

Patterns of Patterns II: Discourse on Implementation

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We review how our earlier theorization of pattern methods fares in the wild. The “wild” here included a graduate school classroom in New York, a workshop at a transdisciplinary conference in Arizona, a nascent citizen science project in Bristol, and a professional development day for a university in Oxford. We encountered unexpected challenges such as working with students in a HyFlex classroom, getting conference attendees to feel comfortable evaluating the conference they were presently attending, and adapting our plans on the fly when leading workshops with surprising attendee responses. We describe and refine patterns specifications that will help other practitioners of patterns in their own forays into the wild.

CCS Concepts: • **Social and professional topics;** • **Software and its engineering** → *Designing software; Open source model;* • **Applied computing** → *Operations research; Computing methodologies* → *Modeling and simulation;*

Additional Key Words and Phrases: Design Patterns, Pattern Languages, Action Reviews, Futures Studies, Causal Layered Analysis, Emacs, Free Software, Peeragogy, Climate Change, Innovation, Anticipation

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1 INTRODUCTION

The previous installation in this series presented a high-level methodological synthesis of three techniques from design, futures studies, and learning management in the form of a design pattern called PLACARD [Corneli et al. 2021]. During the two years which have elapsed since then, we have had opportunities to deploy and further develop these methods in various contexts. We will describe some of these applications in the four case studies below. We have distilled this experience into a collection of practical patterns which augment the earlier high-level pattern. This fully-fledged collection of patterns of patterns can help you organise your work with Design Pattern Language methods.

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2 BACKGROUND

2.1 Recap of “Patterns of Patterns”

We introduced a synthesis of methods that operationalise the “sensory”, “cognitive” and “motor” systems from psychology in the context of social intelligence. The particular methods we outlined were certainly not the only way to implement these system features. What drew our attention is that each of the methods we selected comes with a framework or template; each of the methods is, essentially, a design pattern.

- Project Action Review (PAR): *a set of five review questions to explore at a project checkpoint.*
- Causal Layered Analysis (CLA): *a set of four “layers” that can be used to unpack a problem area of interest.*
- Design Pattern Languages (DPL): *each constituent pattern follows a “Context/Problem/Solution” template.*

We made the further assertion that these sensory, cognitive, and motor methods can be hooked together, theorising design patterns as little pieces of moveable social intelligence. We called the specific method that combines PAR, CLA, and DPL the “PLACARD” pattern.

We applied these methods to analyse the design Pattern Language literature and practices, and also developed a case study examining the way the Emacs Research Group used related methods. We built on these analyses to outline potential futures for the development of pattern methods.

2.2 Related work

Iba and Isaku [2016] provide a large collection of patterns for creating patterns. Their threefold decomposition of the pattern language creation process, into mining (*a sensory activity*), writing (*a cognitive activity*), and symbolizing (*a motor activity*), bears an analogy with PLACARD. However, here, aim is neither to review such analogies, nor to evaluate the specific theory encapsulated in Iba and Isaku’s *PATTERN LANGUAGE CREATION* pattern. Rather, what we aim to describe here in some detail is our overall process of working with patterns.

Earlier authors, such as Moran [1971] and Oxman [1994], looked at the specifically-computational implementation of design pattern ideas. Computational considerations remain mostly in the background for us, as we focus on features of implementation at the social interaction and paper prototype level. We return to questions related to supportive computational implementation in the closing sections of this paper.

Regarding social cognition, we engage with the active inference framework as a formalism which “can be applied to explain the influential flows and dynamics of any open system at any scale,” per Hipólito and van Es [2022]. These authors point out that patterns (in a suitably general sense) are pre-linguistic, discovered and learned through bodily experience. With language, the articulation of patterns allows us to participate in *niche construction*.

In this regard, we work in a way that is rather closer to the sensibilities of Christopher Alexander than those of René Descartes [1850], who wrote:

...it is observable that the buildings which a single architect has planned and executed, are generally more elegant and commodious than those which several have attempted to improve, by making old walls serve for purposes for which they were not originally built.

We embrace the often messy process of prototyping our way forward; and continue the reconstruction of pattern theory begun in the prequel.

3 METHODOLOGY

In the current paper we examine the major events in our work that took place since the publication of “Patterns of Patterns”. We ran three formal workshops that were inspired by the original set of methods, and we will describe *how the methods evolved further in those settings*. We also used the aforementioned paper as a focal reading over three sequential years of a postgraduate course, CIS 9590 “Information Systems Development

Project” at Baruch College, part of the City University of New York. Together, an analysis of these touchpoints suggests ways in which the methods can continue to evolve. As before, we draw on the core methods of PLACARD, for example, using Causal Layered Analysis directly within some of workshops, and also using it as a *post hoc* analysis tool.

Most centrally, we used design patterns both as design inputs and as outputs in the workshops. A selection of these patterns are included here. Each of the patterns is given a marker, (s), (c), or (m), to indicate whether it plays a primarily sensory, cognitive, or motor role. We also include the *itinerary* for each of the workshops to help bring the reader into the scene, and encapsulate post-workshop reflections as further design patterns.

In addition to making use of existing patterns, we made a point of ensuring that those patterns had opportunity to grow and evolve, and examine how their use fostered the emergence of additional patterns. We endeavour to show this process within the paper. As such, the paper includes a combination of patterns that follow a formal template, and proto-patterns with less structure. Proto-patterns without substructure distinguished by a “” marker, evoking the concept of *pattern mining*. In our view, additional formality does not always help with communication, and we endeavour to show how and when it is helpful. In Section 7, we give some examples which add pattern structure to proto-patterns. Appendix A gives some further justification for including work at different levels of formality, with reference to Alexander [1964].

For the patterns which are spelled out formally, we typically use this simple variation on the classical “Context Problem Solution” pattern template:

Context ... [Summary of the working context]
If ... BUT ... [A conflict, problem, or gap arising in this context]
Then ... [Actions to take to resolve the conflict] ...

Some also include an **Example**. We also use an intuitive alternative pattern template structure to describe a sub-language of roles. Narrative around the patterns is presented in an italic font.

We present the patterns that we developed and used in (mostly) chronological order, aiming to show how the use of certain patterns help to give rise to the “seeds” of new patterns. In this way of working, the workshop method itself becomes a kind of (complex) pattern, which we ran with variations. At each stage, input patterns play the role of lightweight hypotheses, structuring the experience and potentially being validated or invalidated by the interactions. As observed by Iba and Isaku [2016] a description of pattern-writing patterns helped to identify when patterns are used, but *not every pattern is used every time*. In our context, the survival of a given pattern the next workshop (or not) gives a sense of the evolutionary character of overall method. Some of the methodological changes were given strategic rationale, and became the seeds of new patterns (e.g., **INCREASE PARTICIPANT CONTROL**, elaborated in the first case study below, is one such example).

On that note, we carefully reviewed the lessons learned after each workshop, either by using the Project Action Review template, or through less formal but nevertheless detailed post mortems. Writing this paper is an opportunity for review at a deeper rhythm.

4 CASE STUDY 1: “GOING META” WORKSHOP AT ANTICIPATION 2022

This workshop functioned as a more developed pilot of methods that we already shared in earlier pilots (at PLoP 2021, at Oxford Brookes Creative Industries Festival, and previously in more nascent forms). Our aims were both to introduce the methods to attendees, and to ‘workshop’ the methods. Our pitch was that we would help attendees to establish a position of maximum leverage, exercising our “Critical Anticipatory Capacities” using “Creativity, Innovation and New Media” (two of the conference’s themes) to explore the future of anticipation.

4.1 Input patterns

A small selection of patterns describing the workshop activities, based on the more informal descriptions in our playbook, were shared with workshop attendees in the form of “pattern cards”, with which we transparently structured the workshop activities. A selection of these are shown in Figure 1. Several of these are detailed below, along a few more-abstract patterns that characterise the process.

DÉRIVE COMIX (s)

Context you want to develop some future scenarios to explore with a group.

If you have a group BUT everyone has their own experiences;

Then Gather data. For example: go for a walk [Debord 1956], or just look out the window wherever you are. (Alternatively, close your eyes and conduct a mental exploration of your selected theme: what do you see in “your mind’s eye?”) Document what you see. Follow up by preparing your materials to share in a succinct fashion, e.g., as photos, a screenshot, slides, sketches, a zine, a map, or some PostIt® notes.

By itself, looking to the immediate surroundings only gives an imperfect picture of how to develop a future scenario. Direct observations might include little to no evidence of, say, top-level government policy which likely is a major factor in the future. Two further patterns access more levels of meaning.

MEANING MAP (c)

Context We have collected images describing people’s worlds (see DÉRIVE COMICS).

If you want to distill shared meaning BUT everyone has their own experience;

Then talk together about the problems and opportunities that everyone sees. Maybe some of these will cluster together, or maybe everyone will have their own different perspective: that’s OK. You can use these different viewpoints to get everyone on the same page.

REINFUSE EXPERTISE (m)

Context a group wants to build a MEANING MAP.

If everyone has experience as a citizen BUT they also have expertise;

Then begin by removing expertise to get everyone on the same page, and subsequently reinfuse expertise to enable richer and more complex thinking.

PATTERN LANGUAGE COMPONENTS (s)

Context In a collaborative setting with people who are new to design patterns.

If new attendees are being invited to create new patterns BUT the context, problem, solution language brings assumptions that they may not be comfortable

Then introduce more dynamic keywords such as HOWEVER (to describe a gap or conflict), BECAUSE (to

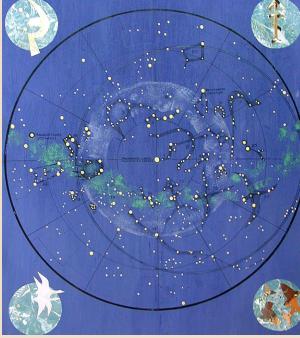
 <p>Dérive Comix</p> <p>Context you want to develop some future scenarios to explore with a group. If you have a group BUT everyone has their own experiences; Then Go for a walk or just look out the window wherever you, and document what you see. Follow up by preparing your materials to share in a succinct fashion, e.g., as photos, a screenshot, slides, sketches, a zine, a map, or some PostIt® notes.</p> <p>Image: Black and white shot of man from behind standing near window covered in water, Melbourne. Photograph by Sam Austin. Public domain via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Window_with_water_and_man_(Unsplash).jpg</p>	 <p>Meaning Map</p> <p>Context We have collected images describing people's worlds (see DÉRIVE COMICS). If you want to distill shared meaning BUT everyone has their own experience; Then talk together about the problems and opportunities that everyone sees. Maybe some of these will cluster together, or maybe everyone will have their own different perspective: that's OK. You can use these different viewpoints to get everyone on the same map.</p> <p>Image: Sai Gon Water Bus - Line 1 map in the Binh An station. Public domain via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Sai_Gon_Water_Bus_-_Line_1_map_in_the_Binh_An_station.jpg</p>
 <p>Reinfuse Expertise</p> <p>Context A group wants to build a MEANING MAP. If everyone has experience as a citizen BUT they also have expertise; Then begin by removing expertise to get everyone on the same page, and subsequently reinfuse expertise to enable richer and more complex thinking.</p> <p>Image: Old Moksha Star Map used by travellers and navigators in Middle ages. Public domain via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Medieval_Moksha_Star_Chart.jpg</p>	 <p>Project Action Review</p> <p>Context Work in progress. If we are working on something together BUT we might lose momentum; Then use a review template to think about our progress. Questions like the following can be asked at any point in a project, and provide a momentary record of perspectives which can be analysed later.</p> <ol style="list-style-type: none"> 1. <i>Review the intention: what do we (did we) expect to learn or make together?</i> 2. <i>Establish what is happening: what and how are we learning?</i> 3. <i>What are some different perspectives on what's happening?</i> 4. <i>What did we learn or change?</i> 5. <i>What else should we change going forward?</i> <p>Image: Knoestige bomen aan het water (Gnarled trees by the water). Public Domain via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Knoestige_bomen_aan_het_water_Knoestige_bomen_bij_het_water_en_jagers,_RP-T-1975-46.jpg</p>

Fig. 1. A selection of the pattern cards we handed out to participants of the “Going Meta” workshop

describe a set of operating causes), THEREFORE (to describe a rationale based on related data) , and SPECIFICALLY (to describe next steps), to help people build patterns piece by piece.

FUNCTIONAL ROLES

(s)

Context When building a new set of design patterns.

If you have ideas about the components of a pattern BUT the pattern hasn't been fully formed yet.

Then introduce different perspectives to critique the pattern as it develops.

In this workshop, we tried aligning the PATTERN LANGUAGE COMPONENTS with FUNCTIONAL ROLES, as per “Phase II” in the Workshop Itinerary which follows (Section 4.1.1). In subsequent workshops, we decided to separate these two dimensions more distinctly. Further details on roles are given in the next Case Study (Section 5).

4.1.1 Workshop Itinerary.

What does the future hold for the anticipation community that we are part of?

Study Hall (5 minutes)

Participants take some time to review this itinerary.

Welcome (5 minutes)

We will briefly introduce design patterns and the workshop methodology and goals with the audience. Briefly, our goal is to help everyone here “go meta” and answer the thematic question above.

Phase I: Envisioning the future (20 minutes)

Groups review 4 cards in order. 1 | **Participatory Scenario Planning:** Get everyone on the same page: *today by using big sheets of paper.* 2 | **Dérive Comix** Bring data: *captioned mental images of “anticipation in action” (feel free to refer to photos on your phone).* 3 | **Meaning Map** Combine and structure the group’s data in a network diagram, and cluster it around potentials for evolution. 4 | **Reinfuse Expertise** to enrich these scenarios, and add further structure to distinguish them (e.g., in terms of their value dimensions).

Phase II: Exploring the future (20 minutes)

Groups use 5 cards to structure a light-weight role-play. 1 | **Play to Anticipate the Future:** We use play to explore what the scenarios might be like: *grab another sheet of paper.* Each person should volunteer for a role. The roles are simple and conversational, and their purpose here is to help us find new patterns. Each role has control over a special word: 2 | **Kaiju Communicator** = “however”, 3 | **Analyst** = “because”, 4 | **Designer** = “therefore”, and 5 | **Historian** = “specifically”. If you want to swap roles, you can, if it’s agreed.

Phase III: Enacting the future (20 minutes)

Groups will present the futures they developed and give a summary of their explorations. Other groups will have a brief chance to ask questions.

Phase IV: Project Action Review (or “PAR”) (20 minutes)

We will work together with participants to build a **Roadmap** towards the desirable scenarios. We do this by carrying out a **PAR** of the activities we’ve done today, and structuring the next steps.

1. Review the intention: what did we expect to learn or make together?
2. Establish what is happening: what and how are we learning?
3. What are some different perspectives on what's happening?
4. What did we learn or change?
5. **What else should we change going forward?**

Phase V: After the workshop

Take action on the next steps we’ve gathered. Share progress via <https://groups.google.com/g/peeragogy>.

4.2 Intermediate artefacts

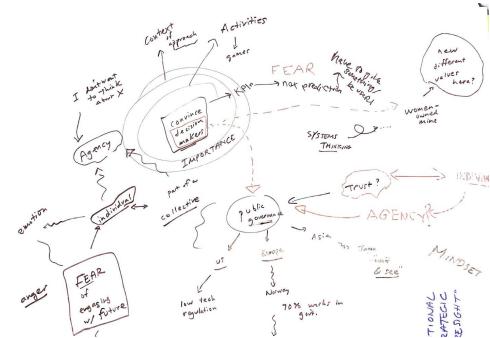


Fig. 2. In the workshop, participants used cards to structure discussions, and facilitators took notes and made diagrams.

Participants had different responses to the structured interactions. Some considered the workshop to have led to good conversations, but doubted if the manipulatives and other structures helped. Nevertheless, some participants did use the manipulatives in creative ways, such as asking each other to pass around the cards describing roles in order to better narrate the points they were making, and joining in on note-taking when the facilitators got up to move around the room.

4.3 Output patterns

The framing our workshop within the Anticipation conference suggested a pattern that could be repeated in other settings:

GOING META

(c)

Context In the course of working on a project together.

If we find a *gap* between our ideals and our methods;

Then Try “going meta”, to explore how the project’s methods can be applied to itself.

Example In a community that usually focuses on anticipating the future for others, try inviting members of the community to anticipate the future of the community.

Reflecting on the attendees’ contributions, both in terms of their concrete comments about the Anticipation community as well as the way they interacted within the workshop gave rise to the following proto-pattern:

◆ INCREASE PARTICIPANT CONTROL

(m)

When organising a collaborative activity, participants should not remain only a audience, or only deliver scripted lines. Give them increasing responsibility.

Looking back at some remove, we can also notice a pattern that relates the work in this section to the paper:

◆ PILOT TO ANTICIPATE

(s)

Now invoking the GOING META pattern in the context of our work on this paper, we reflect that our strategy of piloting our workshop methods was the way we choose to anticipate the issues likely to arise in future iterations of the workshop.

4.4 Diagrammatic Summary

The following diagram shows how the new GOING META pattern was synthesised together with three patterns that were present in the workshop context, namely DÉRIVE COMIX, MEANING MAP, and REINFUSE EXPERTISE. Some new patterns can be worked out in advance of the workshop, however, following the PLACARD method, the synthesis of new patterns typically makes use of the “open world” of the workshop and its context.

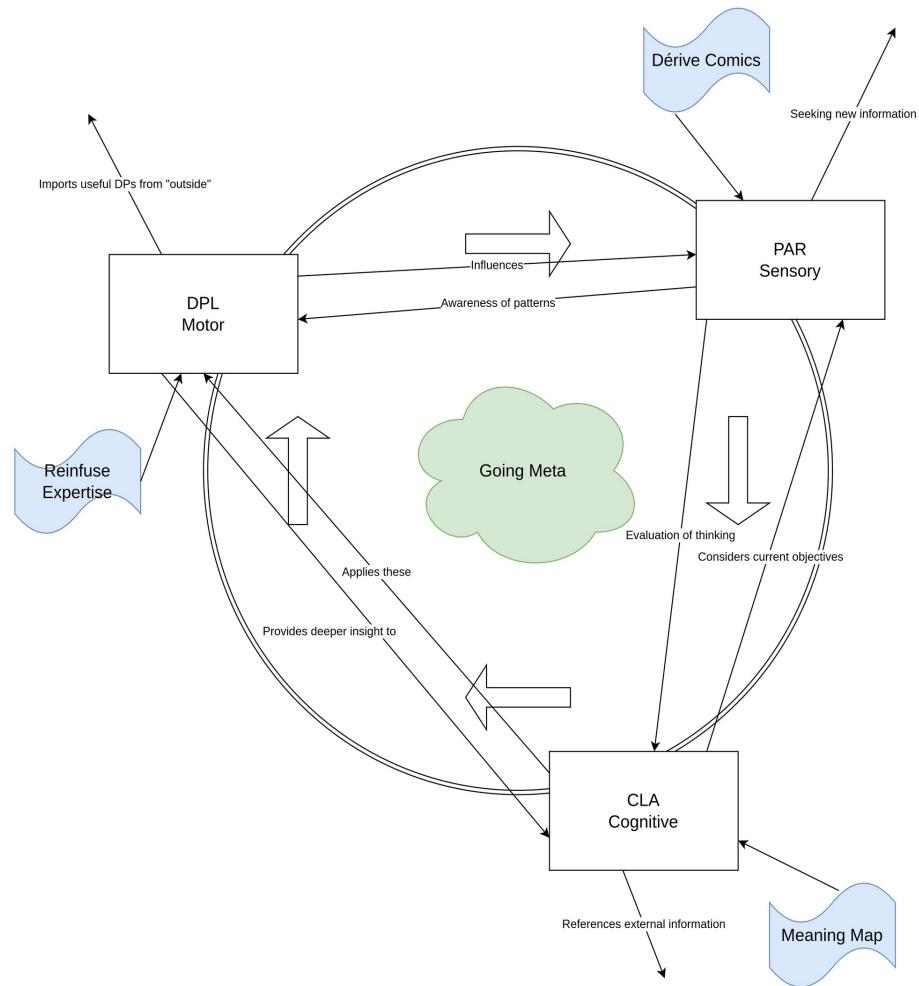


Fig. 3. Relationships between sensory, cognitive, and motor patterns (paralleling *MB DRAWING A MAP* from Iba and Isaku [2016]), here illustrating the synthesis of a new pattern relative to existing patterns

5 CASE STUDY 2: PUBLIC SPACE FOR PUBLIC HEALTH

This workshop was commissioned by Abby Tabor as part of her project “Designing urban environments for human health: from the microbiome to the metropolis”. The aim was to gather attendees with an interest in the project themes and work together to envision next steps. Elaborations of these were developed by participants, and were organised by facilitators using a software tool based on Org Roam and Org Roam UI.

5.1 Input patterns

Alongside the main components of the initial workshop, we looked for new methods to INCREASE PARTICIPANT CONTROL. In particular, we generated some further articulations of the FUNCTIONAL ROLES to help with this.

The patterns are presented here with a mnemonic symbol based on the chess set; at the workshop, participants were provided with physical manipulatives from a chess set that helped them get a grasp on the roles, along with new pattern cards with the text on.

TIME TRAVELLER

(s)

Question *What has happened in the past, what could happen in the future?*

Role To provide historical context and anticipate alternate futures.

WRINKLER

(m)

Question *What could go wrong?*

Role. Consider what might derail or counter the proposed solution. Each wrinkle can be assigned a level of perturbation (from low to high).

ANALYST

(c)

Question *What are the moving parts?*

Role 1 Consider the current challenge and all the components of the potential solution (actors, resources, institutions). Identify and orchestrate the dynamic network of these components.

Role 2 Consider the other challenges specified beyond the current focus. Identify and orchestrate the integration of these components relevant to the present challenge.

(*We also characterised some roles which would be filled by offsite and onsite facilitators.*)

FACILITATOR ROLES

(c)

Context Developing a collection of interrelated design patterns.

If you are getting ideas from participants who play FUNCTIONAL ROLES BUT the ideas aren't all connected with each other in a structured way.

Then introduce facilitator roles to help structure the collection.

Specifically, LINKERS, and REFLECTORS are two roles that we have found useful.

(*The following patterns describe functions that were filled by offsite and onsite facilitators.*)

LINKERS

(s)

Question *How do proposed scenarios build into patterns across layers, and how do they interact within the constellation?*

Role. Data wrangling as it comes in, providing visualisation of patterns and interconnections.

REFLECTORS 

(c)

Question *How is the scenario evolving?***Role** To appraise each developing scenario, provide a format for reflection (e.g., PAR), make decision to continue, reset, end.

5.2 Itinerary

Public spaces are the foundation of healthy communities.**0930-1000. Arrival, tea and coffee (Waterside 3)**

Informal meet-and-greet with other attendees.

1000-1030. Media screening and introduction to the workshop (Cinema 2)

Abby will outline the aims of the workshop. Judith will introduce polyphonic documentary as a way of communicating beyond the workshop. Consent forms needed for the next phase.

1030-1045. Introduction to the hands-on activities (Waterside 3)

Joe will walk through this itinerary, as an overview of the workshop itself.

1045-1230. Session 1: experts to citizens (Waterside 3)

In this session we aim to get everyone on the same page, using big sheets of paper and whiteboards.

Dérive Comix: Share your mental images of “public space & public health” (feel free to refer to photos on your phone or other data you’ve brought along).

Meaning Map: Combine and structure each group’s data in drawings and diagrams, finding common themes.

Envisioning the future: Share key findings as *future stories*, which we will collect in one overall map.

1230-1330. Lunch (provided) **1330-1500. Session 2: citizens to action (Waterside 3)**

In this session we explore the scenarios that we developed and identify paths to action.

When you return from lunch, the offsite facilitators will have created a digital version of the meaning map. They will walk through what they’ve created. Joe will describe the hands-on methods that we will use to communicate our findings from this session to the offsite facilitators, who will use them to elaborate the map.

We will ask you to map out the challenges that your future stories present, and ways of addressing them, using the four keywords and blank cards as your “game board”, and using the roles to elaborate the findings.

1500-1515. Review (Waterside 3)

5 minutes summary from Abby and Joe; 5 minutes outlook on Phase III from Leo and Noorah; 5 minutes comments from participants.

1515-1530. Close (Cinema 2)

(10 minutes) Media screening: We will watch some short films depicting public space, with new eyes.

(5 minutes) Closing remarks from Abby

1530-1700. Reception (Watershed bar) 



Fig. 4. Use of manipulatives to create new patterns (paralleling MA 1.3 *MINING ATMOSPHERE* from Iba and Isaku [2016])

5.3 Intermediate artefacts

Intermediate artefacts generated within the workshop included mindmaps created with participants, on paper. We used a graphical template following the outline of the Causal Layered Analysis layers to explain the workshop's overall workflow, and also asked participants to use a version of this diagram as a "grid" for note-taking within Phase I, to encourage them to work from their observations to the core underlying themes and issues. Participants then clarified these core themes in a share-back process, and in Phase II, developed them further in the form of shared future stories, outlining paths to action. Photos in Figure 4 show the movement from:

- initial sketching at the start of Phase I, beginning at the *litany* level, within small groups (upper left), to:
- a collection of themes shared across groups at the end of Phase I, to create a **MEANING MAP** which, in CLA terms, is intended to bring everyone into a shared *myth* layer (lower left), on to:
- Phase II work using **PATTERN LANGUAGE COMPONENTS**, to identify both general and specific possibilities for action.

5.4 Output patterns

Reflecting on the contributions of the workshop convenor and special guest, we observed a pattern that could be used in subsequent workshops.

CONTEXT SETTING (c)

Context A workshop or other working context has been convened.

If the facilitators have ideas that they would like to explore with attendees BUT these ideas are not top of mind for attendees.

Then do some context-setting, e.g., showing videos, giving a short talk about why people have been invited and describe the hoped-for outcomes.

Participants created several patterns by making use of the PATTERN LANGUAGE COMPONENTS and FUNCTIONAL ROLES. They presented below in proto-pattern form. These summaries condense details which developed in the workshop using manipulatives (cards and chess pieces), which afforded greater articulation, but, perhaps, less coherence.

◆ CONTESTED SPACE (s)

So-called public space doesn't always feel welcoming to all members of the public. It can be overrun with antisocial behaviour. It can feel exclusionary, or uninviting. It can be the site of conflict. Although the uses of public space are complex, each space need not to support every use equally.

◆ REBALANCE SOCIAL SERVICES (m)

Welfare-related services should be supplied in balance with local needs, though they often are not. Can varied expertise be integrated in a similar way to the domain-specific skills practised by Médecins Sans Frontières to address complex local challenges?

◆ FUNDING OF PUBLIC SPACE (c)

Even though public space is known to increase wellness in the population, well-being priorities that would lead to increased funding for public space aren't universally adopted. In order to make the benefits of such investment clear, increase transparency around investments in public welfare, e.g., create register of impacts of local social enterprises.

The right-hand panel of Figure 4 shows how participants elaborated the FUNDING OF PUBLIC SPACE proto-pattern on the day, using the PATTERN LANGUAGE COMPONENTS that we provided as keywords on index cards; the others listed above were diagrammed out similarly on the day.)

5.5 Remark on the Roles of Roles

The three proto-patterns CONTESTED SPACE, FUNDING OF PUBLIC SPACE, and REBALANCE SOCIAL SERVICES each were formed, in part, through the influence of the TIME TRAVELER, ANALYST and WRINKLER roles. Their contents have significant differences, expressing the different compositions and interactions of the workshop groups.

Relevant next steps could include revision and re-articulation of the proto-patterns in more formal terms, and gathering evidence that would support or refute the value of specific interventions. The future operations might be supported by new FUNCTIONAL ROLES, or by further elaborations of those already described above, such as through creating or combining roles. Indeed, review (e.g., during a PAR) of the contributions to the process that were made by different roles could help to articulate the need and plan for evolution at the process level.

TIME TRAVELLER	contributes to elaborating <i>the prior belief over states</i> and the <i>likelihood of specific observations</i> .
ANALYST	contributes to elaborating the <i>generative model</i> .
WRINKLER	contributes to elaborating the <i>factor of surprisal</i> .

Table 1. Key factors in the Active Inference Framework are reflected in participant roles

Presently, with Table 1 we draw attention to the way in which the three main participant roles operationalise key aspects of the Active Inference framework [Smith et al. 2022].

6 CASE STUDY 3: OPEN RESEARCH FUTURES

This workshop was developed as an “Away Day” for faculty and staff members at Oxford Brookes University. The aim of the workshop is to elaborate the institution’s open research strategy relative to its existing organisational strategy. Methodologically, this workshop builds on a pre-seeded Org Roam network of interlinked themes and an additional activity that enlists attendees in taking concrete actions on the identified next steps. This itinerary reused the language “experts to citizens”, “citizens to action” from the previous workshop (with a slight variation suited to the context). These phases mirrors the DÉRIVE COMIX—MEANING MAP—REINFUSE EXPERTISE structure introduced earlier.

6.1 Input Patterns

DO YOUR RESEARCH

(s)

Context Prior to beginning a formal workshop or other participatory research activity.

If it looks like it will be possible to do participatory research BUT the participants haven’t begun speaking with each other yet.

Then start doing the research in a more centralised way before inviting direct collaboration, in order to give participants something to engage with.

Example In the current setting, this pre-research included 1-to-1 interviews with about half of the invitees, as well as internet research to find and explore related scenarios developed by others.¹

STRUCTURE CONVERSATIONS

(c)

Context Having convened a workshop or other participatory research activity.

If unstructured discussions are likely to take lots of time but without yielding concrete benefits.

Then structure the discussions around shared interests to move things forward more effectively.

Example At this workshop, we decided to group participants around tables according to the faculty where they were employed (or most closely aligned, in the case of university-level support staff).

THE FUTURE BEGINS NOW

(m)

Context Having developed possible next steps.

If appears that leaving without concrete commitments means concrete actions are less likely to take place.

Then introduce early actions within the collaborative setting to create commitment.

Example One way to build commitment would be to ask people to develop and share a method for a small-scale experiment that they plan to carry out.

(In the event, there was not time to do the activities described in THE FUTURE BEGINS Now within this workshop.)

¹<https://royalsociety.org/topics-policy/projects/research-culture/changing-expectations/visions-of-2035/visions-of-2035-materials/>

6.2 Itinerary

Open Research can accelerate progress on Brookes 2035 Strategy

1000-1015. Arrival, tea and coffee ☕

Informal meet-and-greet with other attendees.

1015-1030. Introduction to the themes of the workshop

David Foxcroft will introduce the context and aims of the workshop: the [Open Research Programme](#), and the way what we're doing relates to Brookes strategy and vision. The "[SOLACE](#)" acronym is useful for organising this.

1030-1045. Introduction to the hands-on activities

Joe will walk through this itinerary and give an overview of the workshop, briefly describing where the methods came from (Corneli & al., 2021), and what can be expected based on previous pilot workshops.

1045-1230. Session 1: Experts to citizen/scientists

We have an initial "map" of open research at Brookes, based on interviews with the Open Research *ad hoc* Advisory Group. Today, we will work in ≈4 small groups, organised by faculty, to elaborate this map. We will draw on our experience as consumers and producers of research, organising our observations by their depth of meaning. We will share our findings with the larger group as "future stories".

1230-1330. Lunch (provided) 🍽️

1330-1445. Session 2: Citizens to action

In this session, we explore the future worlds we imagined and identify potential paths to action. We will do this using two simple design languages. The first helps us find patterns in our current context. The second helps us see how those patterns evolve over time. Both phases will be lightly facilitated, with share-back at intermediate points.

1445-1455. Comfort break 🛀

1455-1545. Session 3. What now?

In the previous session, we identified possible next steps and their potential ramifications. We will use this session to discuss the *first steps* that we want to take following this meeting, and the accountability that we want to put in place following the workshop. We will use some of the [publication types](#) available on Octopus.ac to write these up.

1545-1600. Closing

Reflections on the day.

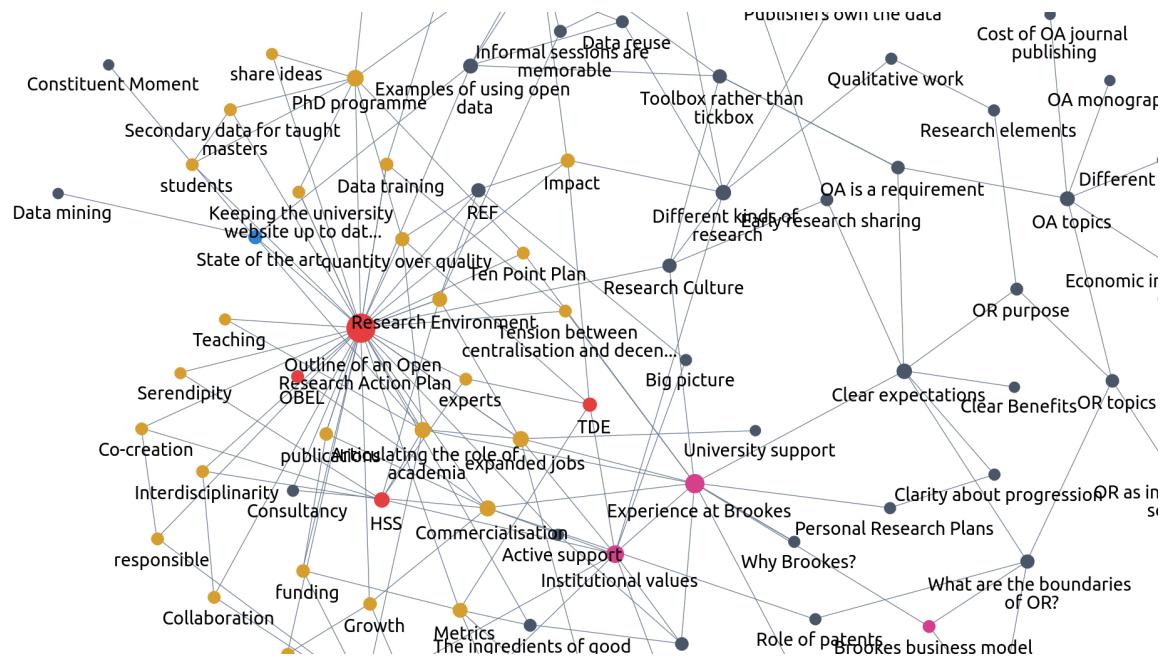


Fig. 5. Screen shot of Org Roam UI, showing the development process leading to a draft Open Research Action Plan (ORAP). Color-coding is: (Gray) Background themes and concepts based on interviews; (Purple) Selected themes from the background which became the focal themes in the workshop; (Yellow) Workshop themes and concepts; (Red) Key points of organization for workshop themes, including discussions per faculty as suggested by STRUCTURE CONVERSATIONS. The node “Outline of an Open Research Action Plan” includes the ORAP, instantiated here as a bullet-point outline, with links to all of the workshop outputs.

6.3 Output Patterns

STRUCTURE OUTPUTS

(m)

Having gathered themes from a participatory project, they may have some explicit (e.g., because of how the information was gathered, cf. STRUCTURE CONVERSATIONS). Additional structure can be created, if you link intermediate artefacts into a relevant template.

In this setting, we used a template provided by the UK Reproducibility Network for developing an Open Research Action Plan (ORAP) [Darby 2021] — itself, essentially, a complex pattern. We linked the themes discussed in the workshop into this template, to form a bullet-point draft of an action plan, incorporating the next steps and concerns raised by attendees. We did not specifically include all of the background that appeared in our earlier interview (*cf.* Do Your RESEARCH). Figure 5 shows all of this material in an intermediate form, where we used Org Roam to analyse the workshop themes (per the LINKERS pattern, above). The process illustrated in this figure moves in the opposite direction of Figures 3-7 of Iba and Isaku [2016], insofar as they complexify a tree as a graph, whereas we here move from an interlinked graph of topics to a summary map in tree form. This relates to the interplay of informal and formal work, elaborated in Appendix A.

7 CASE STUDY 4: CIS 9590, INFORMATION SYSTEMS DEVELOPMENT PROJECT

7.1 Introduction the course from the instructor, Mary Tedeschi

CIS 9590 is Information Technology Project Design and Management is the “Computer Information Systems” (CIS) capstone project course for the CIS major wherein the students will apply concepts and techniques from prior course work, to design, develop, and create an implementable application for a working information system of an actual business. It also focuses on the design and management of systems to meet the increased need for information within an enterprise. The course exposes students to the fundamentals of IT project management required for the successful implementation of IT-based systems. The course presents tools and technologies for project definition, work breakdown, estimating, planning and scheduling resources as well as monitoring and control of project execution. Students utilize knowledge gained from prior coursework, and work in groups to design and manage an Information Technology project. During my first semester Spring 2020 teaching with the students using whatever development tools they were familiar, I noticed this to be a problem so with this knowledge I changed the course to require the use of Intel One API. This did not get implemented until Fall 2021. I actually taught the course three times before requiring the software tool uniformly changed. The course was a 3 hour course, first face-to-face. Then synchronous online only. In Fall 2021 we changed to 75 minutes in person and online (hybrid). Students had to self-teach Intel One API with the use of tutorials and buddy system. The students seemed to have the necessary skills to learn enough of the software to create an implementable application. This semester, Spring 2023, the students really seemed to lack the coding skills.

7.2 Our use of “Patterns of Patterns” within the course

We used the paper “Patterns of Patterns” as a focal text with three successive cohorts of CIS 9590 students. The course syllabus is focused on developing group projects with a computer programming component. Our hope was that the topics in the paper would inspire them with new ideas about design and collaboration. We focus primarily on the latest iteration of the course (Spring 2023), in which we made the most explicit use of the methods described above. Figure 6 shows some of our anticipations of the relevant concerns that apply in this context.

Each year, students asked many thoughtful *questions* about the paper; they also produced their own *written response* to the paper, engaging the original paper in depth; and in the latest run, we offered some in-class *exercises* based on the workshop methods described above. Reading these written responses showed that the students had not only understood the main ideas of our paper, but added to them. In effect, they created alternative imaginaries for the paper’s history and future. For instance, in their 2022 ‘case study’, they generated a “Recommendation and Implementation Plan” which proposed specific actions which a group could take based on our ideas; and, in 2023, the students produced a slide presentation based upon our paper, exploring its relationship to themes such as “emerging technology”. It is worth highlighting that while our paper did touch briefly on the theme of emerging technology, the students considerably elevated the importance of that theme in their feedback.

Building in part on these student responses, we will now present our reflections using the Causal Layered Analysis layers. This is scaffolded by the two diagrams in Figure 6.

7.2.1 Litany. Initially our paper was introduced as a contemporary reading, relevant to the “CIS” theme. Mary chose a contemporary paper in part because students would not be able to “cheat” in their reports, because our paper wasn’t described extensively on Sparknotes or similar. Along with this (intentional) challenge, CIS 9590 students encountered a range of more or less predictable problems, e.g., many felt a lack of confidence with coding. The students came to the course with a variety of different backgrounds (e.g., Python vs C++) which contributed to some friction with this course.

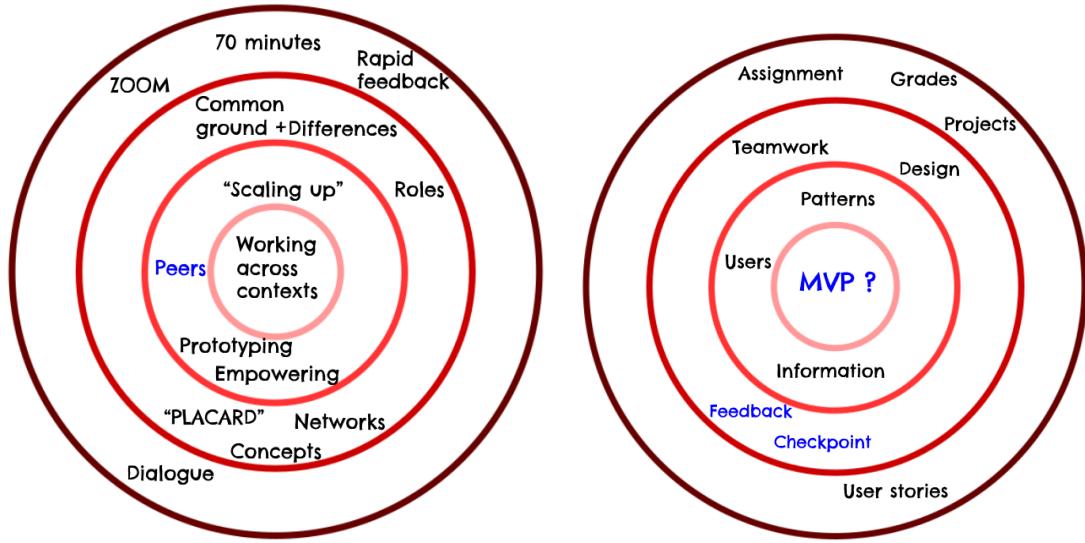


Fig. 6. Diagrams created before our first session with the CIS 9590 students, inspired by Causal Layered Analysis. The diagrams describe our working context as guests in CIS 9590 (left), and our initial understanding of the students' working context (right).

7.2.2 System. Whereas in our rounds of earlier participation we were more there for enrichment, in the most recent iteration our contributions were more closely integrated into the main activities of the course. We attended more sessions, including one in which we attempted to run a short version of the workshop with attendees via Zoom. Ongoing interaction saw us in an ‘in residence’ role, advising on various aspects of the projects. Furthermore, Mary attended at least as many meetings of the Peeragogy project (one of the centres of development for PLACARD) as we attended sessions of the course, fostering an exchange of ideas and viewpoints between these two contexts. In the short term, this led to productive synergy and, in the long term, could lead to our pedagogical and peeragogical initiatives becoming more integrated into a larger system. This collaboration continued post-semester, insofar as Mary invited the students to express interest in possible internships in the Peeragogy project.

7.2.3 Worldview. Students were thinking about their future careers. What they wanted to get out of the course (e.g., becoming a well-paid data scientist or business leader) at times had some friction with the practical reality of the course requirements, in which they had to deliver a concrete hands-on working project, without being able to rely on employees. PLACARD wouldn’t be of much direct help with the technical challenges they faced with the Intel One platform, but we hoped it could help them organise their work in a sensible way. The ideas underlying PLACARD informed our contributions to the course at various levels; for example, in a session with Mary in which we ‘workshopped’ CIS 9590 with other peeragogues, discussants suggested adding more touchpoints for peer learning and feedback (*à la* the PAR).

7.2.4 Myth. A deep metaphor within the classroom setting is *pedagogy*. However, the methods that we brought as guests was more linked with our experience of *peeragogy*. In the new shared context, these two perspectives begin to integrate. Mary as a host exercised the value of *xenia* by bringing us into her course as guests. The possibility of student internships within the Peeragogy project would create the reciprocal opportunity for further

student practice with CIS skills in an applied context, helping to build tools and platforms for peer learning and peer production (including through use of pattern methods). Indeed, the particular combination of peer learning and formal education developed here led us to wonder how far off the Peeragogy project might be from being able to support informal learning of relevant programming concepts (preliminaries to CIS 9590) or applied computing projects (an analogue of CIS 9590). The students' emphasis on the theme of 'emerging technology' suggested that whatever synthesis develops, it may include significantly upgraded technical components.

7.3 Proto-patterns describing the experience, by a CIS 9590 student, Manny Singh

The following proto-patterns summarise one student's reflection on how our "active engagement and promises to come again in the following weeks to see progress on everyone's individual project kept the butterflies, nervousness, and willingness to deliver all alive at the same time." Further inline commentary expands and analyses the proto-patterns using PATTERN LANGUAGE COMPONENTS.

◆ ENGAGEMENT AND GUIDANCE

(m)

The authors of 'Pattern of Patterns' actively participated in our class, to share expertise and create a collaborative learning environment. Their presence allowed us to gain deeper insights into the paper's concepts and methodologies, leading to innovative project approaches. By closely studying the patterns of patterns identified in their research, I gained a fresh perspective on project organization and established a logical and coherent structure.

Notice that within this capsule summary there are at least two implied conflicts:

- Team work is required *HOWEVER* the ways to scaffold effective collaboration are not entirely obvious;
- Project development is required *HOWEVER* project structure is not obvious.

Our interactions with both the teacher and the students helped us theorise the confusion:

- These difficulties exist *BECAUSE* participants do not have enough experience grappling with 'worked examples' (both learning best practices from successful examples, and learning by giving constructive feedback on less-successful examples).

"Patterns of Patterns" provides some generic methods that can be applied to the domain-level problems. Moreover, contact with the authors shifted the game, relative to simply reading the preprint.

- *THEREFORE, share some easy-to-understand general-purpose method with novices, and put them in regular contact with people who have significant experience with problems in the domains of project management and collaboration.*

Thinking beyond the Spring 2023 CIS 9590 cohort to next steps, we need better ways to share this kind of experience:

- *SPECIFICALLY, can the Peeragogy project develop an internship/mentoring programme? Respectively, can more touchpoints for mentoring and peer feedback be built into the CIS 9590 curriculum?*

◆ AVOIDING MISTAKES

(c)

The authors' insights helped me navigate common project development pitfalls. Through their emphasis on effective documentation, regular testing, and thorough project planning, I was able to avoid costly errors. Their guidance ensured a consistent progress trajectory and maintained the professionalism of my final project.

The nice features of "effective documentation, regular testing, and thorough project planning" might be interpreted in terms of PLACARD components:

- *A project needs to be carried out *HOWEVER* it's not clear what to do to make the project a success*
- *BECAUSE projects have fairly well-known failure modes*

- *THEREFORE teach and carry out ways to avert those failures: e.g., use Project Action Reviews to keep track of incremental steps in the development of the project; use Design Pattern Languages to design, build and evaluate prototypes; and use Causal Layered Analysis to integrate data from these to build an adaptable project plan that addresses a real problem.*

(That said, it would be helpful to offer more specific guidance, relevant to the novices' working context.)

- *SPECIFICALLY, use a resource like Hoover and Oshineye [2009] to flesh out this advice for future CIS 9590 cohorts, and ask them to document the patterns they use.*

◆ SCALING AND ADAPTABILITY

(c)

'Pattern of Patterns' underscored the importance of scalability and adaptability in project design. By considering future technologies and incorporating modular elements, I aim to seamlessly adopt new advancements. In particular, I focused on building a flexible framework that could easily accommodate emerging technologies.

In the language we've been using internally, "scalability and adaptability" sounds a lot like 'working across contexts'.

- *We want a system that will adapt to situations we haven't encountered yet HOWEVER we need something reasonably specific and concrete in order to work in any given context*
- *BECAUSE we need to organise evolving complexity*
- *THEREFORE develop a modular approach to design and development, and incorporate future scanning into the workflow*
- *SPECIFICALLY let's look for more ways to develop 'alternative imaginaries' for the Patterns of Patterns project.*

7.4 Further reflections and next steps

Our anticipations (summarised in Figure 6) didn't precisely match our reflections at the end of the course. The missing steps on the way to the eventual synthesis could suggest further patterns, including elaborations on Manny Singh's proto-patterns that would give them more specificity, and influence our participation in future cohorts. We observe that when *working across contexts*, many of the 'forces' at work in a given context are initially hidden to us. For example, we didn't anticipate the students' hesitance around coding, nor did we anticipate their taking up the cause for emerging technologies around PLACARD methods.

The analysis in Section 7.2, paired with the proto-patterns in Section 7.3, develops the *litany-to-myth-back-to-litany* outline typical of other workshops. Like the first case study, we used the experience to workshop our methods, here resulting in specific directions to explore in our ongoing and future work.

For example, in Figure 7, we used a visual CLA template like the ones in Figure 6 to help design a new introduction to computing course for high school students. Here, part the *system* layer envisions 'multiple circles' (i.e., multiple instantiations of this same template) which would express the developing perspective of different groups of students, to be integrated through a 'monitoring' interface used by the instructor. This is a good expression of how working across contexts could work in practice.

8 DISCUSSION

We presented the patterns that we developed and used over successive runs of our workshop, in approximately chronological order. This showed how the use of certain patterns help to give rise to the "seeds" of new patterns. The evolving workshop method is a pattern language which operationalises the PLACARD pattern.

The first workshop mixed PATTERN LANGUAGE COMPONENTS with FUNCTIONAL ROLES, putting participants in the thick of a pattern-related dialogue. While this led to interesting conversations, it was more work to extract any patterns. However, we did find some useful process patterns this way, such as INCREASE PARTICIPANT CONTROL.



Fig. 7. We used the CLA template to plan a future Introduction to Computing course for high school students

We employed what we learned in subsequent runs. In the second workshop, a more distinct use of the PATTERN LANGUAGE COMPONENTS helped the participants come up with their own patterns.

There is an interesting interplay between content-level patterns like these, and process-level patterns. For instance, the workshop is akin to a public space; further development of the associated tools might make it even more of a public resource — somewhat like Wikipedia, but endorsing the contribution of original research, not forbidding it. Already, the workshop is a context in which to do a kind of rapid, local, open research.

In order for any pattern-informed research to work well, we should be gathering evidence for or against the salience of the patterns that are elaborated. The Octopus² platform mentioned in the itinerary for Case Study 3 uses several data types that follow the rough outline of a scientific paper, *viz.*, Research Problem, Rationale/Hypothesis, Method, Results, Analysis, Interpretation, Real World Application, and Peer Review. The formulation of an Octopus-like platform for recording and reporting on design patterns would probably need to change somewhat — but the **Problem**, **Rationale**, **Method**, and **Results** components are reasonably familiar for pattern authors.

Table 2 summarises the patterns that were described in this paper, pulling them together from across the separate case studies. The table shows the patterns grouped in a way that elaborates our use of “PAR”, “CLA”, and “DPL” methods (summarised in Section 2.1) with a more rounded description of the purposes that these methods serve. Figure 8 summarises the patterns in a more visual way.

²<https://www.octopus.ac/>

Sensory:	
DÉRIVE COMIX	'document what you see'
PATTERN LANGUAGE COMPONENTS	'build patterns piece by piece'
FUNCTIONAL ROLES	'introduce different perspectives' (in bold below)
PILOT TO ANTICIPATE	'anticipate the issues likely to arise in future iterations'
CONTESTED SPACE	'each space need not to support every use equally'
Do YOUR RESEARCH	'start doing the research in a more centralised way'
TIME TRAVELLER	'provide historical context and anticipate alternate futures'
LINKERS	'providing visualisation of patterns and interconnections'
Cognitive:	
MEANING MAP	'get everyone on the same page'
FACILITATOR ROLES	'structure the collection'
CONTEXT SETTING	'describe the hoped-for outcomes'
FUNDING OF PUBLIC SPACE	'create a register of impacts'
GOING META	'explore how the project's methods can be applied to itself'
STRUCTURE CONVERSATIONS	'structure the discussions around shared interests'
AVOIDING MISTAKES	'navigate common project development pitfalls'
SCALING AND ADAPTABILITY	'aim to seamlessly adopt new advancements'
ANALYST	'identify and orchestrate the dynamic network'
REFLECTORS	'appraise each developing scenario'
Motor:	
REINFUSE EXPERTISE	'enable richer and more complex thinking'
INCREASE PARTICIPANT CONTROL	'participants should not remain only an audience'
REBALANCE SOCIAL SERVICES	'address complex local challenges'
THE FUTURE BEGINS Now	'introduce early actions within the collaborative setting'
STRUCTURE OUTPUTS	'link intermediate artefacts into a relevant template'
ENGAGEMENT AND GUIDANCE	'create a collaborative learning environment'
WRINKLER	'what might derail or counter the proposed solution'

Table 2. Twenty-five “Patterns of Patterns”

9 CONCLUSION

We hoped that running these workshops would help us design the next steps for our platform and process, and this seems to have been successful. As an immediate outcome, we developed the “PLACARD workshop” — now retitled “Open Future Design” — across several successive runs in different organisational contexts in a way that makes it more robust. This relative success notwithstanding, it is worth recalling that our initial intention in “Patterns of Patterns” was to support distributed collaboration across contexts.

The informal pattern-based review of our evolving work, presented here, is a good start, if only a partial implementation of the vision. Running the Open Future Design workshop in different settings and writing up our findings here implements the Do YOUR RESEARCH pattern. Nevertheless, although wide-ranging and participatory, the development of this research remains mostly centralised. We have not yet implemented a fully distributed peer-to-peer collaboration platform, however, we have created something like a client-server simulation of one.

A crucial insight is that the meta-level is just another domain. All models that aim to be practical — whether patterns of public health, open research, climate action, or patterns of patterns — should include predictions



Fig. 8. Mapping our collected “Patterns of Patterns” to the four CLA layers. (Color code: blue=sensory, green=cognitive, red=motor.)

about the causal connections between actions and measurements, and should incorporate strategic intelligence to articulate action.

Again, here, we have made a start. In particular, this research scaffolds an alternative Causal Layered Analysis of pattern language methods to the one developed in the previous “Patterns of Patterns” paper. (The visual summary in Figure 8 is elaborated in Appendix B.) More work would be needed to fully describe our patterns’ application domains, to build evidence of the kinds of results that can be expected, and to describe their interconnections as a pattern language.

That work would usefully have a software aspect. For example, a not-so-distant future for Org Roam would allow several facilitators to make notes in near real-time into a shared map, and with some more fine tuning

of the Emacs interface, a similar workflow could be used directly by workshop attendees, even across different contexts. Many rich dialogues might ensue: already we have seen the potential for fruitful cross-disciplinary interaction between people from fields as disparate as future studies, health sciences, open research, and information systems.

Org Roam could be augmented with additional “emerging technologies”. Support for the articulation of domain-level patterns which outline potential new behaviours, and for the process of gathering evidence that those behaviours do (or do not) in fact work as intended is already an ambitious but logical ramification of the pattern method.

It is a further step to articulate the learning apparatus that underpins such mechanisms in a computationally-coherent way. The FUNCTIONAL ROLES provide an early informal articulation of the process. We have made reference to the Active Inference Framework as a foundational theory that could scaffold further more formal developments along these lines.

In a Pattern Languages of Programs spirit, it would be interesting to ‘close the loop’ with an articulation of programming-specific design considerations, as described, e.g., by Felleisen et al. [2018]. Thinking beyond traditional programming, AI methods could be employed alongside to elaborate and work with DPL models — to identify analogies between action arenas, to highlight the ramifications of complex actions, to show predicted costs and benefits, to search for tipping points that allow the effects of change to reach across level boundaries, and as well as to surface new questions.

We have begun (as we mean to carry on) by focusing on the development and articulation of multi-purpose tools for thought.

ACKNOWLEDGEMENTS

From Mary Tedeschi: I would like to thank Pai-Chun Ma, Nanda Kumar and Rudy Brown, who allow me to be creative in my classroom.

REFERENCES

- Christopher Alexander. 1964. *Notes on the Synthesis of Form*. Harvard University Press.
- Joseph Corneli, Alex Murphy, Raymond S. Puzio, Leo Vivier, Noorah Alhasan, Charles Jeffrey Danoff, Vitor Bruno, and Charlotte Pierce. 2021. Patterns of Patterns. *CoRR* abs/2107.10497 (2021). <https://arxiv.org/abs/2107.10497>
- R. Darby. 2021. UKRN Checklist for an Open Research Action Plan. <https://doi.org/10.31219/osf.io/94kr7>
- Guy Debord. 1956. Theory of the Dérive. *Les Lévres Nues* 9 (November 1956). <https://www.ccdc.vt.edu/sionline/si/theory.html>
- René Descartes. 1850. *Discourse on the method of rightly conducting the reason, and seeking truth in the sciences*. Sutherland and Knox.
- Matthias Felleisen, Robert Bruce Findler, Matthew Flatt, and Shriram Krishnamurthi. 2018. *How to design programs: an introduction to programming and computing*. MIT Press.
- Inés Hipólito and Thomas van Es. 2022. Enactive-Dynamic Social Cognition and Active Inference. *Frontiers in Psychology* 13 (April 2022). DOI: <http://dx.doi.org/10.3389/fpsyg.2022.855074>
- Dave Hoover and Adewale Oshineye. 2009. *Apprenticeship patterns: Guidance for the aspiring software craftsman*. O'Reilly Media, Inc.
- Takashi Iba and Taichi Isaku. 2016. A pattern language for creating pattern languages: 364 patterns for pattern mining, writing, and symbolizing. In *Proceedings of the 23rd conference on pattern languages of programs*. 1–63.
- T.P. Moran. 1971. (Artificial, intelligent) architecture: Computers in design. *Architectural Record* 149 (1971), 129–134.
- Rivka E Oxman. 1994. Precedents in design: a computational model for the organization of precedent knowledge. *Design Studies* 15, 2 (1994), 141–157. DOI: [http://dx.doi.org/https://doi.org/10.1016/0142-694X\(94\)90021-3](http://dx.doi.org/https://doi.org/10.1016/0142-694X(94)90021-3)
- Ryan Smith, Karl J. Friston, and Christopher J. Whyte. 2022. A step-by-step tutorial on active inference and its application to empirical data. *Journal of Mathematical Psychology* 107 (2022), 102632. DOI: <http://dx.doi.org/https://doi.org/10.1016/j.jmp.2021.102632>

A RELATIONSHIP TO ALEXANDER'S "SYNTHESIS OF FORM"

In this paper and the previous paper on “Patterns of Patterns” we have considered the problems faced by groups of people organizing their activities. This can be usefully related to two diagrams from Alexander's “Notes on

the Synthesis of Form”, recopied below as Figure A.1. Parts a.-c. of this figure have two columns corresponding to context/form (or problem/solution), and one, two, or three rows, corresponding to the “actual world”, “mental picture” and “formal picture”. A design problem is posed at the level of the actual world, say, “build a house atop this hill” or “make a celebration song”.

The design problem can be solved at one of the three levels. The most direct approach is to work in the actual world. For instance, a musician might pick up an instrument, start playing something, try out different possibilities, modify notes or phrasings to make it sound better, and so come up with a song.

At the level of “mental picture”, a designer receives design requirements which describe the problem, and produces a plan which describes a solution. For instance, the host of the party might make a request “Write a joyous song for alto voice accompanied by flute, trumpet, and saxophone to celebrate the acceptance of our paper into the conference.” A composer might then sit down at a desk, away from any instruments, and write out a score which would later be handed to the singer and instrumentalists for performance. Alexander points out that there is a danger in this process: the composer would no longer have the immediate feedback which comes from working directly in the actual world. Accordingly, the result might be a song that matches the description, but doesn’t match the mood of the event.

Alexander’s proposed solution is to produce a formal picture of the mental picture, and instead work with that formal picture. For our example, it might take the form of a suitably elaborate music theory, one that includes concepts like ‘*ballable*’ (which indicates that the song should be danceable). More generally, we employ a suitable metalanguage to reason about the mental representation; this process of reasoning can then take the place of feedback from the actual world in guiding and evaluating our designs. For Alexander, this consists of a set-theoretic formalization of design requirements and potential misfits.

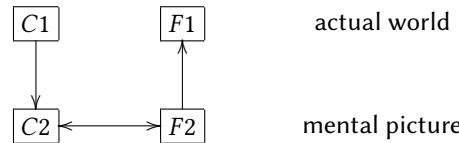
Figure A.1d refers to the process of design once we have arrived at the “formal picture” level. The left panel represents the analytic process in which one decomposes a design problem into subproblems and the right panel represents the complementary synthetic process in which one successively combines solutions to subproblems to arrive at a solution to the original problem. Alexander proposed a maximum entropy method for carrying out the analysis and, in later works, introduced design patterns for use in the synthesis; and ultimately, described 15 principles that could guide a design at an even more abstract level.

The naive “actual world” approach (Figure A.1a) would be when a group takes a “seat of the pants” approach to dealing with issues as they come up in the course of work. PAR can help to sketch a “mental picture”. CLA and DPL can be used as techniques for analysis and synthesis at the “formal picture” level. Just as even a talented musician without a solid grasp of music theory would be hard pressed to compose an augmentation canon or symphony, so too we suggest that a group which faces complex challenges may want to consider these techniques for orchestrating their activities. In sum, the methods we’ve discussed can be used to operationalise a strategy that is at the heart of Christopher Alexander’s oeuvre.

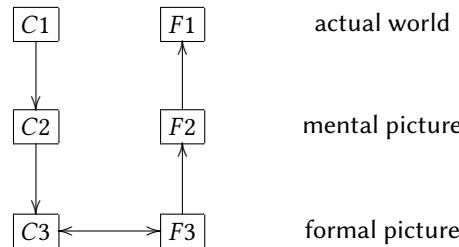
context form



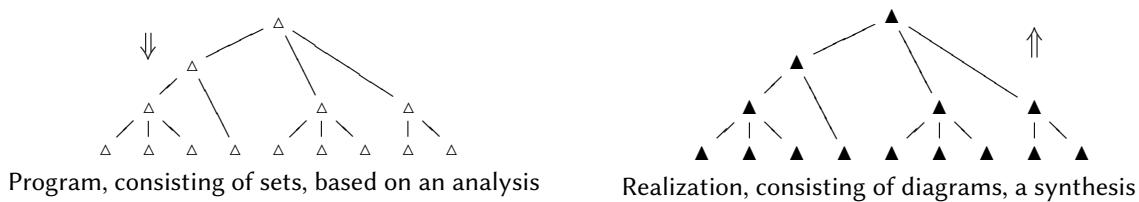
a. In this point there is a close relationship between content and form, and they evolve together.



b. In this setting we add a mental picture C_2 that abstracts from the context (e.g., design requirements). This corresponds to F_2 e.g., plans), and F_1 abstracts further (e.g., a description of the plan). This allows specialisation, but there's no direct link between C_1 and F_1 .



c. Now we add a meta-language: the formal picture corresponding to the mental picture.



d. At this level we have methods for actually doing the programming.

Fig. A.1. Diagrams from *Synthesis of Form*

B SUPPLEMENT: ANALYSIS: CLA APPLIED TO “PATTERNS OF PATTERNS”

B.1 Litany: Understanding data, headlines, empirical world (short term change)

Our Open Future Design workshop has evolved certain key features which have been retained across different implementations. Participants can expect a certain amount of CONTEXT SETTING, as well as an introduction to PATTERN LANGUAGE COMPONENTS, and FUNCTIONAL ROLES. The outputs are created collaboratively, with some emphasis on FACILITATOR ROLES. One outstanding problem is how the process of facilitation can be distributed out to participants. Already these ingredients have allowed us to organize a (small-scale) pattern-based research programme, addressing one of the problems that we saw in our earlier CLA of the DPL literature.

We have seen that Open Future Design can help people articulate and grapple with issues they see in their lives and communities, for example FUNDING OF PUBLIC SPACE, CONTESTED SPACE and the need to REBALANCE SOCIAL SERVICES. This list is representative rather than exhaustive.

B.2 System: Systemic approaches and solutions (social system)

The workshop proceeds through a combination of process steps (DÉRIVE COMIX, MEANING MAP, REINFUSE EXPERTISE), supported by facilitator who work either behind the scenes to Do Your RESEARCH or more overtly to STRUCTURE CONVERSATIONS and STRUCTURE OUTPUTS. Facilitators take on the roles of LINKERS and REFLECTORS, while participants are invited to take on the roles of ANALYST, TIME TRAVELLER, and WRINKLER. The methods we have used have a tendency to INCREASE PARTICIPANT CONTROL. This could be pushed further, e.g., with earlier phases that involve workshop participants in co-designing the workshop experience itself, and in subsequent phases which gather and analyse data. The current articulation of patterns offers a considerable amount of material that be folded into such developments.

B.3 Worldview: ways of knowing and alternative discourse

The perspective, articulated by one workshop user and endorsed by our authoring collective, is that these methods help to communicate a worldview which endorses SCALING AND ADAPTABILITY, which offers ENGAGEMENT AND GUIDANCE, and which helps with AVOIDING MISTAKES. The Open Future Design workshop goes along with the view that THE FUTURE BEGINS Now, insofar as the actions which are considered inside the workshop are things that are worth testing and developing. For this purpose a primary method used is PILOT TO ANTICIPATE. Taken together, these perspectives are linked with the ethos of Peeragogy or “peer produced peer learning”.

B.4 Myths: metaphors and narratives (longer term change)

We have flagged GOING META as the primary metaphor of this work, very much in line with the series title, “Patterns of Patterns”.

C SHEPHERD COMMENTS AND RESPONSE 1 JUL 2023, 05:43

Section4: Question regarding pattern contents: In section 3, it is mentioned that “We used design patterns directly when developing and running the workshops. A selection of these patterns are included here.” Are the patterns presented in section 4 the same design patterns developed by the authors, or are they created by someone else?

Most of the patterns in the Case Studies were developed by the authors, a few were developed by workshop participants during the workshop and only summarised here (CONTESTED SPACE, FUNDING OF PUBLIC SPACE, REBALANCE SOCIAL SERVICES). Regarding contributions from Manvinder Singh: he was originally a ‘participant’, and then became an author.

Additionally, the format of the “Selected Patterns for Case Study” in section 4 varies (e.g., some have only summaries or start with questions), which raises concerns. If these patterns were developed by the authors, it should write patterns in a consistent format with context, problem, and solution. Furthermore, it is necessary to include the Forces that explain the causes of the problem and the Consequences as potential results of implementing the solution.

Personally, I (Joe) don't fully agree with the suggestion to use ‘consistent format’ throughout the document. The patterns are presented at different levels of formality corresponding to their stage of development. Personally I don't see forces, consequences, and potential results as entirely necessary, though they might be nice to have. In particular, if the patterns aren't understandable in their current format, they certainly need to be revised. Let's see if the clarifications we've developed so far are enough.

What we've come up with, after consultation with the coauthors, is a better explanation of what we aim to do with the patterns here (in the Methodology section) and a lot more pictures that aim to illustrate the points that are being made. Hopefully this achieves most of the additional clarity that was intended by the shepherd suggestion above.

(One more quick point about forces: we talk briefly about how a force analysis is complicated by working across contexts in Section 7.4.)

Regarding the structure: In the current paper, each subsection of section 4 presents the Itinerary first, then presents the “Selected Patterns for Case Study.” However, since the patterns are embedded within the Itinerary without being presented beforehand, it becomes unclear. It leads to confusion, such as in the case of 4.1.2. Considering the flow from the METHODOLOGY in section 3, it might be more reader-friendly and coherent to present 4.1.1 as “Selected Patterns for Case Study” and 4.1.2 as Itinerary. This way, readers can follow along with the discovery of how the patterns shape the itinerary. Additionally, assigning pattern numbers to each pattern and including the number in parentheses after the pattern mentioned in the itinerary would make it more comprehensible for readers. For example, something like “Meaning Map (No.3) in the content of Itinerary.”

I've restructured each subsection ‘in order’ with clearly delineated inputs, process, and outputs. 

4.1: Regarding DÉRIVE COMIX: The solution “Go for a walk or just look out the window wherever you are, and document what you see” is important for solving the problem. However, in the Itinerary, it is mentioned to “Bring data: captioned mental images of “anticipation in action” (feel free to refer to photos on your phone),” which does not align with the solution of the pattern.

Slightly reworded to make these align better. 

4.5: The subsection name of “Proto-patterns describing the experience, by a CIS 9590 student, Manvinder Singh” seems to be unrelated to the “CASE STUDIES” which is the name of section 4. It might be better to present this as a separate section. Furthermore, the content written here appears to be a summary of what was learned from the case studies rather than patterns. If it is intended to be patterns, it is necessary to include the context, problem, and solution.

The L^AT_EX section level was incorrect, which was the main source of confusion here. These are “outputs” from Case Study 4 – not reflections on all of the case studies.

That's fixed now. 

(As for how formal we need to be about presenting them, see my comment above for now.)

Examples: AVOIDING MISTAKES, it is necessary to describe the effective solutions and the potential problems that may arise if those solutions are not implemented.

I've presented the material in both proto-pattern form and expanded using pattern language components; I think that's the right level of detail for now. 