Accessing Highly Effective Performative Patterns

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Abstract Design Thinking is undergoing an exciting and critical transformation. Ad hoc content and practices, based on anecdote and experience, are being displaced by new content and practices grounded in empirical evidence and rigorous theory. To bring this new knowledge to both designers and design teams, a new approach to design instruction is required. The radical point of view of our research suggests that the work of design teams is a performative act (designing-as-performance) and that design sessions are a performance of a corpus of behaviors that constitute much of the practice of Design Thinking. Furthermore, this corpus of behaviors can be trained and learned in the form of a skills repertoire called performative patterns. Performative patterns function a shared model of action and reflection which provide structure for previously undefined content (Edelman 2019). This new approach to design education involves not only the intellectual task of designing and understanding theory but a phenomenological practice of perception-action loops between the body, the environment in which the team is situated and the artifacts-media with which the team interacts. Research-based training packages promise to provide both sound theory and highly effective performance patterns which together constitute a basis for excellence in team-based design.

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For Merleau-Ponty, a human subject is not defined,
as Descartes had it, as an 'I think,' but rather as an 'I can.'
The world we experience, for Merleau-Ponty,
is a field of possibilities for skilled action.
E. Baggs and A. Chemero, The Third Sense of the Environment 2018

1 Introduction

The work of design is to see the world as a field of possibilities and the work of learning design is to develop the capacities for skilled action. Teams are the engine of the complex system of innovation, and team *performance* is a critical factor in developing new and appropriate solutions to the problems that face us as leaders and change makers. The focus of this paper is on building the foundation for developing teaching and learning materials for the cultivation of technical skills that build highly effective team interactions, which are the basis for team performance.

Design Thinking holds the promise of equipping its practitioners with the right tools and mindsets to adequately address the challenges presented in the 21st century and enabling them to implement impactful solutions. Iterations, learning from feedback and mistakes and constant improvements have become the mantra for Design Thinking (DT) practitioners.

In order "to understand why and how the Design Thinking method works on a scientific basis" (Plattner et al. 2011b) Hasso Plattner started a research program 10 years ago. The resulting body of research sheds light on Design Thinking from a variety of perspectives and aims at contributing to Design Thinking's academic advancement and ongoing discourse.

Those findings in addition to other valuable insights from related disciplines provide the perfect basis for the iteration and improvement of both DT theory, practice, and education. The novelty of the discipline itself calls for further refinement and development of both its practical implication as well as its body of theory.

In the DT community, the notions and understandings of how DT works vary greatly. One common point of view is David Kelly's framing of DT as a somehow magical process: "…we can put together a seemingly random team of designers out of who is available in the firm at that time, and in the end, magic happens: breakthrough ideas and happy clients" (Kelley 2018). Another perspective presents DT as a more structured and understandable process: "(it) can be well structured, and things that occur during that period are both repeatable and comprehensible" (Kolko 2010). "It is only the lack of understandable documentation, or the decision to not share that documentation, that creates the sense of magic" (Kolko 2015).

Sonalkar et al. describe design team performance as "a complex phenomenon that involves person, behavior and environment parameters interacting with and influencing each other over time" (Sonalkar et al. 2018). This point of view emphasizes the complexity of DT which needs to be looked at from many different scientific perspec-

tives while integrating insights for a common understanding. It is not magic at work, but a network of various factors which can be analyzed and rigorously understood.

2 The State of Play in Design Thinking Education

Design Thinking has become a frequently used method to produce creative outcomes in different contexts. It is applied globally in a variety of various settings and formats.

Current DT training varies in scope and depth from one to three days of Design Thinking introductory formats, to extended offerings providing certificates, and programs over several academic study terms. In addition, there is increasing supply and demand of "online" DT formats for educating DT, ranging from online training within corporations (e.g., SAP and McKinsey), to Massive Open Online Courses (e.g., Design Thinking for Innovative Problem Solving by Darden School of Business) (Plattner et al. 2011a, 2012a, b, 2018; Thienen et al. 2018; Johansson-Sköldberg et al. 2013).

2.1 Design Thinking Learning Outcomes

In their paper "An educational perspective on design thinking learning outcomes," (Taheri et al. 2016) Taheri and her colleagues investigated current Design Thinking education through the lens of an educational model of learning outcomes. Taheri suggests three primary domains of Design Thinking learning outcomes, Affective Outcomes, Cognitive Outcomes, and Skill-Based Outcomes[1] all based on previous work by Bloom (1987), Gagné (1984) (see Fig. 1).

Taheri and her colleagues further argued that there was "a strong emphasis in the literature on the affective outcomes of design thinking, such as creative confidence, and the cognitive outcomes, such as mind-shifts," rather than skills.

Figure 2 shows a conceptual model from Taheri and colleagues illustrating the observed patterns of outcomes in three DT training formats: short term introductory workshops, long term project based formats and formal, real-life DT application settings. In Fig. 2, we see effective outcomes (blue) are highest, while both skill-based (green) and cognitive-based outcomes (red) underperform in all of short-term, long term and the real-life settings. Taheri conclusively points out "the threat of neglecting the skill-based outcomes; as this may eventually result in unrealistic expectations about what can be achieved in a DT training and applied afterwards" (Taheri et al. 2014, 2016).

[1] Skill-based outcome: one of the elements of a classification scheme of learning outcomes based on work by Kraiger et al. (1993), Bloom's (1956) and Gagne's (1984), taxonomies which provides guidelines for researchers in training evaluation, taking a multidimensional approach to learning outcomes. Their lens suggests learning as evidenced through the variation in (1) skill-based, (2) affective and (3) cognitive states of trainees.

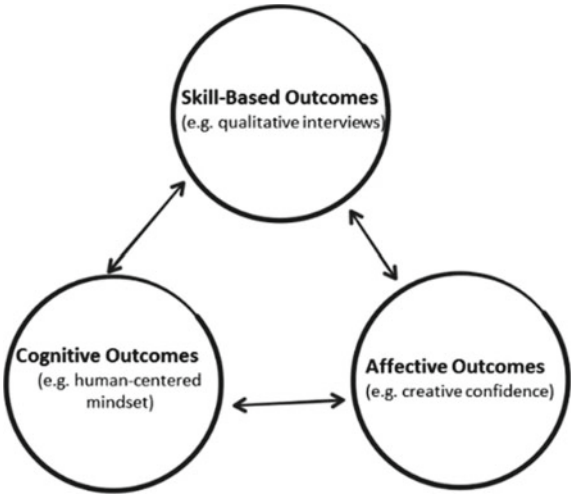

Fig. 1 Conceptual model for design thinking learning domains (Taheri et al. 2016)

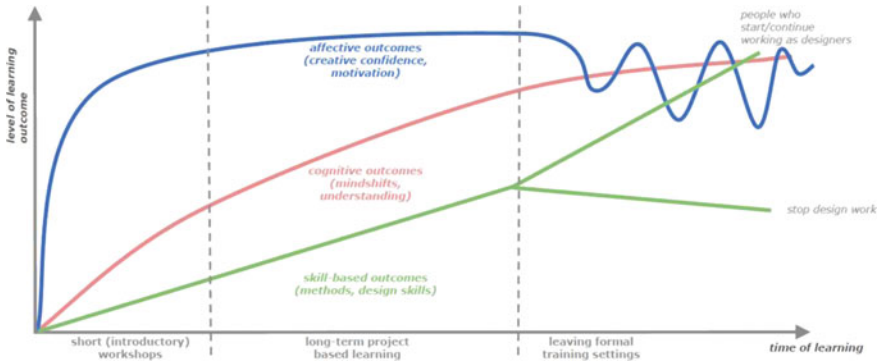

Fig. 2 A conceptual model of expected outcomes of current DT training formats (Plattner et al. 2016; Taheri et al. 2016)

Moreover, Taheri emphasizes "the potential dangers for educational training of future innovators and leaders at the university level." The authors believe that "Neglecting the skill-based outcomes may lead to educating individuals with creative over-confidence, who lack the skills and knowledge to apply their creativity."

In our work as teachers and practitioners, we have found Taheri's insight to be true. To that end, our work takes a *praxis approach* as a remedy for problems in current DT education through emphasizing more skill-based and cognitive-based outcomes.

3 Design-as-Performance: A Praxis Approach to DT Education

> Praxis need not only be seen as the relationship of theory to practice in terms of the work it produces in the studio; praxis can also be used as a means by which students can gain access to what could be described as 'high theory'—(Farrier 2005)

The radical point of view of this research considers the work of design teams to be a performative act (Designing-as-Performance or DaP) moreover, that design sessions are a performance of a corpus of behaviors that constitute much of the practice of Design Thinking.

There are two common perspectives on the word Praxis. The first is the application of the word to mean 'practice.' In this first instance, the Oxford English Dictionary defines Praxis as "formed of habitual action, accepted practice or custom."

The second definition of the word praxis is "an effort of will to transform theoretical concepts and considerations into shared physical activity." Of the two definitions, we are particularly concerned with the second sense of the word praxis. We also employ the extended definition from Farrier, where he describes praxis as a modality where "the relationship between theory and action is played out in the studio setting" (Farrier 2005).

Based on Farrier's model of praxis, we propose Designing as Performance (DaP): a studio setting praxis approach to DT education that not only strengthens both cognitive and skill-based outcomes but also ensures that highly effective performative patterns consist of sound theory and rigorously formulated practice. These cognitive-behavioral models are taught, learned and mastered by individuals as well as teams in redesign scenarios By employing a praxis approach, "the values of theory can be 'embodied' in physical situations" (McCullough 1998).

Taking a praxis approach, therefore, informs our research. Here we align with Farrier who employs the notion of circularity to describe "the relationship of theory to practice that has been developed in several places in the academy and the industry." We agree with Farrier in that we consider the relationship between theory and practice as **circular** (Fig. 3a) and not triangular (Fig. 3b). We also enlist Farrier's cyclical formulation that the relationship is **fluid and dynamic**. Our praxis approach, therefore, leverages on circular formulations without the difficulties that a triangular formulation may have. The quote below from Farrier expresses clearly our notion of the praxis of designing-as-performance.

> Rather than seeing practice and theory at opposite ends of a shape
>
> that values one over the other; a cyclical relationship can be used to
>
> describe to what extent theory and practice can be seen as equally interrelated—(Farrier 2005)

In the context of DT education, we see practice as a part of theory and theory as a part of practice; the two do not have mutual exclusivity and are therefore equally important. We do not perceive design theory as descriptive of the practice of design,

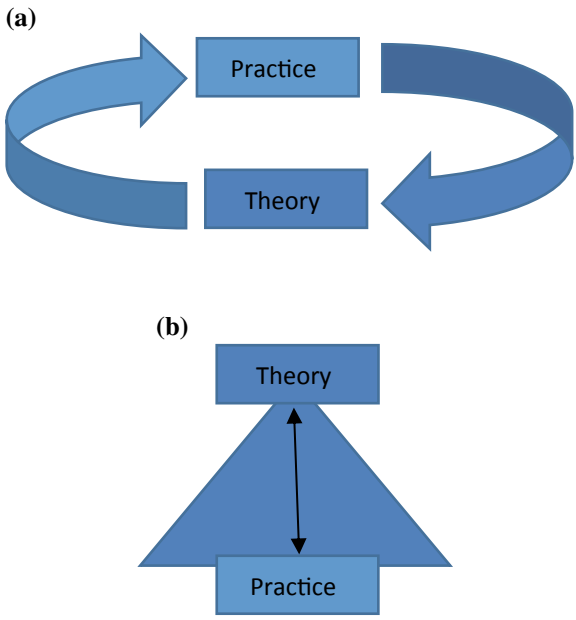

Fig. 3 **a** Circular relationship between theory and practice, a cyclic, fluid and dynamic relationship (Farrier 2005), **b** Triangular relationship between theory and practice, a top down relationship with theory at the pinnacle (Farrier 2005)

but as a dynamic bond to "the creative process which enables a different grade of perception of the possibilities of making performance" (Farrier 2005).

In Designing-as-Performance, we present the creative potential of design theory as a outlining a field of opportunities to DT academics, practitioners and students alike. Complementing current design thinking education with DaP praxis approach involves educating DT learners in understanding DT theory. This would afford DT learners the ability to also critique theory, a process both beneficial for students as well as the design thinking research community. The DaP praxis approach also entails a phenomenological practice of design which takes into account the perception-action loops between the designer's bodies and their environment as well (Edelman and Currano 2011; Kirsh; Kirsh; Rietveld et al. 2018; Edelman 2011). Furthermore, the approach also considers the specific context in which the team is situated as well as the artifacts and media with which the design team interacts (Edelman et al. 2012; Tversky 1993, 2003a, b). Finally, praxis avails both designers and design thinking researchers with an experiential "testing" ground in that the knowledge gained is both intellectual knowledge, as well as physical understanding.

Because an understanding of performance is crucial to our point of view, we provide the following background on performance. We will then frame the structure of the training packages based on training models in performative disciplines like music and sports.

4 Theory of Performance

> The mere act of framing any activity as performance makes it into a performance.
>
> —*John Cage*

It is common knowledge that humans are capable of extraordinary accomplishments, in other words, excellence. These accomplishments are most often produced from a high-level performance (Wilson et al. 2015). Traditionally, performative disciplines have relied on a combination of theory and structured practice that reinforce desirable behaviors which are critical for performative excellence. In the case of sports (Porter 1974; Schmidt and Lee 2014), the understanding of theory and body mechanics as well as the repeated application of this understanding in multiple use scenarios (skills, drills, and free play), are critical for high performance. In the same manner, musical performance (Harnum 2014), enjoys a long tradition of training which is comprised of musical theory, body mechanics, skills, drills, and free play as requirements for outstanding performance. Performance and creativity have also recently been explored in the context of cognition in the theme of dance by Kirsh (Kirsh 2010a, b, 2011a, b; Kirsh et al. 2012).

In our understanding of performance, we build on Erving Goffman's work "The Presentation of Self in Everyday Life" (1959). Goffman defines performing as a behavioral model characterizing any activity. Goffman sees performance as a "quality" that can occur in any situation rather than a fenced-off genre. (Goffman 1959, 1990) We also embrace the composer John Cage's conception of performance. For Cage, "the mere act of framing any activity as performance makes it into a performance" [Schechner and Schechner 1988; Schechner 2003 (2005 printing)].

4.1 Defining Performative Patterns

We note that there are two senses of performance, both of which DaP seeks to cultivate. The first sense is the act of performing itself; the second refers to the results of the performance and points to producing valued results. Performance can take the form of an individual (see Fig. 4a), or a group of people engaging in a collaborative effort (Fig. 4b). There are several examples of performance that we can apply to evaluate what designing-as-performance entails. Generally speaking, music, play, games, sports, theater, and ritual all have "performance" in common.

Before defining performative patterns, we will provide several examples drawn from sports and music. An example of a performative pattern in music occurs in the practice of jazz. Jazz patterns typically use scales, modes, simple chords, complex chords (cycle of fifth, chromatic, stepwise) (Coker et al. ca. 1990). All these jazz patterns help jazz learners improve their hearing ability (listening), develop finger to mind/ear connections, as well as implementing phrase styles. Practicing jazz patterns also helps students to have a deeper understanding of how expert soloists think

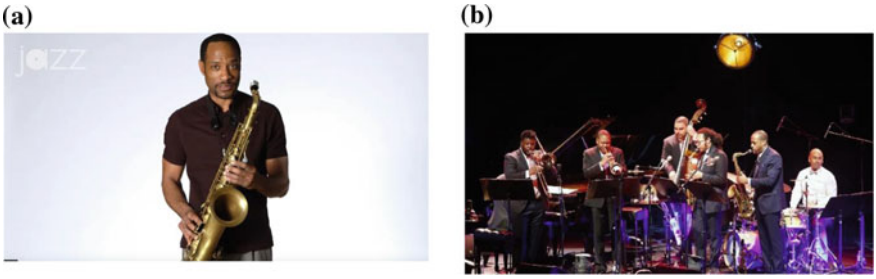

Fig. 4 **a** Walter Blanding emphasizes how practicing scales as an individual is crucial to performance. (jazz.org). **b** Jazz Team with Jazz artist Wynton Marsalis (second from left) performing in concert with his team (Walter Blanding on the Saxophone) (Ravindranath 2017)

through chord progressions, as well as mastering rhythmic constructs used by the best soloists. (Haidet et al. 2017; Cho 2010)

In musical improvisation, a frequently practiced performative pattern is the "call and response," in which players call out musical phrases to one another and return variations on them. An example of this is "You Rascal You," performed by Louis Armstrong and Louis Jordan. We note that "call and response" is a performative pattern which acts as a container for improvisation, invention, and execution unfolding in the moment.

Performative patterns in jazz facilitates group communication in co-creating music. They allow the group to stay on the same page and at the same time push the boundaries of the music. In this way, performative patterns in jazz create a shared body of behaviors and knowledge that serve as a container for previously undefined content.

An example of a performative pattern in team sports is the "play" in American Football. Plays are predetermined plans that the team practices repeatedly, they often involve strategic and tactical decisions based on where the ball is situated on the field. Plays often have several alternatives that can be enacted depending on the movements of the opposing team. Thus, the play anticipates a number of un-choreographed possibilities. Thus, like a performative pattern in jazz, the "play" in football is a performative pattern that serves as a container for improvisation, invention, and execution unfolding in the moment.

Figure 5a, b show the Four Verticals Play. If viewers of a match like this are unfamiliar with American Football, they might be inclined to see a group of men shoving one another around, until the Quarterback throws the ball and someone catches it. However, this movement is a choreographed routine that anticipates changes to the routine due to the opposing team's responses. A performative pattern of this kind allows the team to read one another: it allows the receivers to read the defense within defined boundaries; it allows the quarterback to read the choices the receivers make so he can deliver the ball to a place where no one is at the time of release.

Thus, a working definition of a generic performative pattern is *a set of defined iterative interactions that serve as a container for previously undefined content*.

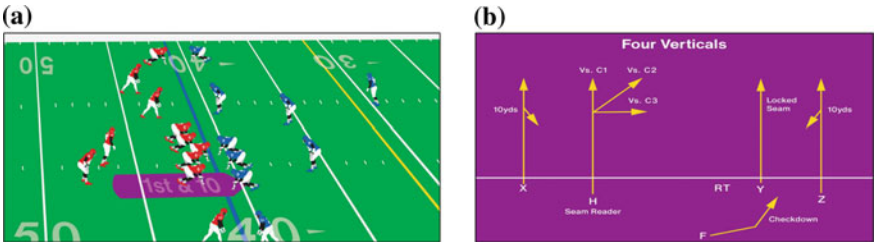

Fig. 5 **a** The four verticals play diagram. **b** The four verticals play on the field

Fluency with performative patterns is one of the factors that allow team members to read one another under quickly changing circumstances because they provide a shared map to contain a range of possibilities for acting on a situation.

In the paper "Teamwork in the Performing Arts" (Rouse and Rouse 2004), Rouse suggests that what makes team performance possible are shared, *mental models*. It is our understanding that Rouse's excellent contribution is based on a Cartesian cognitive model in which thinking happens exclusively in the head. We reframe Rouse's insights in the context of contemporary cognitive models (Kirsh; Tversky 2003a; Clark and Chalmers 1998) and suggest that the models are not merely *mental models*, but *performative patterns*, the elements of which are *theory*, *behaviors* and the *media* which teams use. This is analogous to the patterns, execution, and equipment enlisted in sports (plays; running, passing, catching, scoring; balls, nets, shoes) and music (scales, chords, scores; technique and interacting; instruments).

4.1.1 What Is a Performative Pattern in Team-Based Design?

A performative pattern in design is a set of defined iterative interactions that serve as a container for previously undefined content, that move the inquiry towards potentiality and/or differentiation. Performative patterns in design are often done in groups and mediated with models, tools, and materials.

5 Teaching Performative Patterns

Now that we have established a working definition of performative patterns, we offer a brief survey of some of the methods that sports and music enlist to cultivate expertise in performative patterns.

What follows are examples of several kinds of training from sports and music, though numerous examples can be found in training in any performative discipline. Our proposal is these examples from sports and music provide a model for creating effective curricula for designing as a performative activity.

5.1 Fundamental Units

Practicing scales in music constitute one of the foundations of technical proficiency as well as compositional proficiency. Walter Blanding of the Jazz at Lincoln Center Orchestra (Blanding 2013), relates that he still practices scales after playing for over thirty-five years. Building on basic scales, Blanding suggests that instrumentalists develop their own drills to expand fundamentals. Scales, along with chords and genres, are the building blocks of musical composition (Coker et al. ca. 1990) Thus, the frequent and long term practice of fundamental units like scales can serve as a foundation for performative proficiency, both technical and for development of new material.

In the domain of Classical Music, Chopin's Etudes is an example of highly prescriptive performative instruction. The Etudes enlist specific technical challenges in the context of deep emotional content (meaning). Chopin's insight and contribution is that mastery in music is the joining of the technical and the poetic.

Sports training enlist analogous training practices to those employed in music. An example is the use of *kata* in Judo and other martial arts. A kata is a very formal training method in which the players perform predetermined patterns in order to achieve mastery for application in unstructured matches. Much like the etudes of Chopin, these highly structured exercises are a joining of the technical and the poetic.

Mature disciplines like swimming characteristically deconstruct performance to a remarkably fine granularity. In the following screenshots, we see an account of the physics of buoyancy in breaststroke called "loading" which we see as *swimming theory*; an analysis of the action of the arms in breaststroke; the concept of the "catch" (the critical first part of the stroke), and an exercise called the "front scull" which is a popular exercise practiced to cultivate a proper catch. Furthermore, specific warm-ups and stretches are enlisted that improve flexibility to aid in a range of movement and reduce drag in the water (Fig. 6).

The equivalent elements in music are music theory, understanding genre, chord changes, scales, attack, and phrasing. These are taught for understanding, for an embodiment in playing, and as a ground for communication and development of new musical content.

In music and sports, we have observed theory, repeated practice of foundational units, and repeated contextualization of these foundational units into a broader context of performance to form the core of successful training of high-performance

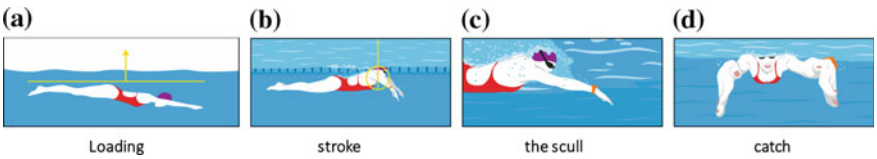

Fig. 6 Swimming: loading, the stroke, the catch and the scull

individuals and teams. In sum, research in musical performance training and sports training suggests:

- Designers may benefit from relevant theory and structured practice of design behaviors
- These behaviors are repeatable and understandable
- These behaviors can be articulated into theory, warm-ups, skills, drills and structured exercises (etudes or kata)
- Repeated practice of well-crafted warm-ups, skills, drills, and exercises build fluency and expertise.

The question we now address is, what characterizes the equivalent to fundamental units in music, plays in team sports, and how can they be taught as skills and etudes or kata?

6 Designing as Performance: Components, Elements, and Core Concepts

A large body of knowledge in Design Thinking and adjacent fields provides the foundational basis for improving design education. A selection of research insights is explored in the following paragraphs, including a summary of the core concepts and their potential impacts on Design Thinking education.

6.1 Media, Behaviors, and Frameworks for Performance

In his doctoral studies, Edelman sought to provide a clear understanding of how the design process works for designers *in situ*, to support their decisions and choices in redesign scenarios (Edelman 2011). Working at Stanford's Center for Design Research (CDR), Edelman's research contextualizes design outcomes in a broader web of behaviors and interactions between teams and the media that they enlist in redesign scenarios. Like other work being done at Stanford's CDR, Edelman sought to identify the empirically observable and measurable characteristics and mechanisms of high-performance teams at work. Acknowledging that "the activity of design is a complex social and technically mediated endeavor" (Jung and Leifer 2011), Edelman's work provides insight into "how design media and behavior entwine to afford the exploration of (sometimes imaginary) worlds and (sometimes imaginary) objects" (Edelman et al. 2012).

His work further presents, an empirically grounded framework to help us understand "how and under what conditions small horizontally organized design teams perform radical redesigns or radical breaks." Edelman focused on designers performing incremental improvements and mid-level redesigns and employed an observation-based case-study approach to examine small design teams in a redesign task. In

conclusion, Edelman's work gives evidence for the work of design teams to be an example of extended cognition; design thinking is accomplished through the expert management of concepts, behaviors, and media.

6.2 Accessing Highly Effective Performative Patterns

The title of this chapter is "Accessing Highly Effective Performative Patterns." By "accessing" we mean both identifying and making available often unseen or overlooked design behaviors that, upon examination contribute to robust team performance and meaningful outcomes. In the first sense of accessing, *qua* identifying, research itself has provided a substantial and growing body of knowledge that identifies the fundamental elements of effective team interactions, whether they be the kinds of questions designers ask (Eris 2003), the kind of new language designers create (Mabogunje 1997), the kind of media they enlist (Edelman 2011), or the kind of frameworks they use to structure and move through a redesign activity (Edelman 2011).

The second sense of accessing, making research insights available, is the work of bringing research to impact. This entails the creation and validation of training packages that translate new knowledge into actionable materials that designers can use. Based on our survey of training methods in performative disciplines, we have formulated eight formal elements which constitute a training package.

6.3 Formal Elements of Training Packages

1. Theory
2. Warm-Ups (curated, simple activities to gain familiarity with the performance of concepts)
3. Individual Skills (in musical terms "chops,")
4. Team Drills (these develop a clear sense of team roles and interactions)
5. Scripted Practice (following the approach of Chopin and the Martial Arts, structured Etudes or Kata; these can be done repeatedly to fine tune skills)
6. Speed Drills (timed interval training, to cultivate quick responses)
7. Free Play (exercises to build fluency, for design teams to experiment with the performative pattern)
8. Toy (an advanced, full redesign exercise used for assessment).

In practice, we have introduced each training package with Warm-Ups, rather than beginning with Theory. The thinking behind this is to provide a carefully curated short experience that gives the essence of the performative pattern *qua* performance. This is followed by a pattern of instruction which combines theory and exercises

in increasing detail. In this way, we strive to co-develop skill and knowledge at the same time.

Our research group has several research-based training packages in development. Many of these have been tested in several venues both in Europe and the United States. The packages are based on the following research:

- Media Models: the media that designers enlist have cognitive affordances (Edelman 2011)
- Generative Design Questions and Deep Reasoning Questions: two kinds of questions that designers use to frame effective inquiry (Eris 2003)
- Solicitations: designers create models that solicit phase appropriate actions (Rietveld et al. 2018)
- Noun Phrases: designers create new language (Mabogunje 1997)
- Dimensions of Engagement: a systems approach to generative product service architecture (Edelman 2011)
- Disruption-Integration: the master algorithm (Edelman 2011; Menning et al. 2018)
- Enactment: acting out in semi-imaginary worlds (Edelman and Currano 2011)
- Marking: designers enlist a shorthand sketch for enacting interaction (Kirsh 2011b)
- Remapping: transposing touch points on to different form factors for new usability and use-cases (Edelman et al. 2012; Edelman 2011)
- Four Forces of Change: Aristotle's Four Causes in the service of design (Edelman and Currano 2011; Edelman 2011)
- Metaphor: using metaphor to leverage high impact opportunities (Edelman and Currano 2011; Edelman 2011).

To include an account of each and every training package mentioned above is beyond the scope of this chapter. However, we offer three parts of a training package based on Ozgur Eris' work on the kinds of questions design teams ask as an example of how an actual training package looks. The entire training package has these elements:

(1) *Theory:* high-performance design teams ask two kinds of questions: GDQs and DRQs
(2) *Warm-Ups*: about X ask questions, ask DRQs, ask GDQs, alternate, answer
(3) *Individual Skill*: ask GDQs and DRQs with X, ask and answer GDQs and DRQs with X
(4) *Team Drill*: ask GDQs and DRQs with X in turn, ask and answer GDQs and DRQs in turn
(5) *Scripted Practice*: design team practices a design Etude or *kata* of GDQs and DRQs
(6) *Speed Drills*: design team practices asking and answering GDQs and DRQs in turn in 10 and then 5-s intervals
(7) *Free Play*: design team ask and answer GDQs and DRQs freely
(8) *Toy*: design teams work to expand horizons on realizing an advanced, complete redesign

For the sake of demonstration, we now present three parts of a package based on Eris' Generative Design Questions and Deep Reasoning Questions (DRQs & GDQs). We will first describe a Warm-Up, then Theory, and finally a Speed Drill.

GDQs & DRQs Warm-Up: Asking Questions

The purpose of these Warm-Ups is to train designers to be sensitive to the questions they ask. This series of Warm-Ups begin as (1) general questions, then (2) questions that move a narrative forward, then (3) cultivate to specific kinds of questions, and finally, (4) specific questions with appropriate answers.

Team members gather in a circle and

(1) Ask questions in turn without responding with answers, just questions
(2) Ask questions that move the narrative forward (e.g., "What are you eating?" "Would you like some?" "Aren't you hungry?")
(3) Ask specific kind of questions that concern an object or experience (e.g., planning an event like a party)
    (a) specification, comparison, and verification (e.g., just how many people are we inviting?)
    (b) what ifs (e.g., what if we all wore togas?)
(4) Same as above but with appropriate answers.

GDQs and DRQs Theory: Asking the Right Questions at the Right Time

Ozgur Eris studied the kinds of questions that designers ask when they are working in teams. Eris found that a combination of Deep Reasoning Questions and Generative Design Questions are needed for successful design outcomes (Eris 2003).

Deep Reasoning Questions (DRQs) are concerned with verification, comparison, specification, in other words, logical status:

- Verification (Is this true?)
- Comparison (Is this heavier or lighter?)
- Specification (Just how big is this?)

Generative Design Questions (GDQs) are not concerned with verification, comparison, specification. Instead, they are concerned with generating possibilities:

- Proposal/Negotiation (How about attaching a wheel to the long LEGO piece?—aimed at establishing a negotiation process based on opinions)
- Scenario Creation (What if the device was used on a child?—aimed at generating a multitude of outcomes)
- Ideation (Are magnets useful in any way?—aimed at generating a multitude of concepts)
- Method Generation (How can we keep the wheel from slipping?—aimed at generating secondary conceptualizations)
- Enablement (What allows you to measure distance?—aimed at identifying resources).

Eris' work drills deep into exactly how questions frame the outcomes of inquiry. In practice, these excellent and fundamental distinctions concerning Generative Design Questions are challenging to master in the short term. We have experimented with GDQs in our workshops and by way of introduction have essentialized GDQs into these three questions:

- How might we?
- What are the ways we could?
- What kinds of scenarios could we imagine?

Additionally, Eris' work highlights a common cause of team dysfunction. We have often witnessed teams that are unaware of what kinds of questions they are asking and unaware of the impact that the questions have on the direction of the team. We have also witnessed occasions in which team members are unwittingly asking DRQs and GDQs at the same time and as a result, are growing frustrated because they are at loggerheads and going nowhere.

GDQs & DRQs Speed Drills: Timed Interval Training

Team members ask DRQs and GDQs in several rounds. Each round is timed for each object and team member in turn; round one is six seconds per turn, round two is four seconds per turn, round three is two seconds per turn.

(1) *Ask DRQs (specification, comparison, verification) about an object X*
(2) *Ask GDQs (how might we?, what are the ways we could?, what kinds of users or scenarios?) about an object X*
(3) *Alternate 2 and 3 above*
(4) *Same as 2, 3 and 4 above with answers*

Where X is a bottle, a camera, planning a birthday or workshop.

6.4 Assessing Training Packages

We generally get good feedback from designers we have trained. What follows is a selection of comments from students and professionals that have participated in our workshops.

> The research-based exercises allow me to understand exactly where the re-design challenge is located in the process… and where I can start a disruption or change
>
> The exercises…were so understandable, exercising felt very intuitive and logical.
>
> It felt like having an x-ray of creative working sessions.
>
> As a Design Thinking Coach and professional designer it was a very helpful workshop to understand how to teach Design Thinking with more concrete and precise exercises.
>
> The methods can be used to find out who is the best "point guard", the best "center" and so on. But they can also be used to make "centers" into "point guards" or the other way round - in a very structured, thus protected framework…This way, people can try out roles that they or others hadn't foreseen for themselves.

Table 1 Performative pattern assessment protocol

Pre-training assessment	Training	Post-training assessment
KAI Creativity test	Single exercises	KAI Creativity test Video recorded redesign task with physiological data
Video recorded redesign task with physiological data Self reporting for creative confidence	Single packages	
Semi-structured interview Expert evaluation of outputs	Multiple packages	Self reporting for creative confidence Semi-structured interview Expert evaluation of outputs

> The workshop was really a massively pivotal point for me in my way of thinking about design.

As gratifying as positive feedback can be, more objective assessments are necessary to ensure rigor. While some of our research into assessment is truly a work in progress, there are several assessments that we are starting to implement. Table 1 is a schematic of the assessment protocol we are currently implementing.

We plan to assess multiple teams of three participants. A control group will be trained with standard Design Thinking materials. Another group will be trained with the research-based training materials that we have described above. Our interest is in determining which approach is more effective in cultivating creativity, high-quality outputs from the redesign task, qualitative assessment regarding participants' sense of their creative confidence, and gathering data concerning the physiological state of participants engaged in a team-based redesign task. The last of these, gathering physiological data is a new enterprise, in part directed toward seeking insights and objective information about how people feel when they are designing, and in part meant to be a complement to new work being done in NeuroDesign at Stanford.

7 Conclusion

We have observed that much of Design Thinking instruction is ten years behind in embodying and communicating new knowledge about design and design teams. Research has matured the discipline of Design Thinking beyond a loosely connected set of best practices. However, the new knowledge resulting from over ten years of research has seldom been implemented in the form of teaching and learning materials.

This paper has presented a new approach to designing and design education called Designing as Performance, which involves not only the intellectual task of designing and understanding theory but a phenomenological practice of perception-action loops

between the body, the environment in which the team is situated and the artifacts with which the team interacts. The work of design teams is a performative act, and that design sessions are a performance of a corpus of behaviors that constitute much of the practice of Design Thinking. This corpus of behaviors is repeatable and understandable and thus can be trained and learned in the form of a skills repertoire, the core of which are performative patterns.

Seeing the world as a field of possibilities and acting on the world with skilled action is the work of design. We hope that the research and training in which we are engaged has enabled designers to see the world as a field of possibilities, and has moved and will continue to move designers to act on the world with thoughtful, reflective and skilled action.

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