Journal of Military and Strategic Studies

VOLUME 17, ISSUE 4

Design in Civvies: The Promise of Creating Degrees of Freedom in Government

Alex Ryan

In 2012, Dana Woodworth, a retired Canadian Armed Forces Lieutenant Colonel and Assistant Deputy Minister with the Government of Alberta (GoA), asked me to train 19 senior leaders from five ministries in systemic design. Woodworth had read the US Army's new design doctrine[1] I had been involved with writing and believed that the same type of thinking could help with some of the GoA's most complex strategic challenges. The training was successful, and so four follow-on projects were initiated to address cross-ministry social, economic and environmental challenges. Meanwhile, one of my former students in design at the School of Advanced Military Studies, Lieutenant Colonel James Allen, had retired and joined the Government of Alberta as a senior leader and a champion of design.

After four successful systemic design projects, I was asked to join the Government of Alberta and start a systemic design and strategic foresight lab. In January 2014, together with Keren Perla, Jonathan Veale, Sandra Honour, and Eleanor Joel, we founded Alberta CoLab. Our intention was to change the way policy was developed in government to account for more complexity, more perspectives, and deliver faster than the traditional policy development process. In our first year, we took on 38 projects led by 14 different ministries. We designed and delivered a six-day

[1] United States, *Field Manual 5-0, The Operations Process* (Washington, DC: Headquarters, Department of the Army, 2009).

©Centre of Military and Strategic Studies, 2017
ISSN : 1488-559X

systemic design training course, and established a community of practice with membership from all ministries. After 3 years, we have added Brent Wellsch, Salvatore Cucchiara, Laura Read, and Roya Damabi to the team. Together, we have completed over 90 projects, hosted an international conference on Relating Systems Thinking and Design, and helped to coach and launch other design labs and communities of practice across the province and across Canada. Our experience demonstrates that the theory and practice of design first developed in the Israeli Defence Force (IDF) and then adapted to the U.S. Army have much broader applicability to government policy and strategy development.

In this article, I want to follow and build on Ofra Graicer's preceding article that introduces the concepts of degrees of freedom and self-disruption. As she exposed in her article, Graicer hammered out these concepts working with Shimon Naveh to develop the IDF design course for generals, which is grounded in more than 15 years working with the IDF as well as the international defence community.

In the workshop leading to this special issue, Graicer remarked: "Design should be a liberating experience! Design is measured by the degrees of freedom it creates."[2] Graicer's concepts resonated deeply with my experience of design and my motivation as a designer. From my experiences bridging design between the military and public policy, I am convinced that Graicer's concepts are not only compatible with, but that they also hold many promises for civilian design. In what follows, I support this claim by making sense of previous civilian design experiences from the perspective of Graicer's degrees of freedom and self-disruption. I first connect degrees of freedom to one of its foundational expressions in ferromagnetism for a deeper understanding. I then demonstrate manifestations of reaching a new degree of freedom from my recent civilian design experiences. I finally address the ethics of creating new degrees of freedom. This provides insight on what these concepts may mean for a design team embedded in government policy development processes.

[2] Ofra Graicer, "Self Disruption - Beyond the Stable State of SOD," *Hybrid Warfare: New Ontologies and Epistemologies in Armed Forces* (Workshop), Canadian Forces College, Toronto, 2016.

Degrees of Freedom in Science and Design

In science, the degrees of freedom are the number of independent ways a dynamical system can move. One of the simplest models of a system with many degrees of freedom is the Ising model.[3] It places a large number of agents on a lattice. Each agent can be in one of only two states at any time, 1 or -1. The state of neighbouring agents influences but does not fully determine the current state of the agent. The Ising model was originally developed as a model of magnets, so each agent is known as a spin. It has since been used to model many other complex systems with interactions between parts organized in a regular configuration.

There are three possible types of interactions between spins: positive (ferromagnet), negative (antiferromagnet), and mixed (spin glass). Consider a simple case of an antiferromagnet arrayed on a triangular lattice. In an antiferromagnet, each spin wants to be aligned in the opposite direction to its neighbours. When all spins are antiparallel, this minimizes the energy for the whole magnet. However, on a triangular lattice, it is impossible to reach the minimum energy state. Consider one triangle on the lattice. Suppose the first spin is positive, then its first neighbour should be negative. However, they both share a third neighbour who cannot be antiparallel to both of them. The technical term for the third spin is 'frustrated'. Frustration is very common in complex systems with multiple interactions between agents. Frustration is itself a source of complexity and uncertainty because it means there is no single optimal or stable configuration for a system. The system exhibits complex dynamics as it creates new frustrations while in the process of eliminating existing ones.

As in magnets, triangles in human relationships create frustration. In any large organization, the subgoals of interdependent agents cannot be mutually accommodated if they are expressed as binary decisions. Autonomous units seeking to maximize their individual performance very quickly create frustration and gridlock, where no unit is able to get what they want, and every step forward by one unit creates additional frustration for other units. In this environment, trust and communication breaks down, units keep their agendas hidden and act unilaterally, and organization alignment and

[3] W. Lenz, "Beiträge zum Verständnis der magnetischen Eigenschaften in festen Körpern," *Physikalische Zeitschrift* 21 (1920): pp. 613–615. For an interpretation of the Ising model as a more general model for complex systems, see Y. Bar-Yam, *Dynamics of Complex Systems* (Boulder: Westview Press, 2003).

organizational learning becomes impossible. A system that becomes gridlocked has tied up all of its degrees of freedom with internal conflict, leaving it paralyzed and unable to act. When we need to resolve challenges that transcend any one organization, the patterns of frustration, gridlock and anti-learning become even more chronic.

In addition to its scientific origins, the concept of degrees of freedom has also been utilized at the intersection between design and complexity theory. Reynolds, Carlson and Doyle developed the concept of design degrees of freedom as a representation of the complexity of a system.[4] They argued that the more intricately designed or highly evolved a complex system is the more tunable parameters are required to specify its structure and behaviour. A corollary to this is that as a system is subject to iterative design, it generates new degrees of freedom and increasing complexity.

As designers, we enter complex, gridlocked situations as gridlocksmiths. Our job is to disentangle the complex relationships between different parts of the organization and its environment, to get the organization unstuck, and to get it moving again in a direction that better matches the unfolding flow of the situation. This cannot happen by a process of continuous improvement. Design is a discontinuity: a point where something genuinely novel emerges that could not be predicted by extrapolating from the past.

In the fall of 2013, farmers in Western Canada harvested a huge crop—almost 40% higher than normal. This was followed by a brutal winter, where temperatures plunged below -30° Celsius. Due to the extreme weather, rail capacity to ship out the crop was almost halved.

By the end of the year, what should have been a hugely profitable year for farmers had turned into a $1.5 billion lost opportunity, as 60 million tonnes of goods sat trapped in bins across the prairies. Farmers, companies, and politicians all started pointing fingers at one another.

In early 2014, the Government of Alberta was unsure how to respond to the situation. Was this a freak occurrence, or were there deeper issues with the rail

[4] D. Reynolds, J. M. Carlson, & J. Doyle, "Design degrees of freedom and mechanisms for complexity," *Physical Review E* 66, 1 (2002).

transportation system? Traditionally, they would have assigned the responsibility to a single ministry—the Ministry of Transportation in this case—and hold them accountable for solving it. Because of the complexity of the issue, the government decided to do something different. They asked Alberta CoLab to lead a cross-ministry response.[5]

To address the issue, we convened 26 leaders from across four ministries to map out the situation and identify the deeper drivers. We designed a process that encouraged participants to acknowledge and engage their disagreements and then develop solutions collaboratively. The group created an innovative structure, a first within the Government of Alberta, to implement the solution. The Rail Transportation Task Team was a time-limited distributed team with representatives from each of the affected ministries. They reported to four Deputy Ministers every week, completing rapid sprints and receiving regular feedback. After six months, the team completed its mission, and the work was transitioned back into the Department of Transportation.

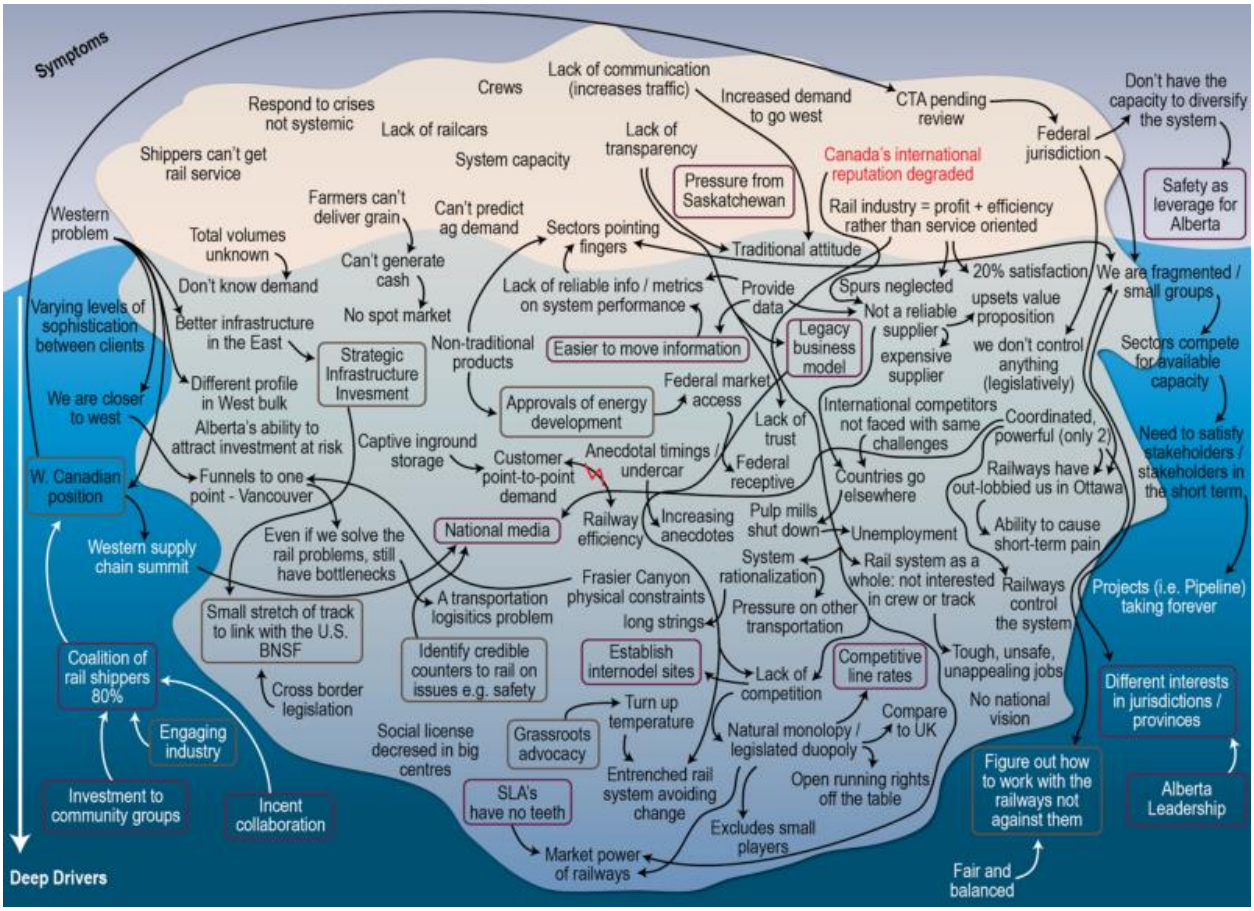
Reaching a new degree of freedom

Framing past experiences using the concept of degrees of freedom allows a new interpretation of the power of design in policy development. In designing the rail transportation team, we experienced a phenomenon that thanks to Graicer we could now call the emergence of a new degree of freedom. While it does not occur in every design project, those times it has occurred are certainly the most memorable projects. In my experiences, I have noticed this phenomenon occurring when things start moving in a different direction with a new velocity. Itis as if a sketch decided to leap off the page and into the third dimension, as in Escher's Reptiles. The new direction is not imposed from the top down, but unlocked from within the group. It is the most exhilarating feeling when a group breaks its own shackles and ventures into uncharted territory. The conversation breaks from the norms of conventional discussion and debate to become speculative and generative. The new way of talking transitions quickly into new ways of acting. Paralysis is broken through collective action on small experiments to explore

[5] https://medium.com/the-overlap/humanitys-hidden-superpower-collaborating-with-uncertainty-6363175e9c90#.qnbukkqqp

the new direction. These probes generate rapid feedback, which enables the group to survey the new territory they have unlocked.

In the Rail Transportation Task Team example, I remember the moment the group transitioned from a sense of helplessness to discovering their own agency. We had filled an entire wall of the CoLab studio with a giant iceberg diagram of all of the issues and drivers (see figure below). The tone of the conversation had been rather fatalist, because rail is almost entirely under federal jurisdiction, and rail transportation is provided through a legislated duopoly. There was almost nothing we could control about the currently unfavourable situation. Instead of lamenting their lack of control, I asked the group to circle everything they could influence. They realized there were over 20 leverage points where the Government of Alberta could exert some influence. Suddenly, there was no shortage of ideas for collective action. The challenge became how to organize and prioritize these areas for action.



It seems unlikely that unlocking new degrees of freedom can be planned in advance. In my experience, it has never happened in the same way twice because it is so dependent on the interaction between individual cognition and group dynamics. In a design workshop for the new tourism strategy, a phenomenon akin to unlocking a new degree of freedom happened when an unspoken rift between two organizations was surfaced and engaged as part of the group's reflective practice. Engaging the conflict created a large amount of tension, which was eventually broken when one participant crossed the floor to hug a participant from the rival organization. This led to spontaneous hugging by all participants across the organizational divide. From that moment on, the group dynamic was completely changed: creative, open, and generative. In a three day workshop on international engagement, it was not until the final session that the group unlocked a new degree of freedom in retrospect. Yet, that one hour was so powerful that the group decided to schedule open design sessions for half a day every two months to explore all of the implications that arose in that final hour. Through these design sessions, the group created a new information management system, a new client relationship management system, and a One Government narrative for international engagement.

As these examples demonstrate, the easiest way to know that a new degree of freedom has been reached is to pay attention to the mood of the group. Much of design is a frustrating slog through confusion and complexity. When the group breaks through into a new space of possibility, the collective mood is at an apogee.

Comparing New Degrees of Freedom between Military and Civilian Contexts

At the level of theory, my intuition is that degrees of freedom applies equally to military and civilian design. In both domains, individual, team, and organizational legacies are inhibiting (and enabling) the group from reaching its potential. Design is a process of surfacing and problematizing these legacies in the light of a changing reality, so that as a group we can reframe our collective understanding and exploit emerging potential. It is the act of reframing that allows both military and civilian designers to unlock new degrees of freedom and uncover new potential.

The design work I have done in both military and civilian settings typically takes place in situations that are highly polarized and conflictual, whether that is the war on terror or oil sands development. One difference is that in the military context, the enemy is currently considered irreconcilable and cannot be included in design dialogue. In contrast, with civilian issues, it is usually possible to bring all parties together, even though they are rarely keen to participate in open dialogue and co-design with their opponents.

The only documented military example I know of convening a whole system team to jointly design a common future was led by Adam Kahane, when both the FARC (Revolutionary Armed Forces of Colombia) and the ELN (National Liberation Army) participated together in a futures scenario workshop in 1996 called Destino Colombia.[6] Due to security concerns, the FARC participated by telephone from prison and in exile. The current president of Colombia, Juan Manuel Santos, who organized the Destino Colombia workshop, said in 2012, "It is good to know that the best scenario that we imagined 16 years ago is now beginning to be realized."[7]

Besides this anomaly, military design is typically one-sided. This limits the potential degrees of freedom that can be achieved during a design challenge. We can see this if we turn briefly to game theory. Gridlock is often so persistent and stable in complex systems because it creates a Nash equilibrium. At a Nash equilibrium, no player can gain by a unilateral change in strategy as long as the other players' strategies remain unchanged. It is only through simultaneous and cooperative shifts of multiple players that the payoffs for individual players and the whole system can be improved. By convening a whole system team, the designer creates at least the possibility of simultaneous and cooperative shifts in strategy.

This happened in Alberta to create the new Climate Leadership Plan. The process began by bringing together major oil sands producers and environmental non-governmental organizations in a mediation process that created shared language and shared understanding. This enabled both parties to participate and contribute to the panel led by Andrew Leech, which integrated Technical, Aboriginal and Public

[6] A. Kahane, *Transformative Scenario Planning: Working together to Change the Future* (San Francisco: Berrett-Koehler Publishers, 2012).
[7] Ibid.

engagement streams. When the final plan was announced by Premier Notley and Minister Phillips, they were joined on stage by 20 key stakeholders, including business interests (Canada Natural Resources Limited, Suncor, Shell Canada, Pembina, and Cenovus), non-governmental organizations (Environmental Defense Canada, Forest Ethics Canada, Clean Energy Canada, and Equiterre), and regulators (First Nations representatives as well as government leaders) who all endorsed the plan.[8]

Announcement of the Climate Leadership Team by the whole systems team.

Forming a whole systems team is not the only way to create new degrees of freedom. Another way to unlock gridlock is to disrupt the current system. The dynamics of disruptive innovation by design are essentially the same across military and civilian domains. The source of disruption can come from inside or outside as Graicer also exposed in her article. There are compelling arguments originating in both cybernetics[9] and disruptive innovation[10] that self-disruption is much more difficult due to psychological, cultural and language barriers.

[8] http://kleinmanenergy.upenn.edu/policy-digests/lessons-alberta-how-implement-carbon-tax

[9] H. Dubberly, P. Esmonde, M. Geoghegan, & P. Pangaro, *Notes on the Role of Leadership and Language in Regenerating Organizations* (Sun Microsystems. San Francisco: Dubberly Design Office, 2002).

Napster and Uber are examples of disruptions from outside the system that created an irreversible change to the stable status quo of the music and taxi industries. Netflix disrupted its own mail-in DVD business with online streaming, which initially caused its stock price to plummet by 76%, but ultimately led to a 150% increase in stock price compared with its previous peak.[11] Insurgencies are the military example of external disruption to an incumbent military and/or political power. Ofra Graicer and Shimon Naveh's approach to design education for Israeli Generals is the best example of self-disruption in the military domain.[12] They educate generals to view their organization from an exterior perspective, in order to disrupt their own patterns of thinking, organizing and acting before their adversary does.

Degrees of Freedom, Degrees of Ethics

While for Graicer, creating new degrees of freedom is a sign of design efficacy, I would add that it is also a sign of ethical practice. (Self)-disruption, also a manifestation of efficacy for Graicer, is less clearly ethical.

It is almost always ethical to create degrees of freedom by expanding towards a whole system design team. Because this approach is non-coercive and welcomes perspectives that have been previously marginalized, the new pathways it opens up accommodate the diverse interests of the affected parties. To be ethical, the process should be designed to approach what Habermas calls an ideal speech situation:

1. Every subject with the competence to speak and act is allowed to take part in a discourse.

2a. Everyone is allowed to question any assertion whatever.

2b. Everyone is allowed to introduce any assertion whatever into the discourse.

2c. Everyone is allowed to express their attitudes, desires and needs without any hesitation.

[10] C. M. Christensen, *The Innovator's Dilemma: When New Technologies cause great Firms to Fail* (Boston, Mass.: Harvard Business School Press, 1997).
[11] http://fortune.com/2016/07/19/business-leaders-disrupt/
[12] https://www.youtube.com/watch?v=6pfZM9uSlmg

3. No speaker may be prevented, by internal or external coercion, from exercising his rights as laid down in (1) and (2).[13]

No design session for an issue of significance can ever realize this ideal, because the number of participants and the time required are prohibitive. However, the ideal speech situation provides a simple rubric to assess when the conditions for free and open discourse are being violated. This allows a design team operating under real world constraints to be aware of and mitigate violations of ideal speech.

The ethics of disruptive innovation are more complicated. When you disrupt a system, you are not being inclusive. If successful, you will create winners and losers. The losers are not consulted in the creation of the disruption. In fact, a disruptive design is actively hidden from the losers to delay opposition until the disruption has already happened and the genie cannot be put back in the bottle.

The effects of disruption are fundamentally uncertain and unknowable in advance. This is true of all intervention, but it is particularly relevant to actions that are intentionally destabilizing. From a consequentialist perspective, this creates concerns about the ethics of disruptive design if we cannot know what unintended consequences will arise from our actions.

Disruption can be justified when the status quo is the clear cause of harm and suffering, and reform from within the system is infeasible because the existing power structure is a source of oppression. Even though the effects of disruption are uncertain, the continuing harm of maintaining the status quo is easier to determine. This is especially true when the status quo violates human rights and liberties. A civilian example is the need to disrupt our currently destructive economic patterns that are causing human-induced climate change and accelerating the loss of biodiversity. A military example is the responsibility to protect against genocide.

The degrees of freedom we should not use are those that create more harm and suffering than they alleviate. The calculus for this is far from trivial. It is an ongoing process of critical reasoning and reflection on action. There are ways of acting that are

[13] J. Habermas, "Discourse Ethics: Notes on a Program of Philosophical Justification," in *Moral Consciousness and Communicative Action,* trans. Christian Lenhart and Shierry Weber Nicholson (Cambridge: MIT Press, 1990).

more sensitive to unintended consequences that should become routine. In our own design practice, prototyping in context enables safe-to-fail experimentation, while developmental evaluation informs strategic learning and identifies side-effects of design action. They do not guarantee right action, but they can limit the risk of harm and maximize the rate of learning in fundamentally dangerous and uncertain situations.

Summary and Conclusion

Continuous improvement gives you more of what you already have. When a change in quality rather than quantity is needed, design provides a discipline for revealing and capitalizing on a new degree of freedom. Once new dimensions for collective action are visible, truly innovative approaches to improving a problematic situation can be devised and tested.

There is no way to guarantee that a given group will achieve a breakthrough that creates new degrees of freedom, but when they do, it is easiest to notice by the change in the collective mood of the group. The mood becomes buoyant and energized as the conversation becomes truly generative.

Both military and civilian design can be measured by the degrees of freedom it unlocks. The main difference is that it is much more difficult and much less common to create a whole systems team in the military context due to the extreme polarization caused by war. Degrees of freedom can also be created by disrupting the existing system from within or from outside. Disruptive design is ethical only when it alleviates more harm and suffering than it creates.

Design is dangerous because it opens up all of our existing structures, institutions and routines to the possibility of redesign. This creates great potential for improvement but also for harm. A responsible designer approaches complex problematic situations with a mixture of courage and humility. They have the courage to act to learn about and to transform undesirable situations, while remaining open to the possibility that their interventions are making things worse. A responsible designer is both an explorer of new territory and a steward of the future.