Cross-Functional Design Leadership: 
Learning from the Future That Was

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Introduction

In 2001, Nortel Networks closed down design interpretive (DI), its cross-functional product design group. At that time, 36 years after beginning with one industrial designer, there were over 100 designers in the group, all steeped in cross-functional product development practices. This paper highlights the lessons learned about working in cross-functional teams and the design methodologies that evolved from those design activities. It looks at the evolving structure of cross-functional teams. It highlights the expertise people brought to the teams and the skills they learned. It describes best practices relevant to education for cross-functional teams in the future. This information was synthesized through interviews with past employees, analysis of historical documents, and a consideration of the literature on cross-functional teams. In March 2005, we sent e-mail requests for participation to a total of 77 DI alumni. These requests directed respondents to access a Web-based survey that asked 17 multiple choice and open-ended questions about their experience of cross-functional teams. Our response rate was 20%. Through this process we have come to the conclusion that DI was a unique environment with important implications for the future of design leadership.

History of the Organization

The design interpretive group at Nortel Networks could trace its ancestry back to Alexander Graham Bell, who had sold his patent rights to the National Bell Telephone Company of Boston. In 1895, National Bell consolidated the different phone companies in Canada into the Bell Telephone Company of Canada and later incorporated its mechanical department into Northern Electric and Manufacturing.1 In 1956, Northern Electric set up Northern Telecom, an R&D organization with 52 engineers in Ottawa, Canada, where it grew quickly to 500 people. In 1965, Northern Telecom hired its first industrial designer, John Tyson, who was responsible for the Contempra telephone that is now in the permanent collection of the Museum of Modern Art. By 1971, when Northern Telecom created Bell Northern Research (BNR) as its R&D unit, 75% of its products were designed in-house. By 1973, the fledgling design group, called design interpretive, included seven industrial designers, one market researcher, and two prototype pattern makers.2 Eventually, a human factors group was amalgamated with the group and in 1976 user needs assessment was added. This was rather progressive as it was at a time product direction was led exclusively by technology and product management.3 Through this complementary amalgamation, the seeds for cross-functional teams were planted in the organization.

Tyson left the group for several years and returned in 1991 to head up what was then called the Corporate Design Group, (CDG) and charged the group with a design leadership focus on

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1 Weil, Dennis, “Nortel Network Corporate Design Group: From Form-giving to service prediction; A Path to High Value and Product Design in the Telecommunications Industry”, p. 6
2 IBID, p. 10
3 IBID, p. 12
“customer driven innovation rather than technology driven innovation.”4 His influence turned the group into a corporate centre of excellence with the core competence of “understanding of user and chooser values.” 5 While in its previous incarnations it had functioned largely as an internal consulting organization, at this point it was funded through a corporate “tax” which both compelled other groups in the corporation to partner with CDG and also allowed the group to pursue some of its own agendas. Cross-functional design teams were also an essential ingredient of the newly incarnated CDG.

Cross-Functional Teams as Core Methodology

Tyson initiated a classic matrix structure consisting of functional and product axes. The functional axis was driven by the component disciplines while the product structure was driven by a new role, that of product design managers who became the leaders supporting specific lines of business.7 (See Figure 1.)

The matrix organizational structure of CDG/DI was not static. From the start, DI personnel were told that the matrix was inherently unstable, and some time later, the functional axis became the knowledge domains of infrastructure services, transactions services, communication services, and network management. However, the cross-functional nature of the teams was preserved.

In 1995, CDG/DI issued a Management System Manual outlining its design development and teamwork processes declaring a design approach with following three distinguishing characteristics:
1. A fundamental focus on behaviorally based design principles and on customer and user values underlies all product design effort.
2. Early and ongoing market verification of product hypotheses and concepts.
3. Use of multidisciplinary product teams with the diverse experience of experts in user needs assessment, user interface design, industrial design, graphic design, mechanical design, and model making.8

The cross-disciplinary product teams were expected to develop close partnerships with other organizations in BNR and Nortel during the product development process. In its design leadership role, CDG set the pace for cross-functional work throughout BNR.

The CDG/DI management team conscientiously examined the current information on cross-functional team processes. For example, in 1993 CDG/DI reviewed Anne Donnellon’s groundbreaking work about accommodating organizational structure to cross-functional team process. Donnellon reported that not only did the cross-functional team approach lower...
production and labor costs, it also led to greater employee commitment. Donnellon asserted that the team approach to the integration of specialized knowledge domains was appropriate to the product development process as it calls for a “constant, mutual adjustment of that knowledge.”

Donnellon identified three challenges to building effective and cohesive cross-functional teams:

1. If team members do not have a personal commitment to the team and the other team members, they will not be loyal to the team goals.
2. If team goals are set by the organization and team members are “held individually accountable by their functional superiors for achieving one of the several goals of the division, [they] can find themselves caught in rancorous conflicts or wasting valuable time.”
3. If team members have not received training in how to work or manage in teams, they bring primarily their area of expertise and too few skills for collaboration, thus leading to conflict.

When Donnellon was invited to review CDG 1994, she reported that: “to a person, the CDG professionals seem convinced of the appropriateness of the cross-functional team approach to their work and committed to the concept. There is widespread eagerness to learn how to work more effectively in such teams—which is a critical precondition for improved performance.”

She also had some suggestions for improving CDG/DI processes:

1. Train teams in an “orientation to team work and to the functional specialties that are represented in the teams, conflict management and mutual gains negotiation, group facilitation, membership strategies, and possibly some work on the basis of structured problem-solving and managing a meeting.”
2. Build better relationships by “inviting critical BNR partners to participate in team training with you” or by convening “meetings between the whole team and the partners.”
3. Examine the role of functional [discipline] managers who were charged with developing and certifying the expertise of their function (e.g., industrial design, user needs analysis) team members, but were not involved in the cross-functional design teams and could not assess team members’ performance in practice.

Many of Donnellon’s points resurfaced in our respondents’ comments. Many noted how unsatisfactory they found the function axis to be. The caretaker role of function management left both managers and the people they managed frustrated. For their part, the function managers felt that their responsibilities would always be subservient to the business imperatives represented by their product management counterparts. Meanwhile those who were managed—those caught in the middle—felt a mixed allegiance that would always prioritize business objectives above the demands of their respective functions. As well, product design managers often had a tacit “smirk” about the entire matrix structure illustrated in Figure 2. They knew that their priorities would always take precedence. This situation was not helped by the fact that the senior management team often held dual roles as both senior function management as well as senior product management. By wearing “two hats,” those senior managers led a bipartisan existence that was felt by those they managed and was often characterized as “conflicting messages from above” or “poor corporate management.”

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10 Donnellon, IBID, p. 388
12 Donnellon, IBID, p. 3
13 Donnellon, IBID, p.6
14 Donnellon, IBID, p.5
Team Functional Expertise

Respondents had worked in DI for a range of 3 to 20 years with the overwhelming majority having ten or more years experience in the organization.

Over their careers, many of our respondents worked in several roles. In Figure 2, we show the proportion of respondents claiming each of nine distinct functions including industrial design, user interface design, mechanical design, usability testing, user needs analysis, product design management, senior management, function management, and technical/engineering. The largest proportion of our respondents had worked as user interface designers and/or product design managers. However, our respondents included at least some representation from each of the nine design functions in DI.

The cross-functional make-up of DI’s teams illustrated in Figure 2 was perceived as both good and bad. While most of our respondents felt that cross-functionality was a positive attribute, many also observed that the absence of significant technology, marketing, or line-of-business representatives was a problem. This was not a universal ailment however. At least one team included all of the above functions plus representatives from manufacturing as well.

Design Methodologies

One interesting trend was the degree to which respondents felt that team rooms or team spaces were important. Many of DI’s cross-functional teams had rooms of varying sizes that were permanent or semipermanent meeting, deliberation, and design spaces. Often flip charts or Post-It™ notes or file cards papered the walls, representing works in progress or design decisions. Perhaps this may have been an outgrowth of the difficulty of finding appropriate meeting spaces in BNR/Nortel at the time but we think it may be something more than this. The flip charts and notes helped to identify key milestones or critical moments in ways that many current collaborative tools cannot hope to emulate. The team rooms manifested the teams’ identities and many people felt uncomfortable even entering another team’s room.

We also sensed that many respondents felt the cross-functional teams were a laboratory for learning about diversity, teaming, team dynamics, and leadership as well as about design. This seemed to be reflected in response to the question: What from your DI experience are you applying in your work now? Many comments highlighted working across functions and multi-disciplinary teams and the overall culture. They also valued working on the whole product solution as opposed to working within a subset specific to a particular skill or skills.

Lessons Learned
We had asked respondents to appraise some of the cross-functional team characteristics they had experienced at DI. A summary of responses is captured in Figure 4. The highest ranked characteristics included the following:

**Facilities and Tools:** Each team had their own team space and access to a seemingly unending supply of state-of-the-art tools and technologies.

**Team Functionality:** Most team members were selected by other members based on functional expertise and past experience.

**Size of Team:** Teams were small, and everyone had something significant to contribute.

**Team Skills:** Team members’ expertise was well respected by their peers.

Clearly, our respondents felt that the make-up of their teams and the facilities provided were among the most positive attributes of the cross-functional team experience. This was also reflected in the open-ended comments. Many cited factors such as “taking advantage of diversity of people”, “openness to others ideas”, “people with similar interests”, and “dedication to a common cause” as some of the factors that made the best-performing teams what they were.

Cagan and Vogel (2002) describe the features of high-performance teams and our respondents generally corroborated those results. Cagan and Vogel claim that high-performance teams have the following characteristics:

- self-motivated, accept criticism, quickly establish an atmosphere of mutual respect, and integrate different perspectives
- function horizontally, rather than in a hierarchy, and shift leadership roles as appropriate;
- actively seek advice and input from managers, expert advisors, and potential customers
- identify and correct flaws rather than become overly defensive;
- have a clear rationale for their decisions;
- tend to have a sense of humor as a group and use it to shed stress;
- quickly become experts in the subjects needed to develop insights into the product opportunity;
- accept the fact that they are mutually responsible for the work of the team; and
- develop the gestalt dynamic where the team is greater than the sum of the individual capabilities of its member.¹⁵

The most negative characteristic cited by our respondents had to do with their teams’ integration with the rest of the company, a point that had also been made by Donnellon in 1994. Some teams had good integration with the rest of Nortel, sometimes even incorporating non-DI personnel within the cross-functional team. More often, unfortunately, the teams existed outside of the company organizational structure and were disconnected from more mainstream development.

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¹⁵ Cagan, Jonathan, Vogel, Craig M., *Creating Breakthrough Products: Innovation from Product Planning to Program Approval*, p.150
and business activity. This was reflected in comments about what the teams could have done better: “true cross-corporate teams”, “come down from the ivory tower”, and “tighter coupling to company business goals”. Respondents also observed that some teams did not have enough non-DI team members nor did they have non-DI management buy-in to their efforts.

This negative attribute also seemed to be reflected when respondents were asked about the overall impacts of their cross-functional teams. In Figure 5 we see that although respondents felt that their cross-functional teams had a positive impact on user value, their impacts on revenues and corporate leadership were marginal. Presumably a better integration with the rest of the company might have improved the bottom line. As Cagan and Vogel say, “an attitude of cooperation and collaboration and an openness to creative thinking can often lead to win-win situations.”

![Figure 4: Team Impacts](image)

**Incorporating the Learning into the ID Curriculum**

Traditional industrial design studio teaching provides students with the opportunity to work on teams with other students. This can potentially provide opportunities to learn or experience collaboration and negotiation skills, as well as other relationship building skills. However, if the School of Industrial Design at Carleton University is typical, the students tend all to be like-minded visual thinkers with the same educational background who know each other well. This limits the possibilities for them to learn how to negotiate, compromise, and collaborate in regard to the competing discipline-specific priorities they will encounter in their working lives. Previously Melamed, Page, and Scott (2003, 2004) reported on courses in which they combined students from industrial design, mechanical engineering, and business to work together in cross-functional teams to research and develop new products for a client company (sponsor). This is an excellent way to provide the students with cross-functional design development experience.

The implications of cross-functional collaborative teams challenges the vertical structure of universities (as well as business) in a way that parallels the “old, sequential model of product development, in which a design idea originates in a business unit, is then given visual form by industrial design, and is then passed off to engineering” The University of Chicago at Illinois has taken a daring step that provides a role model for other academic institutions to collaborate across disciplines in teaching product development practices. They have moved beyond basic discipline-specific skill building into the more complex arena of human interaction across disciplines. Melamed, Page and Scott acknowledged that:

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16 Cagan and Vogel, OP CIT, p.147
17 Melamed, Stephen, Page, Albert L., Scott, Michael J., “Lessons learned Year Two: Teaching Interdisciplinary Product Development Course at the University of Illinois at Chicago”, p.171
18 Melamed, Stephen, Page, Albert L., Scott, Michael J., “From Experience: Launching an Interdisciplinary Product Development Course at the University of Illinois at Chicago”, p. 159
at the start of the first year of the IPD, the three faculty members made a decision to treat the students and their teams in a mature manner and let the student teams work out their internal problems on their own without faculty intervention. At the end of the second semester, ...it was quickly learned that taking a hands-off approach to the students and the teams was a mistake. A lot of complaints were received from the students regarding internal team problems...mostly related to friction among team members and to individual team members who did not deliver their agreed upon deliverables on time causing difficulty for the entire team. The number one issue emerging from the students’ evaluations was team dynamics.¹⁹

In effect, the skill requirements for an industrial design student have expanded. It is apparent that students must enter into cross-functional teams with well-developed discipline specific skills, as did the design interpretive employees.

Based on the learning from DI, the following issues are important to create an atmosphere for cross-functional teams in an academic environment:

- members must be encouraged to develop a personal commitment to the team and in the other team members through team building exercises and self selection
- goals must be set by the team first and negotiated with the faculty members to provide the team with a sense of autonomy
- structure should be determined from within the team, and team should be encouraged to have flexible roles depending on the requirements of the project at different phases
- members must receive training in orientation to team work and to the functional specialties that are represented in the teams, conflict management and mutual gains negotiation, group facilitation, membership strategies, structured problem-solving and managing a meeting.²⁰
- faculty and team members must build better relationships with the rest of the university by publicizing the work and inviting outside people to participate to increase support for the concept and to increase the opportunity for diversity of discipline participation
- faculty should take a regular coaching role with team members
- team rooms are essential to support the team building, goal orientation and cohesiveness of the teams
- teams should be small, ideally three to five people

One of the challenges of cross-functional teams in an academic setting is grading individual team members’ contributions, which was analogous to the challenge faced by Function Managers in the CDG/DI.

As Melamed, Page, and Scott point out;

What has been less clear is how to monitor the tasks and contribution of individual participants...Teams are expected to make decisions as teams and to arrive at consensus in major matters; no individual, whether supervisor, boss, team leader, or faculty member, dictates what the group works on.²¹

Conclusions

¹⁹ Melamed, Stephen, Page, Albert L., Scott, Michael J., ‘Lessons learned Year Two: Teaching Interdisciplinary Product Development Course at the University of Illinois at Chicago, p.171
²⁰ Donnellon, IBID, p. 3
Design Interpretive/Corporate Design Group was a visionary place. One anonymous respondent said it most eloquently:

DI was probably the best job I ever had and will probably be the best job I will ever have. It was a wonderful, dynamic, creative, and caring group of skilled designers who knew how to have fun and be visionary. It is sad that we were not more connected to the rest of Nortel so that all that wonderful energy could have been better harvested and appreciated.

Now it is time for the harvest.

Bibliography


Melamed, Stephen, Page, Albert L., Scott, Michael J., “From Experience: Launching an Interdisciplinary Product Development Course at the University of Illinois at Chicago”, Proceedings 2003 Eastman National IDSA Education Conference, Pratt Institute, pp. 159-164.

