Improving Management by Design: Novel Tools for Expanding and Deepening the Business Model Design Space

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The map is not the territory.

Abstract

In this text I propose to strengthen the cognitive processes involved in design thinking, especially for cross-functional teams, both through artificial intelligence techniques and focused cognitive coaching. I take as an example of design thinking the canvas metaphor used by Osterwalder and Pigneur (2014, 2010), selecting its CS (customer segment) component for further scrutiny. Specifically, I introduce an amplified form of design thinking called "transformational" thinking that is grounded in research in adult cognitive development over the lifespan (Laske 2008 [2017b/c]). My approach is rooted in DTF, the Dialectical Thought Form Framework developed at the Interdevelopmental Institute (IDM) in the year 2000.

In focus in the text is the notion of "hidden dimensions" of the canvas that iterative cognitive sprints of a cross-functional team reveal. I see such sprints as based on a combination of "breadth-first" and "depth-first" search, where the former is focused on creating the biggest possible picture, while the second deepens and refines the picture in its details, both in terms of thinking and resulting outcome. I show that the two kinds of searches are mutually reinforcing and that purely logical thinking (and thus algorithmic thinking also) fail in depth-first search,

At the end of the text, I demonstrate by example how cognitively high-performing teams engage in innovative thinking supported by DTF thought forms and their base concepts. I suggest how transformational thinking can be effectively supported by cognitive coaching as well as artificial intelligence techniques.

From my consulting and teaching experience with DTF I draw two conclusions regarding innovative approaches to canvas design:

1. agile coaching could become more effective if it included the practice of breadth- and depth-first search here outlined;

2. artificial intelligence techniques could be used to implement in canvas design cognitive templates that visually provoke team members to engage in transformational thinking.

Introduction

Osterwalder and Pigeur's *business model canvas* (2010) is simultaneously a conceptual and a visual tool for innovative thinking. The canvas, composed of nine components hypothesizing

how a business functions, creates a design space -- thus a mental space. It also provides a shared language in which to think about innovating a business.

In the canvas language one can create collaborative intelligence, even self-reflection. The canvas is also a grammar of sorts that helps people understand a topic as well as each other better; it helps clarify the semantics interlocutors adopt.

Design thinking, long absent from business schools (Glen, R. et al, 2014), makes possible a focused dialog about any and every aspect of a business from a bird's eye view. One condition of using it is the willingness to take a critical view at the status quo of one's business, thereby transcending the business-as-usual focus on operational issues. Of great help in this switch is sampling and scrutinizing team dialog raw, with refined listening capabilities schooled in transformational thinking detailed in this blog.

Often, team listening is overwhelmed by placing colored "stickies" on walls (rather than building visual networks as, e.g., in Stella Architect). While the cherished sticky tool is helpful, it tends to sideline deep listening (if not deep thinking also), and is probably more helpful to cognitively less than more developed teams. This also because stickies (in my experience) tend to be tied to purely logical thinking and thus don't sufficiently challenge team members to be aware of, and observe, their own thinking which is required for doing depth-first search as detailed further below.

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While most organizations still struggle with adopting "management by design", there is already a sizable number of organizations and institutions, and not only start-ups, that have learned that ideation, prototyping, storytelling, use of scenarios etc., are mighty tools for managing from the future.

It is pervasively purely logical thinking that is used when building a canvas. This has considerable drawbacks since formal logical thinking is based on the identity clause A=A (excluded middle), and thus does not excel in understanding real-world transformations. Rather. it reduces transformations to linear and causal change which is a superficial way of viewing the real world and is prone to thought fallacies.

For all of these reasons, it is desirable to consider possible extensions to formal logical thinking that move canvas design closer to how the real world works. How the real world works has very little to do with how humans conventionally think. In order to close, or at least narrow, the gap between the two would seem to be highly desirable.

Below, I outline some new resources for canvas design and design thinking generally. A selected bibliography shows where these resources can be obtained. Examples of their use are further detailed at http://www.interdevelopmentals.org/?page_id=4321.

Hidden Design Spaces

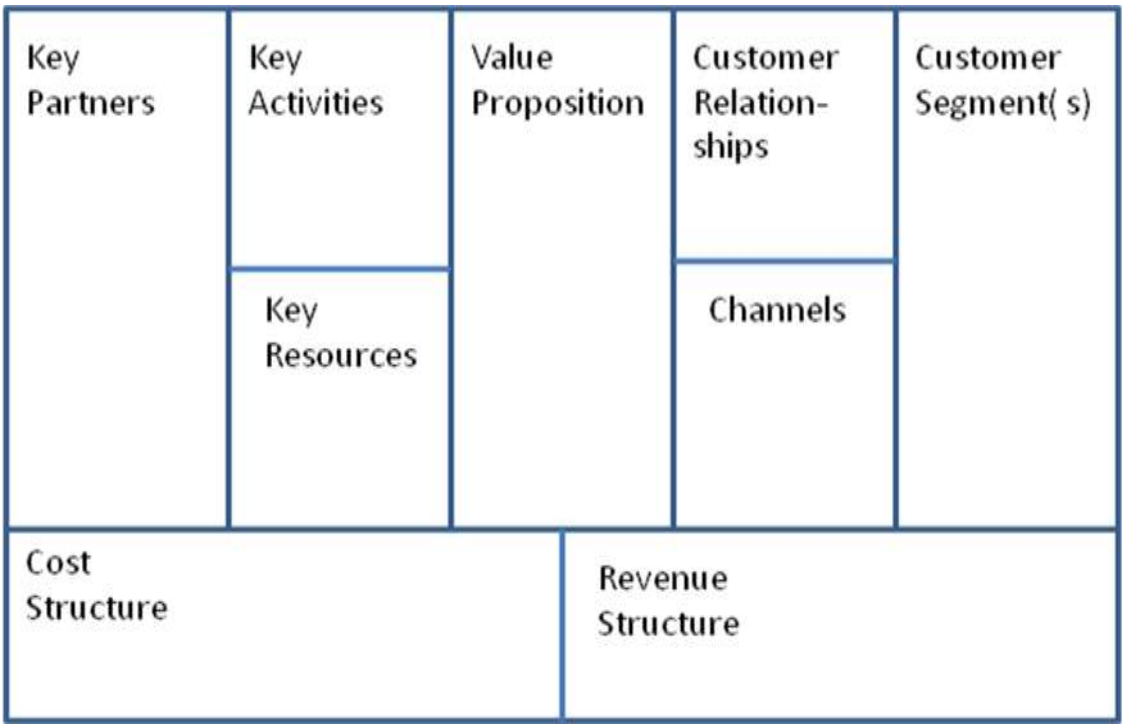

Fig. 1 Business Model Canvas (after Osterwalder & Pigneur)

Fig. 1, above, shows a business canvas. It's important to view the figure not only in terms of what it shows but also what is absent in and from it, the empty spaces between its components. Actually, it is what is absent that creates the design space – mental space – to be filled, whether by an individual or team.

Obviously, a strong advantage of the canvas is that its components together form a whole that is more than its parts. This whole amounts to an hypothesis as to what those responsible for a business need to pay attention to, even regularly put in doubt. It has little to do with the real world, but primarily with how people think about it or parts of it. I will show below that thinking about components of a business in purely logical terms is a good start but only if we insist, at our peril, that the canvas is a closed system.

Whether the way they think about the canvas meets requirements of critical realism wholly depends on the structure of the thinking that is used to design and refine it. This structure is not immutable, nor is it necessarily restricted to working with closed systems. This blog sheds light on alternative structures of thinking.

The major question an empty canvas poses is: "is this a closed or open system?" In both cases the further question of what is absent from the canvas is central, but has a different meaning for a closed compared to an open system.

To answer the question for a closed system is relatively easy since it requires only filling in obviously missing context and perhaps some external relationships. This is different when directing the question to an open system where the question “what is missing or hidden here?” requires breadth- as well as depth-first search that also brings in questions of process and intrinsic (rather than external) relationships which together explain transformation.

Even if each part of the canvas shown would be filled, in the perspective on it as an open system more would remain hidden than is apparent simply because the filled-out canvas is seen as embedded in a real world in unceasing transformation, something that logical thinking is woefully inapt to understand.

The DTF framework initially provokes the following questions regarding canvas components that point to its *hidden dimensions* (what is presently unknown). The questions guide two kind of searches (explained below), a breadth-first and a depth-first search.

1. What are the layers of each component? (“Our VP is …). [I will henceforth refer to this as CONTEXT, which most closely equates to logical thinking].
2. What are the relationships between each two and all other components? [RELATIONSHIP]
3. Are these relationships merely external, or are they intrinsic in the sense that one component can’t even be defined without another (or even all others, as in an open system)?
4. What are the *real-world processes* that enter into each of the components? [PROCESS].
5. What is missing from *our mental processes* (interpretations, hypotheses, available data …) by which we address these real-world processes?
6. What is the combined effect of both PROCESS and RELATIONSHIP elements upon our canvas design? This amounts to the question of " what developments can we expect will unfold that are dictated by the real-world processes and relationships involved in the canvas?).
7. What is required of us to understand the canvas (or a canvas component) in depth, enough to be able to explicate the processes and relationships it embodies, so as to master the transformations of the canvas when embedded in the real world?

For achieving critical realism in design, the last question is fundamental since the canvas is not simply a mental construct. Rather, it claims to be in a more or less truthful and effective relationship with *how the real world works*, rather than being a mere expression of how humans think.

The Hidden Dimensions of the Canvas

The hidden dimensions of a canvas are not mysterious. They are "hidden" only for human thinking, especially logical thinking that can't capture transformations. We therefore needs a many-pronged tool to address these dimensions. The best way to view the hidden complexity of a canvas is to begin viewing it in terms of four *metaphors* taken from observing nature (Laske 2016): (1) tree stump, (2) wave, (3) vineyard, and (4) rainstorm, as shown below.

Except for the first one (which is made up of layers), the metaphors point to the dynamics of the canvas. I will refer to the four *perspectives* on the canvas these metaphors open up as CPRT (context, process, relationship, and transformation). In addition, I will calibrate hidden dimensions by attaching to them three *depth indicators* called p➔e➔l (pointing, elaborating, linking). This will help us pose the question: "how deep (not only broad) is our canvas?" In other words: how close is it to the real world?

Let's first review the metaphors one by one, keeping in mind that the four hidden dimensions of the canvas are not obvious. The reason for this is that hidden dimensions transcend purely logical thinking; they thus require an extra effort to deal with them. It is this extra effort that I am referring to as *transformational thinking*.

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I start with the hidden dimension above referred to as "C" (context), followed by the other three (P, R, T). The metaphors show us how these four dimensions differ among themselves, and what when linked together they can achieve.

- Context (C; “tree stump”): we can analyze static scenarios (closed systems) to the finest detail but may not understand how they form a whole, or how their parts are configured as layers of varying stability; in open systems, contexts play only a subordinate role:

- Process (P; “wave”): we may see patterns of interaction but constantly risk arresting essential motion by way of logical categorization; or we may not understand how one process (if we can capture it realistically) is embedded in another (which could be its opposite), especially in open systems:

- Relationship (R; “vineyard”): we may discern external relationships but are likely to miss intrinsic co-defining relationships which make each component what it is and make all components together form a holon; in open systems, intrinsic relationships create external ones as mere symptoms:

- Transformation (T; “rainstorm”): taking multiple perspectives, we may be able to anticipate outcomes of a process but may misjudge (a) the limits of stability of the storm system the canvas represents; (b) the function of conflict in stabilizing it; (c) an open system's potential for re-emergence through breakdown; (d) the logic of coordination of its components and their subsystems:

Fig. 2 The four hidden canvas (and environment) dimensions, CPRT

Clearly, many of these misses or near-misses in logical thinking transcend even the greatest wisdom of a team. They are more effectively dealt with by team members who know and master *transformational thinking* (whether they use stickies or not).

What is transformational thinking?

Transformational thinking is a *discovery procedure* for finding temporary footholds in a world in constant transformation and integrate such footholds into real-world movements. It is a kind of thinking made for dealing with open, in contrast to closed, systems. On account of its ability to take on transformation, not just change, this kind of thinking can be said to exemplify the kind of critical realism that is needed in dealing with real-world issues. This thinking may be called "innovative" since it relinquishes the logical identity clause, A=A, and presupposes that "A is always non-A, or other than itself".

If you include non-A in A (say, a canvas component), what you are saying is "we need to know all that is not A to fully understand A".

Thanks to Bhaskar's work (Laske 2016), we can define this kind of thinking based on four hidden dimensions, outlined above by metaphors (CPRT), which he called *moments of dialectic (*Bhaskar 1993*)*. Let's continue to call them hidden dimensions.

When we go beyond viewing a canvas as a mere context (C) by seeing it as a wave (P), vineyard (R) or rainstorm (T), we are "going into breadth" (or do breadth-first search) in the sense that we trying to arrive at the largest possible picture of the canvas in motion, including in the canvas a) a set of processes (P), b) a set of relationships (R), and c), and arriving at it as an open, transformational system.

However, to get even deeper into a canvas, we need to go even further, and unfold each these four hidden dimensions in terms of what I call "thought forms" (TF), using a specific number of them for each hidden dimensions, as I do below.

Procedurally, what we gain by using thought forms is that we can generate an expanded set of questions not restricted to the canvas as a context (C), but can also address the canvas as a set of processes and network of relationships. And this will, in time, prepare us for being able to address the canvas as an open or transformational system.

This opens up two questions: (1) What are thought forms? (2) How can we learn them? I deal with the first question here, and with the second one further below.

Thought forms are templates for complexity thinking. They are forms of thought that explicate, for instance, the canvas as a tree stump, a wave, a vineyard, and a rain storm, respectively, helping us do depth-first search into the hidden details of a canvas. Each thought form (TF) is a template that gives rise to an unlimited number of questions triggered by thinking about the canvas with regard to its CPRT dimensions (context, process, relationship, and transformation).

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Let me review the two movements-in-thought I have made:

1. I introduced four hidden canvas dimensions referred to as C (tree stump), P (wave), R (vineyard), and T (rainstorm). I referred to moving from one of these dimensions to another as "breadth-first search".

2. I associated with each of these dimensions a set of thought forms (TFs) that refine and detail the hidden dimensions further. Using TFs enables us to do "depth-first search".

This is summarized by the diagram below:

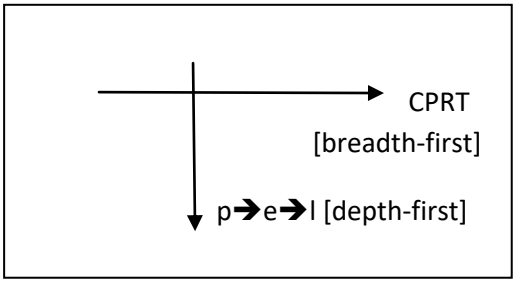

Fig. 3 Combining breadth-first and depth-first search
in the canvas and its environment

The relationship between the CPRT dimensions and TFs that unfold them in DTF is simple: each dimension is associated with a certain number of TFs. such as 3 (4x3=12) or 7 (7x4=28). In this short introduction to complexity thinking in the canvas I use 12 TFs, as shown farther below.

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One major advantage of using TFs to amplify systems thinking is that one begins to make a distinction between "how reality works" and "how humans think". Another way of stating this is to say that TFs make us aware that we are actually "thinking", and that we could also, and probably should, be thinking differently than we presently do.

When used in a team, TFs not only strengthen dialog but also self-reflection. They help make discoveries. Whether used on top of existing stickies or in order to arrive at innovative content is immaterial. In both cases, fluidity of thinking is increased.

In the design community, the advantage of using TFs has not yet been understood. Therefore, the *iteration sprints* now emphasized remain caught up in purely logical thinking that barely even reaches what we have called breadth-first search. Such sprints presently exclude depth-first search entirely.

This is an important omission since the world a team returns to in a second sprint is not the same world it faced initially. Only if it were the same world could we speak of "improving" team work. But the world corresponding to the second spring has moved on, having been in unceasing transformation anyway. It is a constantly moving target. Improving it will not help; only realizing that it is a different, changed world, and understanding what might have changed it, will. And that different, changed world is exactly what TFs alert us to.

Facilitation based on transformational thinking

I have suggested that we can reduce, or at least minimize, the gap between an abstraction like "canvas" and the real world by transformational thinking, an extension of systems thinking, and that transformational thinking comprises two kinds of search:

1. a breadth-first search to broaden the canvas context dimensions (C) into hidden dimensions P, R, and T

2. a depth-first search using TFs by which to go into depth about each of the hidden dimensions opened up by breadth-first search.

On account of my research in transformational thinking, I find it highly questionable that a combination of insights, often referred to as "wisdom of the team", will go beyond amassing pertinent contexts (tree stumps; C) using some breadth-first search, and that it will ever reach the point of depth-first search, except if present in a cognitively highly mature team.

As a result, the *wave (P), vineyard (R), and rainstorm* (T) dimensions of the canvas will continue to elude even the most competent cross-functional team.

Here is why:

1. Most team members are not schooled, or have not learned, to transcend purely logical thinking; they are thus not competent to think in terms of the three hidden canvas dimensions that transcend context, - namely, process, relationship, and transformation (PRT).

2. Most team members are not schooled in listening to the thought forms used by their interlocutors (team members or other), and thus cannot act as teachers or coaches of transformational thinking.

3. Being habituated to "stickies", most team members are unaware that they are primarily focused on logical contexts, and thus need cognitive coaching to reach higher-level breadth-first search as a precondition of depth-first search.

4. To begin with, present-day canvas design thinking does not capture processes and captures relationships only when they are external to what they related. Intrinsic or co-defining relationships (in terms of which A cannot be defined without its non-A), is not in focus for such thinking.

What is to be done?

Learning TFs that address hidden dimensions pointing to canvas dynamics (PRT) requires a mix of learning and cognitive development. Since the latter determines the limits of the former, learning TFs without intense schooling has decisive practical limits (Laske 2017a).

For these reasons, cognitive coaching for the purpose of instilling the capacity of discerning, reflecting on, and using TFs is a necessary addition to agile coaching, both of individuals and teams.

The Business Model Environment

Since every canvas is embedded in a fast-changing real-world environment, the need for complexity thinking based on TFs that reveal the canvas' hidden

dimensions doesn't end with designing the canvas itself.

In fact, dealing with the canvas is simple compared to the complexity of the real-world environment to which it refers and in which it is embedded. Therefore, the need for transformational thinking increases when turning to the environment in which a canvas is embedded. It is here, that a team's thinking meets the real world head-on.

Configuring a business model's external environment as an additional, enlarged "design space" (Osterwalder 2010) is certainly provocative. It is also simplistic, especially when that environment is reduced to four components (industry forces, macro-economic forces, market forces, and key trends). These components primarily render ways of thinking, not the structure of the generating mechanisms that determine real-world events.

Simplifying the real world environment is, of course, necessary, but it can only be a first step in an arduous thought journey in which the four environmental components selected will increasingly show themselves as being thoroughly intertwined and undergoing constant transformation in and between themselves.

Like the canvas, its environment equally comprises the four hidden dimensions I outlined above using the *tree stump-wave-vineyard-rainstorm* metaphors. The logical tree Osterwalder suggests is therefore a far cry from what the real world looks like.

In a situation of having to simplify and being, at the same time, at risk for oversimplifying, transformational thinking based on TFs is of major benefit. This is so because a schooled TF user has an awareness of many more choices of asking questions about the canvas than logical thinking provides, whether s(he) uses breadth-first (CPRT) and/or depth-first search (p➔e➔l).

How thought forms (TFs) work

TFs (thought forms) are learnable high-level abstractions that function as *mind openers.* An example would be "inclusion of opposites" (TF4). Their function is to make a thinker (team member) formulate innovative questions in his/her mind that without them would be hard to invent. Once learned (or shown through pop-ups), TFs also help team members analyze their colleagues' thinking and correct or improve it. Therefore, one can best think of them as templates that generate innovative movements-in-thought.

TFs do not apply in a vacuum, of course. They are always bound to one of the hidden dimensions referred to as CPRT and are needed at a point where following C, P, R, or T has led to the need for additional detail and scrutiny. They thus turn up just in time to introduce an innovative thought.

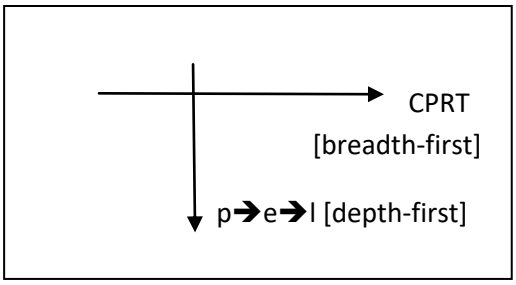

Fig. 3a Extending breadth-first (CPRT)
through TFs for depth-first search

Having given some examples for using C, P, R, or T as a search light in breadth-first search, we now want to take an additional step and extend our search into the depth. We can do so in three successive ways symbolized by the "p➔e➔l sequence":

- pointing to (mentioning) a hidden dimension (p), whether C, P, R, or T, by using TFs Cp, Pp, Rp, Tp
- elaborating a hidden dimension further (e), by using TFs Ce, Pe, Re, Te
- linking hidden dimensions for one and the same issue under discussion (l), by using Cl, Pl, Rl, Tl

The deepening I speak of here is nothing mysterious but intrinsic to the functioning of the mind. It happens naturally when a person follows the logic of his/her untrammeled thought -- thought freed from the identity clause that excludes Non-A from A.

Typically in thinking, we begin by pointing to something using a specific concept; we elaborate the concept chosen, for ourselves as much as for others; and finally link the concept we started out with other concepts that have emerged for us in the meantime.

In the table below, this dynamic of thought is shown abstractly, by listing individual TFs. I present 12 TFs, three each for each of C, P, R, and T, in the sequence shown. I do so to create a reference by which the reader can follow how further below I go into depth about CS (customer segment).

Context	**Process**	**Relationship**	**Transformation**
Cp [TF1] Relationship between part(s) and a whole	Pp [TF4] Emergence and inclusion of opposites	Rp [TF7] Bringing elements into relationship	Tp [TF10] Limits of system stability
Ce [TF2]	Pe [TF5]	Re [TF8]	Te [TF11]

Structure and stability of a system	Patterns of interaction	Structure of relationship	Developmental movement of systems
Cl [TF3] Multiple contexts and frames of reference	Pl [TF6] Embedding in process	Rl [TF9] Patterns of interaction and influence	Tl [TF12] Comparison and coordination of systems; emergence of new entities

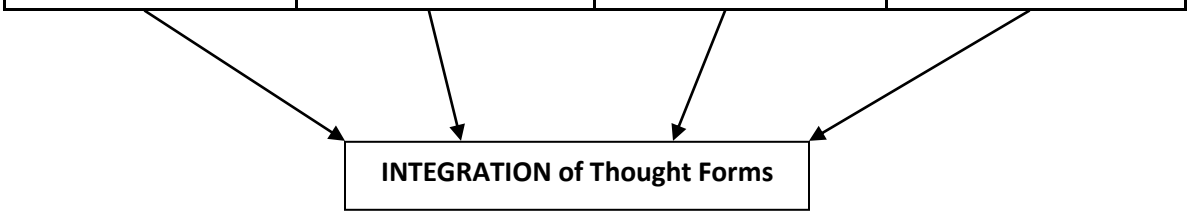

Table 1. The DTF approach to canvas complexity
in terms of TFs (thought forms)
(p=pointing, e=elaborating, l=linking)

The table enables team members to follow a different *cognitive tactics* compared to what they may be used to. The tactics is one of depth-first search (for answers to questions). It helps switching from mere breadth-first search guided by CPRT to a refined, depth-first, search. Each of the three TFs attached to C, P, R, and T advance us from "pointing" to "elaborating" to "linking" within the same dimension or between different dimensions, in the way indicated below:

- Cp, Ce, Cl ➔ depth-first search for Context (static configurations; closed systems)
- Pp, Pe, Pl ➔ depth-first search for Process (configurations undergoing change)
- Rp, Re, Rl ➔ depth-first search for Relationship (configurations that are networks of relationships)
- Tp, Te, Tl ➔ depth-first search for Transformation (configurations that mold P, R, and T together into the complexity of an open system).

When we do depth-first search along these lines, we achieve several things at once:

1. We are taking progressive steps in thinking about canvas, canvas components or canvas environment, leading from mere mention (pointing) to elaborating and finally to linking multiple perspectives on them
2. we are augmenting the grammar of the business canvas and the structure of its environment by a *thought grammar* comprising three levels: p, e, and l.

As a result, when thinking 'p' (just mentioning something), we are challenged to go further and think 'e' (elaborate what we mentioned), or even 'l' (that is, see what we elaborated from other perspectives (C), embedded in something other or opposite, (P), standing in interaction with what was elaborated (R), or giving rise to an entirely new element (T):

Cl [TF3]	Pl [TF6]	Rl [TF9]	Tl [TF12]
Multiple contexts and frames of reference	Embedding in process	Patterns of interaction and influence	Comparison and coordination of systems; emergence of new entities

In sum, we are aware of alternatives in thinking and therefore able to be truly agile.

The example below shows how this works when we want to pin down exactly which customer segment we want to offer a value proposition to.

Using transformational thinking to differentiate customer segment (CS)

For the sake of demonstration, let's choose a single canvas component, customer segment (CS). and demonstrate the impact of using each of 3x4=12 TFs attached to C, P, R, and T shown in Table 1 above. (We could be working with more than 12 TFs but this selection will suffice for our purpose).

To determine the focus of the dialog, let's detail CS (customer segment) for the sake of *management consulting*, rather than coaching or a different key activity.

When doing depth-first search in the p➔e➔l sequence, there is actually no need for us to be bound by the rule of first pointing to (p), then elaborating (e), and then linking (l) to something, as in logical thinking. Often, thinking is innovative because it makes jumps. Merely mentioning (naming) something is just what comes easiest to logical thinking which is why I put context (C) first in the hidden- dimension sequence. A mind uncensored by logic might naturally jump to elaborating or even linking without initially pointing to something (a move-in-thought that an expert in transformational thinking can *hear* happening by schooled listening).

For simplicity sake and pedagogy, though, let's here follow the linear route, also because in sticking to the sequence p➔e➔l we begin to see that this progression is one of *increasing complexity of thinking*: p>e>l, where '>' stands for "presupposes or implies".

As a DTF-schooled person, we can therefore prompt a team member whom we heard to be using thought form Cp (TF 1) to advance to Ce (TF 2) and Cl (TF 3), or even to jump to Pe (TF 5), simply by prompting him/her to reflect on what s(he) just said.

It is important to understand that each of the 12 TFs, from Cp (TF1) to Tl (TF12), resides on a meta-level, in the sense that it can give rise to many different ways of thinking about, e.g., customer segment. **That's because each of these TFs is a flexible question generator, thus a mind opener, assisting our intuition about a subject matter (concept, event, situation, absence, etc.).**

At our most agile, we would expand the canvas design space by using both breadth-first and depth-first search. Both are performed by innovative questions. Breadth-first search is performed by questions regarding the four hidden dimensions of CS (C, P, R, T), while depth-first search is performed by the individual TFs associated with each of these dimensions.

Below, to outline DTF cognitive tactics more specifically, I list several of the questions a particular TF (question generator) gives rise to, referring to Table 1, above.

- Cp (part-whole; TF 1): what might set our CS (customer segment) apart from other, similar CS; what might be the parts of CS we are focusing on; do these parts have layers we need to observe; or do they overlap; how does the total CS influence (underpin) each part?

- Pp (emergence/inclusion of opposites; TF 4): what internal motion in CS are we arresting when categorizing it as we do; what in the part(s) we are focusing on might we be overlooking; are there parts we are disregarding but should be including; are there emergent parts not fully visible; to what extent are parts different from or antithetical to each other; and are there segments to which to consult is desirable and feasible but not viable or not feasible given our key resources?

- Rp (bringing into relationship; TF 7): what is shared (common ground) among the parts of CS we want to consult to; how substantial or fuzzy are the lines of separation between them; and what is the value of bringing parts of CS that appear as different into relationship with each other?

- Tp (limits of system stability; TF 10): how stable are the parts we distinguish within our CS, either conceptually [in terms of our definition of them] or in terms of real-world trends; and are some these parts competing with each other, or developing closer to each other over time that would upset our categorization?

What have we achieved so far?

Fundamentally, by *pointing to* each of the four hidden dimensions of CS individually, we have established that customer segments are complex, and that we need to look at them in more than one way to get a good sense of what we are dealing with even before doing depth-first search.

By giving each hidden dimension of CS a name -- C, P, R, T -- we have bestowed on CS a multiple identity (breaking away from A=A), and thus have made a first step into complex design. In addition, we have transcended descriptions that see CS as a static (unchanging) configuration or closed system, thereby avoiding a logical thinking fallacy.

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Let's proceed to CS elaboration. In terms of the 'p➔e➔l sequence, we can speak of a pointing, elaboration, and linking phase of depth-first search. Moving from p➔e, we come upon the following questions grouped under specific TFs:

- Ce (structure and stability of system; TF 2): what is the fine-grain structure of the chosen CS; are there further important distinctions we need to make that call for different VPs (value propositions); are all of these segments equally stable, or are some of them shifting from one state to another; what function would consulting to each of these segments have in the entirety of our consulting services; what mind sets are we encountering when dealing with the CS chosen (empathy map)?

- Pe (pattern of interaction; TF 5): in what way do customer sub-segments interact or even interpenetrate; is there a shifting pattern to this interaction or interpenetration that we can describe; would consulting to one of the segments be seen by customers as deviating from our brand and thus be without credit; is there a favored interaction in terms of customer relationships that should inform our work with all of these segments?

- Re (structure of relationship; TF 8): how, precisely, are the customer sub-segments related to, or overlapping with, each other, say in terms of intellectual frame of reference, ideology, or tradition that will determine different needs for consulting services to satisfy; are we at risk of seeing the sub-segments as too similar, thus missing important aspects of uniqueness in each or some in terms of their value system (reductionism)?

- Te (developmental movement of system; TF 11): what is the developmental potential of each customer sub-segment from a consulting perspective; how to make an evaluative comparison between sub-segments (in terms of cost or revenue) focused on what unique benefits we can deliver to them; what trends are these sub-segments presently subject to; are those sub-segments presently in an unsettled state worth paying special attention to that hinders us from making a cogent value proposition?

It will be evident that what occurs in the *elaboration phase* of canvas creation with DTF is a deepening of thought. This deepening of thought is predicated first of all on the realization "I am actually thinking, and could be thinking otherwise" which does away with the extrovert form of business as usual.

On scrutinizing the questions I have derived from TFs 5, 8, and 11, above, we can see that innovative thinking is highly *conceptual*. For instance, being innovative about TF 11 (Te; developmental movement of system) means to be able to imagine what real-world events or movements-in-thought "fall under" the rubric of "developmental movement of system" focused on by TF 11.

Innovative thinking in the DTF framework thus amounts to a conceptual strengthening of everyday knowledge and observation by way of using a particular *base concept*. If there is any magic in this process, it is the magic of introducing new concepts that do not strictly logically follow from the base concept (something that could be further strengthened by artificial intelligence supports now absent).

What level of team maturity is needed for a team to be proficient in depth-first search elaboration? Competences and diversity of competences by themselves will not suffice. Rather, a team must be able to think abstractly in terms of base concepts; and demonstrate (DTF-supported) intuition for making conceptual derivations like those made above.

Of course, a high-performing team might reach the elaboration phase of depth-first search right away. Teams thinking less complexly (e.g., at their beginning of their cognitive development as adults) will have to be coached to get there. However, with artificial intelligence support of canvas creation based on hidden dimensions and associated TFs even cognitively moderately developed teams could get into the e-phase of canvas design more quickly, and achieve a higher level of collaborative intelligence faster. I reserve questions of training regarding this issue to another blog.

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The *linking phase* of canvas creation with DTF requires and demonstrates the most complex thinking agile teams are likely to achieve. This phase may be open only to cognitively mature teams that can think beyond their competential specialties and can therefore truly "think together". However, it is a phase that focused cognitive coaching as well as artificial intelligence supports can open up to teams now excluded from it.

Depending on the team's level of fluidity of thinking, and thus collaborative intelligence, its work in this phase might look as shown below. Pay attention to the *base concept* each TF encapsulates to appreciate the conceptual derivations made by the team. These derivations are no longer restricted to the hidden dimension the TF in focus is initially attached to (e.g., C), but is based on linking together different hidden dimensions (such as C+R, C+P, C+T). We speak of *TF constellations* which presuppose the separation of hidden dimensions as a basis of linking them.

- Cl (multiple contexts and frames of reference; TF 3): what emerges if we view CS from multiple perspectives simultaneously: e.g., in terms of the segment's strongest pain points to be addressed; the resources required to support it; predominant activities/channels needed to do so; the greatest benefits deliverable to the segment; the customer relationships to be established and the cost structure of such? As well as: is our frame of reference informed by a cogent empathy map that guarantees that what we intend to offer is on target? (TF 3, associated with dimension C, does more breadth-first than depth-first search, but a DTF-schooled agile team member (or cognitive coach) is able to introduce a smattering of the latter, for instance by combining Cl with P(p;e;l) or R(p;e;l), held together by the notion of *frame of reference* [the base concept].

- Pl (embedding in process; TF 6): in what larger social processes, market trends, or technological changes is the CS focused on embedded; what hidden market forces determine its openness to our VP; how can our value proposition draw advantages from the interaction (all) sub-segments of CS participate in (e.g., by prototyping consulting techniques that anticipate foreseeable sub-segment alliances); how can we consult to these sub-segments in such a way that their interaction with each other reduces our cost structure or enhances revenue without additional investment or effort; and does the fact that our target-CS is embedded in a new technology trend change the structure of our consulting relationship to it (Pl+Re)?

- Rl (patterns of interaction and influence; TF 9): does our CS comprise a constitutive sub-segment that strongly demonstrates the main CS pain points and thus should be in the forefront of our effort; are there great differences between the sub-segment value systems, and which are the ones we should primarily cater to; what patterns of interaction between the segments do we need to take into account in delivering our value proposition (Rl [focus on relationship] + Pe [focus on process])?

- Tl (emergence of new entities; TF 12): are the sub-segments we focus on merging or does their transformation give rise to entirely new groups that, now hidden or barely visible, should become a new focus for our consulting (Tl + Pp); how can we make an evaluative comparison between these emergent sub-segments that shows us ways of strengthening our core value proposition (Tl + Ce); how can we coordinate our offering to all sub-segments taking on a new form so as to maximize our brand (Tl + Ce); and what has to be the focus of customer interviews with our CS to avoid the impression that our consulting brand is changing with new technological developments (Tl + Te)?

Further Steps

I could certainly demonstrate, in a second example, how a TF-based discovery procedure is applied to the canvas environment, from whatever vantage point we would want to approach

industry forces, macro-economic forces, key trends, or market forces. More importantly, using TFs we could easily transcend these pre-ordained (and thus limited) abstractions and think of the canvas environment in more complex and integral ways that are closer to the real world.

I leave this exercise to the reader.

Summary

I have shown in this blog in what way cross-functional teams of all levels of cognitive maturity and degree of collaborative intelligence benefit from the DTF approach to design thinking. The approach combines breadth-first search into four hidden dimensions of the canvas (CPRT) with depth-first search unfolding these dimensions further based on dimension-specific thought forms (TFs). I have also shown that the highest level of cognitive fluidity in teams lies in the ability to link TFs from different hidden dimensions into *TF configurations*.

By following the p→e➔l line of depth-first search within the confines of CPRT breadth-first search, team members, without losing the advantage of possessing starkly different competences, can stepwise deepen their thinking about the particular canvas component they are in the process of designing. (They are certainly likely to enhance the use of their unique competences once they bring to it depth-first search based on TFs.) By moving from TF1 [Cp] to TF12 [Tl], team members can totalize and bring together many (perhaps all) of the hidden elements relevant to their design.

There are two support systems that strengthen canvas design by teams using DTF thought forms even further:
1. Building artificial intelligence supports that smooth the path to using TFs by (visually or otherwise) reminding team members of considering each of the four hidden dimensions (CPRT) when making an inquiry into a canvas component or entire canvas.

2. Making cognitive coaching based on DTF dimensions and associated TFs the core of "agile coaching", with a focus on helping team members master TFs sufficiently to generate from (or for) each of them a multitude of innovative questions.

These two supports actually work best together:

Novel design thinking supports	**Obstacles to better design thinking**
Visually presenting CPRT hidden dimensions through software ⇩	There are many different simple and sophisticated a.i. solutions for unfolding

Visually presenting p-e-l thought forms associated with CPRT through software	CPRT dimensions into p-e-l TFs, which so far are not in use
Through coaching in DTF, helping teams derive innovative design questions for each of the hidden CPRT dimensions	There is presently no awareness of the limits of team wisdom based on competence models alone [thus logical thinking], and thus no training of agile coaches as transformational thinkers

Fig. 4 Software and coaching supports
for expanding the canvas design space

In this endeavor, a.i. supports could be configured as cognitive coaching (or mind-opening) tools, and building and using a.i. supports could be viewed as formalizing coaching techniques supporting agile thinking in teams.

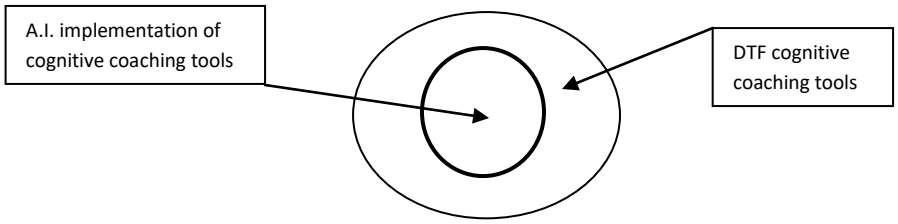

Fig. 5 A.I. implementations of DTF coaching tools

It would be the purpose of a.i. supports in canvas design to provide members of design teams with the following digital thinking help:

1. Visual templates of each of the four hidden dimensions, CPRT, introduced in this text through the "tree stump - wave - vineyard - rainstorm" metaphors.

2. Visual templates of individual TFs attached to these dimensions that function as *mind openers and question generators*, -- generators based on which team members can become aware of, and replenish, what is missing from their present thinking.

Since competence-based thinking in teams is primarily purely logical, such a.i. supports would introduce an important "change of mind". Through this change of mind, the powerful notion of hidden dimensions of the canvas would be introduced, and tools for approaching hidden dimensions through depth-first search would become available to team members.

In all cases where powerful questions about hidden dimensions of the canvas fail to materialize based on competences in cross-functional teams alone, a.i. supports would broaden team members' thinking beyond purely logical design thinking. They would open team members' mind to the structure of their own thinking in previously not experienced ways and thereby strengthen their cognitive agility.

Availability of agile coaching would also dramatically effect design thinking agility. Agile coaching would be forced beyond its narrow limits of a rehearsal of agile/lean start-up ideology and logistics, and would be broadened to transform in the direction of cognitive coaching based on DTF.

Below I review some research findings that substantiate my proposal.

Findings in cognitive research regarding team wisdom

Research in the cognitive development of adults found that the four hidden dimensions (CPRT) (not only of the canvas, but of the real world) become salient for people in the sequence of C➔P➔R➔T, and that the p➔e➔l sequence precisely describes the trajectory of adult cognitive development over the lifespan. In short, adults take a life time to transcend logical toward transformational thinking, and their advance is precisely mapped by the p➔e➔l sequence.

However, development does not equate to learning but rather determines the limits of learning at any particular point along a team member's lifespan trajectory.

In response to these findings, the Interdevelopmental Institute (IDM) developed a program for transformational thinking in organizations (see http://www.interdevelopmentals.org/?page_id=1974 (Publications) and http://www.interdevelopmentals.org/?page_id=4321 (Services), taught since 2005. Today, the institute is focusing such thinking on business model canvas design. Its practitioners are all certified based on real-world case studies focused on professionals in charge of change management and innovation.

Some results of the institute's experience with teaching DTF-based complexity thinking are worth noting:

1. While even a cross-functional team of moderately developed logical thinking can successfully arrive at a big picture of a canvas by using only C- or context thought forms (TFs 4-6), approaching the real-world complexity of a canvas realistically requires schooling in complexity thinking in the three other hidden dimensions (P, R, T).

2. Such schooling is most successful in the framework of the canvas itself whose base concepts naturally invite cognitive deepening into P, R, T, especially when team dialog is focused on the process, relationship, and transformational forms of visual thinking (with stickies).

3. When experiencing the deepening of thinking in the canvas through P, R, and T mind openers, teams become sensitized to complexity thinking and can ready themselves for moving into depth-first search in the canvas using TFs in the sequence p➔e➔l.

4. Teams comprising different levels of adult cognitive development (referred to as "cross-developmental") fare best when coached by an expert schooled in adult development as well as transformational thinking whose understands the limits of -- up to now empirically entirely unexamined -- cross-functional "team wisdom".

Conclusion: The map is not the territory

It seems to me that when borrowing the design metaphor from the discipline of architecture, Professor Boland (Boland et al., 2008) may have overlooked that the techniques he found so personally transformational already contain the seeds of breadth- and depth-first search. However, the Gehry team he consulted was unable to make the structure of its own thinking explicit so that this aspect remained hidden to both parties.

As a consequence, the present state of the art of design thinking is still far removed from complexity thinking in the sense outlined in this text.

While visual-thinking tools now available, such as *Mural*, are nearly perfect for straightforward logical thinking, they not only do not invite transformational thinking (in the sense here intended), but also lack even the beginning of artificial intelligence supports by which transformational thinking in cross-functional teams could be strengthened.

Importantly, the now widespread use of "stickies" is not structurally suited to lead beyond the use of mere context C thought forms (TFs 4-6). Visual thinking in the form of stickies leaves depth-first search options unused, and thus excludes thinking about, and tools for, systems dynamics. And while the canvas itself invites thinking about the relationships between different canvas components, in its present form it excludes ways of making relationships, especially intrinsic relationships, explicit. The same holds for tools for thinking in process terms.

Since transformation can be effectively thought about only when insight into processes combines with insight into relationships (TFs (4,5,6) + (7,8,9)), canvas design thinking today is excluded from even elementary forms of complexity thinking and systems thinking in the sense of the *Dialectical Thought Form Framework* (DTF).

As Glen, Suciu, and Baughn say in *The need for design thinking in business schools* (Glen et al. 2014): "design thinking is an iterative, exploratory process involving visualization, experimenting, creating, and prototyping of models, and gathering feedback".

On account of my practical work in transformational thinking with groups and teams, as well as research in the cognitive processes underpinning collaborative intelligence, it is inconceivable to me that "experimenting" and "creating" are as effective as claimed without accessing the four hidden dimensions (CPRT) and their associated pel-sequences outlined above.

Even prototyping of models as practiced in Mural, e.g., is far less developed than it is found, for instance, in Stella-Architect, a software in which processes and intrinsic relationship are easily modeled and model simulations easily executed in visual form.

If that is a correct assessment, this text has begun to make explicit what is waiting to be developed further in the discipline of design thinking. Management by design would certainly handle complexity more effectively and easily if what is now not even felt to be absent were finally sighted and widely supported through A. I. and cognitive coaching.

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