What is Algorithmic Pattern? Reflections on a Salon

The emerging research theme *algorithmic pattern* is introduced, as bringing together people from a range of fields, including a wide range of cultural and theoretical backgrounds, to define a new interdisciplinary field. This is done in the context of the Algorithmic Pattern Salon in late 2023, considering both contributions and surveys of participants taken before and after the event. We work towards defining the central algorithmic pattern term, to help build a collective understanding of the theme. The different aspects of algorithmic pattern form primary interrelated themes: abstraction, material behaviours, human culture of pattern making, and patterns in nature. Commonalities and differences between practices are considered towards developing language for discussing them on equal terms, and opening spaces for experimentation between them.

1. Introduction

Algorithmic pattern is an emerging research theme that explores the intersection of procedural logic and material practices, encompassing the ways that algorithms interact with embodied, hands-on pattern-making traditions. It brings together people from a range of fields including algorithmic choreography, live coding in performing arts, design computation, and experimental textiles/fibre arts. As such, algorithmic pattern is a space where such people are coming together to define a new interdisciplinary field. The words *algorithm* and *pattern* are brought together as being on one hand largely synonymous, standing for a procedural, systems-based approach to creativity, but on the other hand having very different senses in popular use. This intersection opens up ways of thinking that address computation not only as abstract and digital, but also physical, historical and cultural—blurring these boundaries (Griffiths et al. 2023).

Although patterns are found in creative disciplines throughout history, and across cultures, the use of the term pattern as synonymous with algorithm in the context of computing technologies and creative practices (Dourish 2016, Spiegel 2018) generates new meanings and ways of doing that dialogue with their ancient roots. Patterns are used, committed to memory, recognized and distorted, rotated,

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transformed etc. with creative purposes but rather than abstract entities they interact with the materials of their various implementations.

Practices such as knitting patterns, weaving block designs and juggling site-swap patterns, for example, although perhaps viewed as distant from digital computation, embody algorithmic thinking in physical, embodied forms (McLean 2020). They notate discrete, numerical procedures and are therefore themselves digital and computational. These practices reveal how algorithmic systems can emerge in culturally embedded ways. This framing grounds algorithmic pattern in lived experience and tradition. Thus, this research asks "what is algorithmic pattern" in the context of practices using algorithmic pattern-making as a way to generate material.

The word *algorithm* stands for a sense of corporate, coercive control such as the hidden hand behind 'algorithmic timelines' in social media, or the unfathomable complexity of large language models. The word *pattern* has a perhaps more humane sense of patterns in hands-on craft; procedural knitting patterns, weaving block designs, and so on — what Audrey G. Bennett refers to as *heritage algorithms* (Bennett 2016). These contrasting associations offer a productive tension with which to explore how algorithms and patterns both converge and diverge in practice. Rather than positioning these as in opposition to each other, we acknowledge the potential of algorithmic pattern research practice to interrogate and potentially reframe them.

As a theme of research and practice then, algorithmic pattern seems well placed to connect people from a wide range of cultural and theoretical backgrounds, to try to establish a humane approach to creativity with algorithms, as a way to survive the 'AI summer' by connecting heritage and contemporary pattern-making technology, and better ground our understanding of what should happen next. With this motivation in hand, we still need to define what an algorithmic pattern actually is. There is a 'boot-strapping' problem here; as an interdisciplinary community, such a field should define its own terms, but does not yet fully exist. To resolve this, we created space for the community to come together and start to define itself, as the algorithmic pattern salon.

2. Algorithmic Pattern Salon

The salon took place over five days, spread between 23rd November and 1st Dec 2023. It brought people together to share and discuss algorithmic approaches to pattern-making in creative arts, craft and code. We are writing some time after the salon, using the opportunity to reflect on what went on, before our next event in September 2025. Because the salon was in part convened to help define what we might

mean by the term algorithmic pattern, it did not address a fixed theme, but began the process of building a community of researchers and practitioners to create one. Already, the algorithmic pattern framing helped us to separate computation from the specific realms of machines and codes. Yes, they are there too, but the term helps surface likenesses to a broader range of embodied, cultural, historically rich traditions. In some ways, it brings context to code and enriches our understandings (and thus future visions) for computation in society — algorithmic pattern points to a long history, not just one that emerges with industrial automation and silicon-based computing.

The following brings together the defining themes that emerged through the salon, and participants' takes on the concept of algorithmic pattern.

2.1. Communities of Practice

People have creatively explored algorithms as patterns together across millennia, working with diverse materials, developing procedures to extend their collective imaginations, and developing practices and communities around them. Such procedures may provide a defamiliarising force, as a means to arrive somewhere not purely driven by intention. As such, the creative domains under which the remit of algorithmic pattern falls are extensive, diverse and transdisciplinary; notions of pattern run through the fields of textiles, choreography, mathematics, music, design, and the visual arts, to name but a few. Each may have varied understanding, informed through entangled (Frauenberger 2019, Nordmoen and McPherson 2022) and situational knowledge (Haraway 1988, 2016) that informs the practice. For example, within textiles, one might view algorithmic instructions for knitting a sock as a "knitting pattern", but also once the sock is knitted, will observe the pattern as a construct that is both perceptual and conceptual, through its visual symmetries, presence/absence of repetition, and physical behaviours.

Patterns are also seen in contemporary computing, from the binary operations involved in low-level machine code, to high-level operations used by creative coders. However, the word *pattern* is overloaded, often used to describe simple phenomena such as straightforward sequences in music. On the other hand, as mentioned earlier the word *algorithm* is often used to describe unfathomable complexity. In combination, *algorithmic pattern* refers to human-made algorithms, where complex and surprising results can result from the combination of simple parts or rules. This offers us rich ways of making, that are easy to learn but may take a lifetime to explore.

As salon organisers, we brought together our own prior experiences working at the boundary of algorithms and patterns linking heritage and contemporary contexts, for example developing craft grammars for transmitting algorithms of wire bending in the Trinidad and Tobago Carnival (Noel 2015, 2020), introducing algorithmic musicians to the heritage algorithms in tablet weaving (Griffiths et al. 2023), generating continuous kolam line drawings and integrating them in textiles (Reddy and McLean 2024), and making pattern-based programming environments for weavers (Friske et al. 2019) and musicians (McLean 2014).

This salon itself brought people together with deep curiosity for patterns. The scope of submissions covered the following topics: architecture, music, performing arts, visual arts, textiles, human movement, mathematics and coding, and many intersections of these domains. By creating space for these communities to interact, we hoped that cross-pollination of understandings might form new insights and build pathways between less-explored conceptual framings.

2.2. Structuring Participation

The participants of the algorithmic pattern salon spanned geography, domains of practice, and professional association or otherwise. The open call invited perspectives to be held on equal ground during the symposium. For example, a PhD student might present their research studying new forms of notation for a textile craft, followed immediately by a video of jugglers enacting manoeuvres based on numeric sequences. As organisers, we found this to be a refreshing shift from the more codified and exclusive formats provided by professional and academic conferences. In some ways, it felt like a possible new path forward for collective sharing and community development that side-stepped the messy politics and exclusivity mandated by certain professional organisations. The presentations and discussions resonated with a spirit of generosity and mutual connection that emerged from a shared passion and interest in pattern, notation, algorithm and embodied experience.

This interdisciplinary spirit is prerequisite to defining algorithmic pattern as a field of practice and research, and so in a sense, forms part of its definition. We have observed that pattern-based practices traditionally take place within community groups, and perhaps as a result are often self-segregated, for example with heavy gender, ethnicity and/or class biases. Trying to work against these biases is challenging, where respect must be given to all the cultural contexts and histories at play. We hope algorithmic pattern can be common ground

for exploring these issues, and for creating space for new creative coalitions to grow inspired by these histories.

3. Defining Algorithmic Pattern

After the salon was completed, we looked to the participants of the salon to help build a collective understanding of the idea of algorithmic pattern, rather than an individualist perspective, drawing on Gergen's definition: "Knowledge is not something that people possess in their heads, but rather, something that people do together" (Gergen 1985, 270). People and groups create knowledge by negotiating the meanings of words, actions, situations, and material artefacts. They all participate in and contribute to a world which is socially and culturally structured and constantly reconstituted by the activities of all those who belong to it (Gherardi 2008). These ideas align with those expressed in the exocerebrum hypothesis, proposed by Bartra (2014), that suggests thinking is a combination of processes that occur inside and outside the skull, when our thoughts are shared with others. Cultural symbols, and symbolic systems are completed when they are put in relation to others' ideas. As such, we wanted to mediate meaning through collective knowledge from participants' reflections.

Before the salon, a questionnaire was sent to all registered attendees, asking them to share a definition of algorithmic pattern, from their own vantage point. A similar approach is employed in Live Coding: A User's manual (Blackwell et al. 2022), where members of the live coding community provided a diverse range of definitions of live coding: a practice that across domains, cultures and knowledges means different things to different people. Likewise, the open-ended question was given to the participants: "How would you define what an 'algorithmic pattern' is? No wrong answers!"

After gathering the results of the participants' individual responses, we looked for ways to draw out common viewpoints. A thematic analysis was conducted on the responses from participants according to Clarke and Braun (2017). Themes were coded with an inductive approach, where there were no prescribed frameworks for analytic preconceptions, but rather themes were left to emerge through repetitions of key concepts.

3.1. Pattern as culture, behaviour and abstraction

From the thematic analysis, we found that the different aspects of algorithmic pattern can be grouped into three primary interrelated themes. The first theme is that pattern-making involves abstraction,

generally in terms of notated procedures for making, although these procedures may also be passed on via oral tradition. These abstractions may be arrived at through playful experimentation, or potentially reasoned about as mathematical or computer scientific constructs of geometry, data structures, models and representations.

Crucially though, these abstractions result in our second theme; real-world, material behaviours. Such behaviours are often surprising, as a feature of the deterministic yet chaotic nature of the pattern-making algorithms at play, and/or with the rich physical properties and constraints of the particular medium that the pattern is working within, whether primarily material (such as textile) or temporal (such as music). In this, human perception is foregrounded and given a creative role in interpreting or perhaps finding new patterns in the behaviour. This can include the perception of interferences, deviations, glitches and errors relative to a perceived underlying pattern. As behaviour, pattern isn't just in the notation, the algorithm in motion, the material results, or our perception of those results, but in the combination of these elements as a whole.

Our third and final core theme is the human culture of pattern making, that is, the arts, crafts, musical, social and political context in which a pattern operates. This is where creation and perception of pattern becomes meaningful, whether through ritual, sharing, collaboration, decoration, trade, or the collective rhythmic entrainment of making or dancing together. This culture develops through generations, being passed on as heritage but continuing to develop, adapting to changing socio-political conditions, such as acts of colonialism and resistance.

An additional fourth theme relates to patterns in nature and geology, where patterns arise through processes such as growth, without human involvement. This is a huge and rich topic in its own right, but runs separately from our focus on human pattern making through notational and algorithmic practices. Nonetheless, patterns in nature often are involved with or inspire the abstractions, behaviours and cultures of human pattern-making, so this distinction is far from clear-cut. We also acknowledge the problems of defining nature itself, and considering ourselves as separate from it.

3.2. Commonalities and differences between practices

A challenge for any interdisciplinary community is developing understanding of each other's practices, through developing language for discussing them on equal terms. This is a particular challenge for us, as the very idea of a 'pattern' may be a core obsession in some

cultures (e.g. textiles, mathematics), while being an ambivalent or pejorative term in some others (e.g. classical music composition).[1] This work needs to establish commonalities and differences between them, reaching understanding of the trade-offs at play, and identifying the limitations of each practice. Here *limitation* is not pejorative; we see that creativity in pattern-making thrives by exploring, pushing against and at times beyond limits.

3.2.1. Pattern in creative feedback

One commonality or difference is where pattern is placed in a creative 'workflow'. Where there is an abstraction, such as a notated pattern function or procedure, this might precede an outcome, in telling how a pattern will be made. Alternatively, it may follow an outcome, in recording how a pattern was made. Perhaps things are most interesting where paradoxically, the notated pattern both precedes and follows the patterned outcome. That is, the notation is the interface for the outcome, where it is first made as speculation, followed through to one outcome, and then adjusted in response to that conclusion, to a new outcome.

In this way, the pattern-maker follows their patterned notation and material, to an outcome well beyond their imagination. According to Tim Ingold, this following of material is a given, in that all making is "[...] a matter of finding the grain of the world's becoming and following its course." (Ingold 2011). Perhaps then this is a commonality for all those now finding each other in the algorithmic field. A weaver dreams up a block design from an experimental configuration of shafts and tie-ups, tries it out in practice, and returns to adjust their notation in response, perhaps to explore interesting interactions happening in areas with unbound floating threads. A juggler tries a complex site-swap pattern, and adjusts it to find a more practical rhythm. A live coder continually adjusts their code in response to the music generated by it.

3.2.2. Material constraints

Different practices are marked by the materials and apparatuses they centre around. These materials set the rules, as much as rules are applied to them.

- Weaving - loom creating tension of warp, which weft is passed over and under. These "overs" and "unders" are dictated by a draft, a set of binary instructions that set a framework for action which, in forms of weaving that are not fully automated, invite the weaver to interpret (e.g. for instance, in practices of inlay; Searles 1984). The weaver may form part of the loom, for example a back-strap loom, where tension is provided by the body.

- Siteswap juggling - throws notated as time durations, measured in discrete 'beats', where in solo juggling an odd number passes from one hand to the other, and an even number throws and catches a ball with a single hand (Polster 2002).

- 'ET' drumming notation - a technique introduced by drummer Jaki Leibeziet (Podmore 2020), with a binary dot-dash notation as with morse code. A dot denoted a single strike, and a dash a double strike (with one hand). Rules of dynamics follow, where playing a dash with one hand gives more time for the other hand to lift and therefore hit the drum with greater force, producing an accent.

These examples of pattern-making with fiber, movement and sound respectively, are all characterised by rules that follow from physical constraints, which create rich spaces of possibility for artists to explore. All three feature discrete symbols - the up-down counts of a 2/3 twill weave or ones and zeros of a binary grid for weaving, the throw counts of juggling siteswap, the binary dots and dashes of ET notation. What happens when we take some numbers used in one practice, and use them to create patterns in another? What if we juggle a weaving pattern, drum a juggling pattern, or weave a drum pattern? Almost always, the results fall apart, or are too simple or arbitrary. The materials at play are intrinsic to the notation's meaning.

During the Algorithmic Pattern Salon the physical constraints of the materials and apparatuses appeared in the discussion of the computational constraints for the computational render of high period examples of the Mandelbrot set (Heiland-Allen 2023). When describing the process of weaving incorporating "the shifting of weight on the bench, the creaking of the loom, the rhythm of breath, the pauses for cups of tea, background chatter, and silent contemplation." It was pointed out that

the result and the time needed for weaving depends on these elements (Wood 2023). These experiences align with the idea that "weaving connects the physical materiality of the woven patterns with their immaterial algorithmic descriptions" (Griffiths et al. 2023), creating a space where unanticipated results happen that can be explored creatively.

4. Reflection

Research events are often considered simply as venues to share outcomes and network. However, above we have looked to capture and reflect upon the actual work of meaning-making that took place at the algorithmic pattern salon itself. As organisers we do not consider ourselves neutral in the process; by making space for things to happen (and indeed forming the selection committee for proposals), we drew on our diverse experiences to create potential for outcomes. However, our aim was to create a space rich enough for unanticipated outcomes, and it was the participants who brought the process to life and saw it through.

In this paper we have explored the commonalities and differences between the practices that arose, considering that a challenge for any interdisciplinary community is developing understanding of each others' practices, through developing language for discussing them on equal terms. This analysis focused on understanding the trade-offs at play, and identifying the limitations of each practice. These common points not only allow us to understand the different practices through a common language but also reveal spaces for experimentation that are intrinsic to the practices themselves.

Two commonalities appeared across the different themes: creative feedback and material constraints. Creative feedback refers to a 'workflow' where there is a notated abstraction that might precede an outcome, in telling how a pattern will be made. An interesting space for experimentation appears when the notated pattern both precedes and follows the patterned outcome, this is, notation is the interface for the outcome, where it is first made as speculation, followed to one outcome, and then adjusted in response to that conclusion, to a new outcome. Perhaps we are following this same pattern in reflecting on the salon, ahead of planning our next event in the series.[2] A call for proposals is like a notation for proposing a pattern of thinking, and we write our next call in response to the patterns of activity that followed it, and flowed into each other during the salon itself.

Regarding material and apparatus constraints that come together with the "physical implementations" of the pattern abstractions, they are all characterised by rules that follow from the physical con-

straints at play, which create rich spaces of possibility for artists to explore as they define the practical actions that come into play. These actions not only define the practice itself but represent the most basic language through which it is possible to experiment in creative ways.

We grouped the different aspects of algorithmic pattern practices into primary interrelated themes: abstraction, material behaviours, human culture of pattern making, and patterns in nature. These themes are present across a wide range of practices and function as recurring elements, whether they are employed as a source of creative material, a framework for structuring design processes, or fundamental principles that guide the materialisation of the practice. We focussed on the first three of these themes, in order to centre human engagement with computation and material. Right now, this focus on human action feels important, reframing algorithms in terms of human agency, and sidelining the notion of algorithms as completely autonomous agents.[3]

Our focus on human algorithms is currently unfashionable, when so much attention is on large language models, artificial intelligence, and autonomy. We are mindful here of Ursula Franklin's description of the continual shift in the "real world of technology" (Franklin 1999) seen in the past decades, from holistic technologies supporting human activity through work, to prescriptive technologies of control. Alan Jacobs supports Franklin's and similar perspectives which he groups as the "Standard Critique of Technology" (Jacobs 2021), while also pointing out that rather than restating this critique of the dominant technological paradigm, we should demonstrate alternatives in order to make a real difference. This is where we hope algorithmic pattern comes in - as a field of research and practice where we reflect on holistic (Franklin 1999), convivial (Illich 2001) technologies from the past and present, to try to create a new future, building upon and inspired by them.

Notes

1. Andrew Hugill noted differences in understanding pattern in a discussion with mathematicians, designers and western classical composers in his May 2013 presentation "Establishing Transdisciplinary Entities in Universities, or: why is it that musicians make the best interdisciplinarians?", available at https://medias.ircam.fr/x6e2d95.

2. Our next event will be Algorithmic Pattern 2025, a full conference and festival taking place in September 2025. https://2025.algorithmicpattern.org/.

3. We do not dismiss the potential for AI language models, and do support and engage with movements around explainable, responsible and ethical AI, but are here centering other approaches to human creativity through algorithms

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