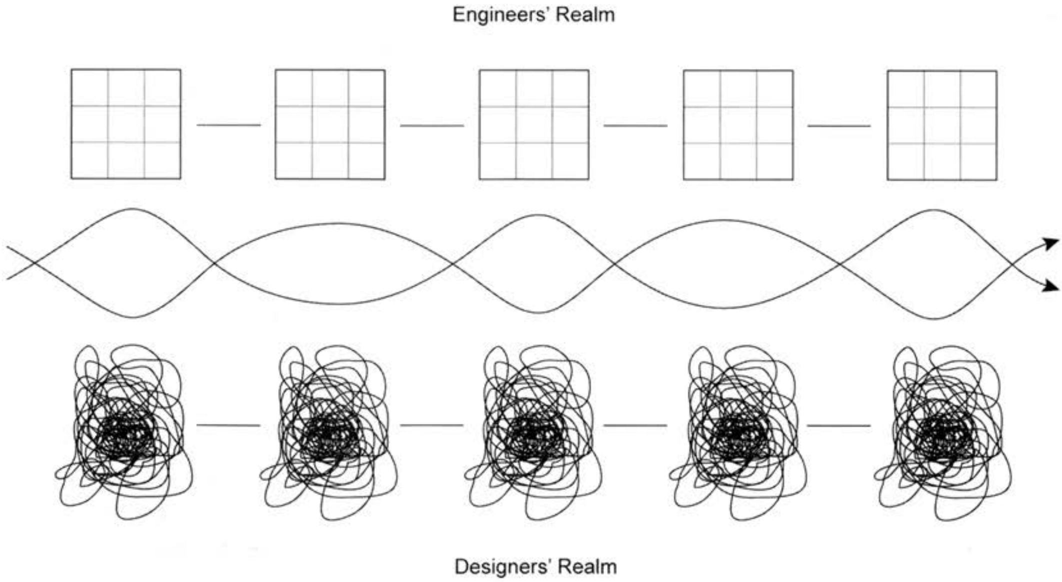

Figure 25.11 The new model for collaborative practice—a continuum of expertise. (Copyright author)

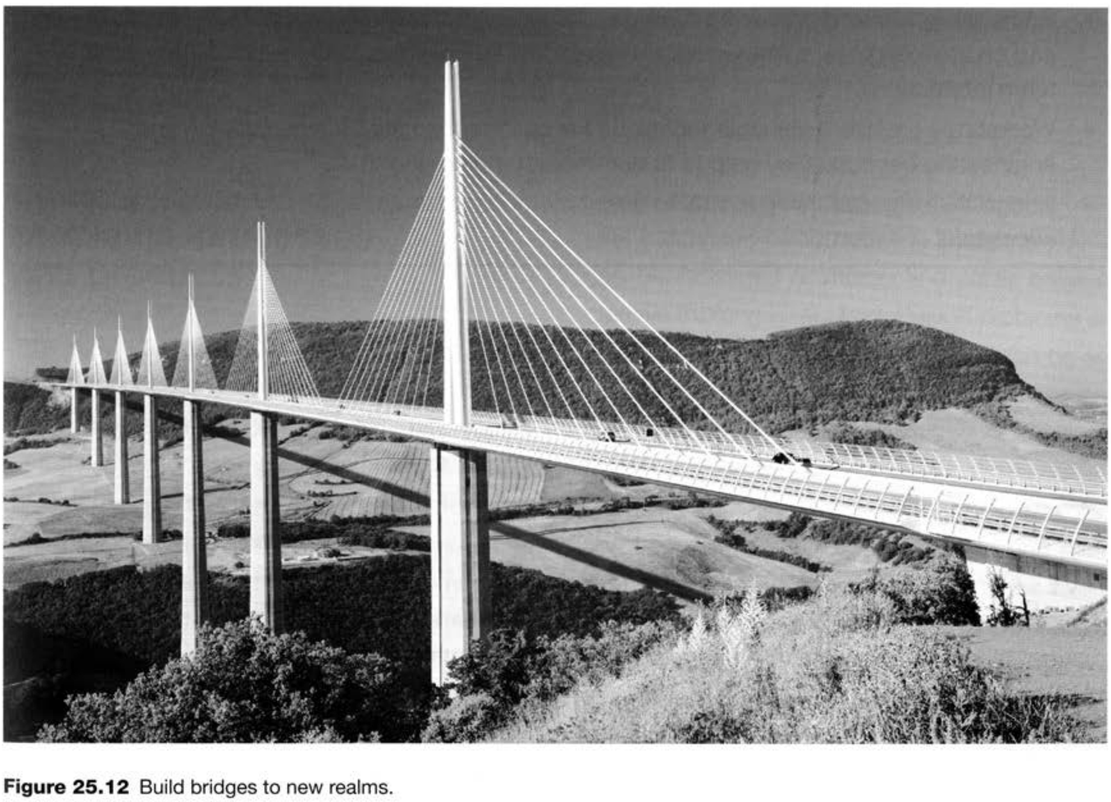

Figure 25.12 Build bridges to new realms. (Shutterstock 32185006)

Overcoming these differences and any associated prejudices for the sake of a successful collaboration on any scale can be transformative. Good resources exist to guide our design processes and practices, but ultimately it is up to us as practitioners to develop our skills and bring about change.[5] Collaboration skills can enable us to effectively operate across barriers. Designers, particularly, need to develop skills for building and crossing bridges into different realms and disciplines. They need to be individuals prepared to use these bridges to build partnerships that enhance and develop innovative processes and products.

CHAPTER SUMMARY

- Commercial design today is largely a team process requiring collaboration between a variety of participants. Poor collaboration stifles innovation. Building bridges of understanding is essential to successful collaboration.
- One of the key relationships in transport design, as well as many other disciplines, is that between designers and engineers. These professions display distinctly different knowledge bases and thinking styles. Perceptual gaps can exist between them.
- Some designers and engineers have developed hybrid characteristics. Analytical designers and creative engineers are two hybrid types. These individuals can help facilitate positive team interactions.
- Workshops provide a valuable technique for building bridges between design and engineering because they help to foster understanding and trust.
- Bridge thinking leadership is vital to assist members of interdisciplinary teams in achieving successful collaboration.