Kairotic Coding – Performing Thinking in Action

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ABSTRACT
This paper addresses how the twin principles of liveness and visibility within the performance of live coding might be used for showing and sharing the practising within the practice, conceived as both the ‘performing of thinking’ in action and the performing of ‘thinking-in-action’. Underpinned by the principle of performing its thinking through ‘showing the screen’, live coding ‘makes visible’ the process of its own unfolding through the public sharing of live decision-making within improvisatory performance practice, emphasizing the durational ‘taking place’ of something happening (live). This making visible of thinking ‘in action’ has epistemological import, shedding light on the nature of knowledge production and mode of intelligence operative therein, generating insights into this habitually unseen aspect of creative endeavour. Drawing on the Ancient Greek concepts of kairos (opportune timing) and métis (cunning intelligence), in this paper I explore how certain live coding practices can be conceived as an embodied ‘thought exercise’ for cultivating the human qualities of heightened attention, cognitive agility and tactical intelligence.

The theoretical observations made within this paper draw on fieldwork and lived interactions from within two recent AHRC research projects, where my role has been as a critical interlocutor invited to approach the field of live coding from the specific perspective of my own research practice and interests as a writer-artist from within the discipline of fine art. As such, I reflect on live coding not through attending to the techniques and technicalities of this emergent practice; but rather, my intent has been to consider how the process-oriented performativity of live coding relates to wider debates concerning the epistemic — even aesthetic-epistemological — potential of artistic endeavour. Before elaborating these theoretical concerns further, I want to provide some brief contextual description in relation to this fieldwork process, not least to clarify the partial nature of my enquiry, which draws its reference from specific approaches to live coding practice rather than from the field of live coding performance as a whole.

Firstly, in 2012, I was invited as a critical interlocutor to develop theoretical reflections in response to the research project Live Notation: Transforming Matters of Performance, an interdisciplinary collaboration funded by a UK Arts and Humanities Research Council Digital Transformations Amplification Award, led by co-investigators Alex McLean and Hester Reeve for exploring the possibilities of relating live coding (performing with programming languages) and live art (performing with actions). Central to this research project was the formation of the Live Notation Unit (LNU), a research collective initiated by Reeve and McLean, working in dialogue with an international network of artists, coders and theorists including Sam Aaron, Geoff Cox, Yuen Fong Ling, Dave Griffiths, Thor Magnusson, Brigid Mcleer, Kate Sicchio, Andre Stitt, Wrongheaded and Maria X. On the 27th July 2012, the Live Notation Unit staged a symposium and series of performances at

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1 Whilst also addressing the performing of thinking in action within live coding, this paper develops a different line of argumentation – more directly based on the notion of kairos – from my forthcoming journal article, ‘Performing Thinking in Action: The Meletē of Live Coding’, in Live Coding in Performance Arts, a special issue of the International Journal of Performance Arts & Digital Media (Issue 12.2, October 2016).

2 The reflections are also informed by a series of interviews conducted with live coders Sam Aaron, Benoît and the Mandelbrots, Shelly Knotts and Alex McLean, as part of the research for a forthcoming publication on Live Coding that I am currently co-authoring with Alan Blackwell, Geoff Cox, Thor Magnusson and Alex McLean.
Arnolfini, Bristol to test and question what the term ‘live notation’ might signify. The Live Notation Unit event was intended as an ‘experimental laboratory’ in which to approach programming as performance art, performance art notation as code, code as speech, bodies as interpreters, and involved improvisational sound works (where computer code and the artists bodies become instruments), site-specific time based art works (where notation becomes the ‘piece’ as opposed to its recording device) alongside a series of position papers. Based on my direct observation of this event and a series of subsequent conversations and discussions with the Live Notation Unit, my responses to this project focused on the somewhat slippery notion of liveness, where ‘live’ not only refers to the durational, embodied, non-repeatable moment of performance, but also to a kairotic species of liveness, where a specific form of articulation is produced as a live event simultaneous (and in fidelity) to the experience it attempts to articulate. Specifically, I proposed the term ‘kairotic coding’ to describe the particular qualities of timing and timeliness, as well as invention and intervention, that I had witnessed within the performance of live coding and live notation during this project. Drawing on the Ancient Greek rhetorical conceptualization, the term kairos is often taken to mean ‘timing’ or the ‘right time’, a ‘decisive’ critical moment whose fleeting opportunity must be grasped before it passes. According to Eric Charles White, kairos has origins in two different sources: archery, where it describes “an opening or ‘opportunity’ or, more precisely, a long tunnel like aperture through which the archer’s arrow has to pass”, and weaving where there is “a ‘critical time’ when the weaver must draw the yarn through a gap that momentarily opens in the warp of the cloth being woven” (1987: 13). Putting these two definitions together, White argues that, “one might understand kairos to refer to a passing instant when an opening appears which must be driven through with force if success is to be achieved” (1987: 13). This ILC paper further elaborates on the kairotic aspect of live coding, conceived as a form of live thinking-in-action.

Secondly, based on my reflections generated within the Live Notation project, I was invited as a critical interlocutor to work as part of the research project Weaving Codes / Coding Weaves project (2014 — 2016), an interdisciplinary collaboration funded by a UK Arts and Humanities Research Council Digital Transformations Amplification Award, led by principle investigators Ellen Harlizius-Klück and Alex McLean, with collaborative developer Dave Griffiths and co-investigator Kia Ng. Weaving Codes / Coding Weaves explored the historical and theoretical points of resonance between ancient loom weaving and computer programming, the insights gained if we bring these activities together. During this project my own fieldwork was conducted through attending, observing and participating in a series of research residencies as well as through sustained discussion especially with McLean and Griffiths. The research residencies ranged from exhibitions and live coding performances, for example, in the Museum für Abgüsse Klassischer Bildwerke (Museum for Plaster Casts of Classical Sculptures) (Munich, May 2015) where Harlizius-Klück’s exhibition, Textile Matrix, became activated by a live coding performance by slub (Griffiths and McLean, alongside Harlizius-Klück) in the museum itself, using McLean’s tidal software to generate sound, with code visually projected onto a transfixed ‘audience’ of classical statues; to a live coding/ live weaving performance at FoAM Kernow, Cornwall with slub coding sounds to weave by, projected 3-D digital procedural rendering of an evolving weave meeting the physicality and materiality of live tablet and loom weaving, the close up visuals of actual threads on the loom generating an abstract backdrop for improvisation (October 2015). Research workshops were also staged, for example, in October 2014 with Geoff Cox and students at the Centre for Participatory IT, Aarhus University, to scrutinize, read and notate the structure of dog-tooth fabric, before testing these emergence notation systems using a prototype Javascript loom-computer designed by McLean, or in January 2016, a workshop involving tablet-weaving and live coding took place with Julian Rohrhuber and researchers at the Institute for Music and Media (IMM), Dusseldorf, with reflection on the capacity of both looms and computers as algorithmic environments for creative work with sonic pattern, different tactics for the sonification of thread language.

My own interests within this project focused on the questions: What qualities, capacities and even knowledges are cultivated through the practice of live coding, and what do they share with ancient weaving? What is the specificity of thinking-in-action operative whilst improvising within a live running code, and how might it relate to the embodied ‘thought-in-motion’ (Hawhee 2004: 75) activated whilst working on the loom? What are the points of shared resonance between these two
(temporally disconnected) practices, and how might an engagement with the past (the historical practice of ancient weaving) open up new ways of thinking about the future (of live coding)? Through the process of observation and conversation undertaken within this project, it seemed that ancient weaving and live coding (especially as expressed by Griffiths and Mclean) share similar capacities, knowledges and modes of attention; both require heightened alertness to the live circumstances or ‘occasionality’ of their own production, a form of live thinking-in-action immanent to the process itself rather than conceived in advance. Whilst I have elaborated on the resonance and connection between weaving and coding in a previous ICLC paper entitled Live Coding/Weaving: Penelopean Métis and the Weaver-Coder’s Kairos, my intent for this paper is to explore how the performing of thinking in action within live coding might resonate with other artistic (research) practices concerned with making visible the ‘practising of a practice’, the exposure of ‘thinking-in-action’ as an epistemological imperative.

Arguably, through the process of my own research, I have encountered a specific form of live coding practice – one that is outward-facing, engaged in reaching towards and making connections with other creative practices that seemingly share similar principles (whether that be choreographic practice, live art or ancient weaving), whilst at the same time as being reflexively introspective, critically (and perhaps even politically) concerned with the specificity of live coding, arguably even retaining some of the core values established by the early TOPLAP manifesto. Admittedly, my own interest is in relation to those examples of live coding that are not so much concerned with the planning and designing of a ‘script’ in advance, but instead are practised through a contingent, improvisatory process, where the specific form of articulation is immanent to the situation, that embrace the potential of ‘tactics for not knowing’ (Cocker, 2013) and of necessary risk. However, to begin with a general description, live coding describes the improvisatory real-time composition of predominantly computer-generated audio-visual material, where the writing of the code itself (or other executable instructions) is presented as a live event for an audience. The TOPLAP (an acronym of changing reference, for example, “temporary organization for the proliferation of live audio programming”) manifesto makes the intention explicit: “Give us access to the performer’s mind, to the whole human instrument. Obscurantism is dangerous. Show us your screens ... Code should be seen as well as heard, underlying algorithms viewed as well as their visual outcome”. ³ Live coding thus asserts value for the liveness of its performance, moreover, the principle of ‘making visible’ the process of its own procedural unfolding.

In one sense, the emphasis on the liveness of live coding and the heightened attention given to the coder-performer’s actions — both mental and physical — could be conceived as a call for an increase in or return to the value of authenticity and auratic authority often considered lost within computer-generated music. Moreover, the focus on the technical intricacies involved in the live coder’s creation, modification and application of a live programming language could imply a resurgence of interest in and appreciation of virtuosity within live coding’s performance, the virtuoso character or skill of the coder demonstrating mastery of their art. This renewed emphasis on virtuosity might in turn be critiqued, for example, with reference to Yvonne Rainer’s much cited ‘No Manifesto’ (1965), and its refusal of self-expression and theatricality within performance, its “No to spectacle. No to virtuosity ... No to style ... No to seduction of spectator by the wiles of the performer”. Alternatively, Shila Anaraki and Frederik Croene (in collaboration with Edurne Rubio and Lilía Mestre) expand the notion of virtuosity beyond the “mastery of a singular technology and its purist approach”, where they reflect on the:

“Performer as the craftsman, which exhibits her/himself in the creation of meaning by crafting relations, by communicating in the present time, by exposing the tools s/he or they preconceived and now articulate in front of an audience. We are in a post-disciplinary era that encompasses the relation of a singular knowledge to several other knowledges and tries to trace their agencies.

making that process and product become one in the act of communicating; making the audience a co-actor in the play".4

Certainly, the performance of the live coder could be conceived in such terms — the crafting of relations in present time, real-time; the performer’s exposure of his/her tools of production, process and product blurred in the live event. My own enquiry is not concerned with issues of authenticity and virtuosity performed within live coding as an expression of a perfected and crafted art, which according to the TOPLAP manifesto might involve, “The skillful extemporisation of algorithm as an expressive/impressive display of mental dexterity”, alongside (potentially) “the glorification of the typing interface”.5 Rather, I am interested in how the twin principles of liveness and visibility within the performance of live coding might be used for showing and sharing the practising within the practice, the sense of working-out as a live process, considered less as a virtuoso act and more as a ‘thought experiment’.

Performing its thinking through the ‘showing of the screen’, live coding reveals the underlying operational layer of activity beneath the more familiar, readable gestures of computational performance. To expose the inner workings of a practice foregrounds the process itself, emphasizing the methods and mechanics of production, the durational ‘taking place’ of something happening (live). It is a means for rendering communicable to an audience the dynamic experience of decision-making, the navigation of competing forces, the activity of working with and through obstacles or of ‘figuring’ something out. The projected code reveals the presence of the programming language behind the audio-visual effects witnessed within the live coding performance, moreover, makes tangible the process through which the live coder modifies and reworks this material, from the construction of the language itself, to the changing of its variables, parameters and functions. These modifications are not just conceptual workings, the logical manipulation of an abstract notational system. Rather there is an inherent physical, kinetic dimension to the live writing of code, a movement vocabulary of micro-adjustments, changes and shifts performed in the frantic shuttling of the cursor around the screen, in the flash points of activation and execution. Coding as a live and present practice, the real-time toggling back and forth of the cursor, decisions made from within the continuity of a process (a running command line) rather than through a figured-out design applied from without. Live coding gives texture to the textual screen, transforming it into a stage of sorts upon which the cursor-coder’s thinking makes its moves. Significantly, the commitment to making the operational principles of coding visible or even ‘tangible’ within the context of a performance practice is not always about explication or instruction, an approach based on the pedagogical transmission of a specific method, its technics and techniques. Showing the process — the ‘making visible’ of the operational thinking and working out — within live coding at times seems predicated less on a model of ‘how to’ (apply logical, algorithmic methodologies); instead performed in the key of ‘try this’, a democratizing gesture or call towards the development of further exploratory, playful practice.

Live coding is arguably a hybrid — even liminal — practice, operating at the critical interstice between different disciplines, oscillating between a problem-solving modality and a problematizing, questioning, even obstacle-generating tendency. Significantly, it deviates a computational logical-numerical-linguistic mode of thinking (algorithmically) towards artistic application, involving not only a musical-rhythmic intelligence or sensibility (Gardner, 1983), but also some of the more intuitive, haptic knowledge(s) more commonly associated with creative thinking. Or alternatively, it draws attention to how an algorithmic approach to dynamic thought and action is already creative, underpinned by many of the principles considered intrinsic to artistic practice and research. I am particularly interested in live coding performances that are less concerned with the planning and designing a ‘script’ in advance, but instead are practised through a generative, improvisatory process, the live running code a site for testing the potential of this or this or this or this. Knowledge through experiment might take the form of doing and undoing, the repeated labour of trying

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4 See http://www.workspacebrussels.be/nl/productions/and_what_about_virtuosity-1661.html (Accessed on 15 January 2016) for more about the research project, And What About Virtuosity? Specifically, this project refers to ideas around virtuosity through the prism of Paolo Virno’s ‘A grammar of the multitude’.

something out. More than a strictly ‘logical’ procedure live coding proceeds through trial and error; it involves the investigative practice of doing something as a way of knowing how something is done, moreover, for knowing how it might be changed, swerved, taken in a different direction. Certainly within live coding, knowledge of the process is required before it can be truly experimented with, however, the knowledge of the process is developed only through experimentation. A form of deep working knowledge developed then through use and experiment; tacit knowledge cultivated through the accumulation of trial and error, innumerable versions and iterations, tests and attempts. Specifically then, my focus on the improvisatory practising within a performance is not to de-value or detract from the years of preparatory practise or pre-work required in order to perform. Practitioners of live programming report considerable practise sessions before the performance, where it is possible to differentiate between moments of practise engaged in seeking out new ways of working, from the practising that is perhaps more akin to rehearsal, a practising to perfect. Indeed, my emphasis on the practising within a performance seeks to retain the potential of the first kind, the possibility of encountering something new or unexpected as a live event.

Whilst grounded in a commitment to the practise of coding (a familiarity with and fluency in computational language), this specific form of live coding performance is not one of simply showing one’s expertise (as rehearsed and scripted), but also seeks to create the germinal conditions wherein something unplanned for or unanticipated might arise. Improvisation involves the cultivation of a contingent form of present-activated future-oriented imagination intent on courting rather than thwarting the unexpected. The principle of improvisation — of beginning a performance without preset plan or script, without knowing where it will lead — necessarily embraces a sense of risk and uncertainty, the stepping off or away from what is known towards ‘not knowing’. Live coding performances actively disclose their moments of not knowing, of trial and error, of testing something out (through endless subtractive and additive procedures, the testing of constants and variables), moreover, the promise of not knowing (and the risk and uncertainty therein) is arguably part of live coding’s improvisational performativity. As Dan Stowell states, “The danger of making mistakes which are audible by everyone gives a certain tension that the audience can feel”; moreover, “You can show the process evolving ... They can see when there are errors, or can see when there are things that you are developing and coming back to”.\(^6\) The disclosure of process (in all of its messiness) foregrounds the thinking-through-doing within live coding at the level of both aesthetics and episteme, shedding light on the nature of knowledge production and modes of intelligence operative therein. However, the epistemological significance of live coding is not just in ‘performing thinking’ in action, the ‘making visible’ of the process (including the ‘not knowing’) of its own production, but also in how it performs ‘thinking-in-action’. Avis Newman could as easily be reflecting on live coding, when she refers to drawing as a “record of the workings of thought”; a form of ‘meditation by ‘a self regarding consciousness’, where consciousness is understood as a process ... It is a site of inquiry, response and invention, and in that sense becomes a philosophical activity” (2003: 169).

Refusing to be prepared for in advance, live coding performs its improvisational thinking-in-action akin to an exercise in thought, a meditative activity to be used for practising attention; for developing qualities of que vive, alertness, vigilance or watchfulness; for practising present-ness; for cultivating an ethical and elective rather than obedient relation to the rule; for working with limits as points of creative leverage rather than of control; for converting chance and contingency into opportunity, for practising a ‘fall’ from what is known in order to encounter the as-yet-unknown. In one sense, the use of algorithms could operate as a way for the artist to surrender responsibility, absolving him or herself of agency or control within a performance in order to be surprised, for generating outcomes that the conscious mind could never have planned. It could be tempting to conceive of live coding as an algorithmic process that once set in motion is capable of sustaining a trajectory by its own momentum. However, the performance of live coding is not to be undertaken passively, but rather requires continual attention. Creating the right tension — a process of improvisatory working emerges through cultivating an understanding of tolerance, how far something can be pushed or

pressed before it breaks, indeed, when to install breaks or rests. Gilles Deleuze names the power to affect other forces — spontaneity, and to be affected by others — receptivity (2009: 60). Here, perhaps, the improvisatory practice of live coding might be disentangled from the resulting product and considered more as an end in itself, a site for practising the relation between spontaneity/receptivity, yielding and control, between the agency of the self and the forces of the external world. For Kent de Spain, the process of improvisation emerges through the negotiation of different forces, including external factors (which in live coding might include the constraints and affordances of technology, even collaborators) and internal factors (specifically the relation between memory and intentionality). For example, he identifies kinesthetic memory as the “seemingly unconscious ability of the body/mind to remember and reproduce specific movements and/or qualities, complex coordinations or habitual movement responses” (de Spain 2003: 32). Whilst he is referring to the somatic experience of choreographic improvisation, this play of forces might also be discerned within live coding performance.

Debra Hawhee similarly conceptualizes the medial practice of ‘invention-in-the-middle’, a form of inventive “response to the forces at work in a particular encounter” (2002: 18). For her, ‘invention-in-the-middle’ involves a practice of “simultaneous extending outwards and folding back”; it is a “space-time that marks the emergence of a pro-visional ‘subject’, one that works on and is working on by — the situation” (Hawhee 2002: 18). Within live coding, the coder must consciously adopt a medial position, where they become responsible for actively maintaining the conditions that will keep the performance dynamic, navigating a course of action by intuiting when to yield and when to reassert control, when to respond and when to interrupt. Here, the code itself has the capacity to be modified or adapted even while it is being executed. In this sense, an algorithmic process is not just set in motion, but is constantly reviewed, dismantled once it begins to stifle action or no longer offer provocation. For Nick Collins, the ‘human operator’ within live coding acts reflexively, where the “more profound the live coding, the more a performer must confront the running algorithm, and the more significant the intervention … the deeper the coding act” (2011: 209). In a wider sense, the notion of elective or modifiable rules offers a reminder that many of the rules by which we live our lives might in fact be flexible, negotiable. To improvise within a given structure requires skillfulness and attention, a capacity for biding one’s time and for knowing when and how to act. Different pressures compete for attention as one force gives way to allow for the emergence of another, as the rule created in order for something to begin is superseded by another that allows it to continue to develop. The force that initiates a process has the capacity to destroy it also; production can become entropic in the absence of the decision that determines when to stop or change tack. Live coding performs a complex, nuanced or even entangled human/machine relation, where technology is not so much put to use as worked with, the process unfolding through attending to — even collaborating with — the resistance exerted by the technology or apparatus rather than conceiving it simply as a tool that needs to be brought under control, mastered. Within live coding, where does the capacity of the coder end and technology begin? Subject-object divisions begin to blur. Live coding is performed as a live and embodied navigation of various critical thresholds, affordances and constraints. Indeed, the constraints of a given technology might be considered as ‘enabling’ rather than as limitations. For Manning and Massumi, an “enabling constraint is positive in its dynamic effect, even though it may be limiting in its form/force narrowly considered” (2014: 93). They argue that within improvisational performance, “unconstrained interaction rarely yields worthwhile effects. Its results typically lack rigor, intensity and interest for those not directly involved … Effects cannot occur in the absence of a cause. The question is what manner of causation is to be activated” (Manning and Massumi 2014: 93). Arguably, this principle of enabling constraints within performance can be witnessed in examples of live coding where the novelty of seemingly complex programming environments are eschewed in favour of a more pared back, even restrictive, programming language.

Live coding involves cultivating a working knowledge of a process such that it becomes ingrained in mind and muscle, activated at the fingertips, live and emergent to the situation rather than pre-planned in advance. It involves a contingent form of working knowledge, which is not based on knowing how to deal with a situation in advance, but rather a knowledge born of the moment, from having confidence. Within certain live coding practices the challenge is not one of ‘scripting’ in...
advance or designing from a distance - less one of responding with learnt behaviour or activating a latent 'know how' - but rather of learning how to 'invent' or 'improvise' the appropriate response, harnessing the potential unique to every contingent situation. As Nick Collins et al note, live coders “work with programming languages, building their own custom software, tweaking or writing the programs themselves as they perform” (2003: 1). Code is written as it is performed; a practice often referred to as ‘coding on the fly’ or ‘just-in-time coding’ (or what I would propositionally name ‘kairotic coding’). Live coding requires an improvisatory tendency located at a threshold (the gap or ‘creative interval’) between the ‘now’ of the present and the ‘to-come’ of a future-present, the live point of ‘seizure’ or decision-making wherein the unfolding future of the performance emerges simultaneously to its imagining. Etymologically related to the Greek word keirein — to cut — kairos can be conceived as both a temporal ‘opening’ or critical moment (a ‘nick’ in time) and, in White’s terms, a ‘will-to-invent’ capable of responding to this opening: “Kairos thus establishes the living present as point of departure or inspiration for a purely circumstantial activity of invention” (1987: 13). Indeed, kairos describes a qualitatively different mode of time to that of linear or chronological time: it is not an abstract measure of time passing (chronos) but of time ready to be seized, an expression of timeliness, a critical juncture or ‘right time’ where something could happen. For Carolyn R. Miller’s kairos, “encourages us to be creative in response to the unforeseen […] The challenge is to invent, within a set of unfolding and unprecedented circumstances, an action (rhetorical or otherwise) that will be understood as uniquely meaningful within those circumstances” (2002: xiii). A form of invention in response to the ever-unfolding and contingent conditions of the living present, moreover, a form of invention whose success will only be known retrospect not only describes rhetorical practice, but can also be applied to artistic invention, indeed to the improvisatory performance of live coding. White, “kairos stands for a radical principle of occasionality which implies a conception of the production of meaning in language as a process of continuous adjustment to and creation of the present occasion” (1987: 14). He argues that kairos involves a ‘will-to-invent’ that necessitates “adaptation to an always mutating situation. Understood as a principle of invention … kairos counsels thought to act always, as it were, on the spur of the moment” (1987: 13). White refers to Gertrude Stein’s writing as an example of such occasionality, a form of ‘speculative thought alert to its own occasion’, which in Stein’s terms involves a ‘decentering of attention’ within which ‘talking and listening’ might occur simultaneously, at the same time. My assertion is that live coding shares this performative ‘principle of occasionality’ that White describes, an improvisational capacity “alert and able to adapt to the present occasion” where “the writing subject must always be in the act of creating itself anew” (1987: 54 - 55).

Elaborating on the rhetorical dimension of kairos, John Poulakos notes that kairic “speech exists in time and is uttered both as a spontaneous formulation of and a barely constituted response to a new situation unfolding in the immediate present” (1995: 61). Kairos requires a ‘stepping off’ or away from what is known or certain, an unhinging from the ‘as is’ of the present by leaning into the void of the ‘to come’, at the same time as suspending the desire to fix or firm up the ‘what now, what next’ too hastily, based on the experience of what is already known. For Hawhee, the art of ‘knowing how’ and ‘knowing when’ central to kairos, “is difficult to gauge, let alone teach, and it must be achieved through practice” (2004: 70). However, she argues that is it still possible to become sensitized to the potential of kairos through the cultivation of ‘immanent awareness’ or a quality of attention that includes “different modes of thinking aside from the noetic, diagnostic, rational” idea of practising (Hawhee 2004: 70). In these terms, the temporal opportunity of kairos has little power on its own; it requires the perceptions and actions of an individual capable of seizing its potential. Indeed, as Hawhee notes, “kairos entails the twin abilities to notice and respond with both mind and body. In other words, the capacity for discerning kairos … depends on a ready, perceptive body” (2004: 71). The opening of opportunity’s aperture in the situation is co-emergent with the opening up or receptivity of the individual in response; kairos thus refers to the emergence of a temporal opening and the capacity or readiness of an individual to actively seize the opportunity therein.

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7 The connection between kairos and the English word nick, used to refer to a critical moment (“just in the nick of time”) is made by Richard Onians 1951: 347) cited in Rickert (2013: 79).
Through reference to the *kairotic* dimension of live coding it becomes possible to differentiate between modes of performativity operating therein. The first (arguably Anglo-American) model of performativity relates to the specific mode of enunciation within live coding, the “performative as something that in its enunciation acts” (Fischer-Lichte 2008: 9). Geoff Cox argues that, “like poetry, the aesthetic value of code lies in its execution, not simply its written form” but also that “to appreciate it fully we need to ‘see’ the code to fully grasp what it is we are experiencing and to build an understanding of the code’s actions” (2000: 5). For Cox, code “says and does what it says at the same time. Such utterances are not conventional but performative” (2012: 35 — 36). This specific mode of performativity draws on J. L. Austin’s *How to Do Things with Words* (1955), where as Cox states, Austin establishes how “sentences can do something … a sentence or utterance of this kind he calls a ‘performative’, to indicate how it performs an action” (2012: p.35). Within live coding, the production of language is not only performative but also *kairotic*, on occasion a not-yet-known language emerging simultaneous to (unique and in complete fidelity to) the emergent situation as it is unfolding. Here, the production of the code neither precedes action (in the form of a pre-set script) nor follows as annotation or documentation, but rather it is produced simultaneously to (and often as) the performance itself. For Erika Fischer-Lichte, Austin’s ‘performative utterances’ are “self-referential and constitutive in so far as they bring forth the social reality they are referring to … Speech entails a transformative power” (2008: 24). Fischer-Lichte develops a parallel model of performativity where the emphasis is placed less on enunciation and more on a process of co-emergence or co-creation, the “dynamic of performer and audience mutually involved in an ongoing dynamic of the fulfillment of the process of life and consciousness, not under the control of either” (2008: 9). Reflecting on the principles of kairos, White also argues that “the fluid and relative moments of the immediate situation would be constitutively involved in the invention process … (an) attempt to ‘make do’ with whatever is conveniently at hand" (1987: 13).

Reflecting on the *kairotic* principles of live coding also draws attention to the different perceptions and possibilities of temporal experience within live performance. Indeed, it might be tempting to focus on the ‘just in time’ nature of live coding as one that is necessarily connected to the immediate and fleeting moment, to speed of action urgent in the now of the present as it is *seized*. Indeed, *kairos* describes the radical temporality of the very moment of something new coming into being, unique to that very moment. However, the performativity of timing and timeliness within *kairos* relies on the *dual principles* of slowness and speed, of biding one’s time and of knowing when to act. Paradoxically perhaps, the opportunity within the ‘opening’ of *kairos* (ready to be seized) might only be discerned through a slowing down of habitual flows and rhythms, thereby producing the necessary quality of ‘attention’. Referring to the work of Henri Bergson, Simon O’Sullivan argues that ‘attention’ involves “the suspension of normal motor activity which in itself allows other ‘planes’ of reality to become perceivable (this is an opening up to the world beyond utilitarian interests). The event then emerges from the world but from a world usually imperceptible” (O’Sullivan 2006: 45). Moreover, as O’Sullivan states, it is this “affective-gap”, or ‘hesitancy’ as Henri Bergson understood it, between stimulus and response, which in itself allows creativity to arise” (O’Sullivan 2006: 37). *Kairos* is not performed in haste, without due care and attention: consider the hunter or angler (both *kairotic* exemplars) whose practice involves extended periods of waiting before an action is required. Here, attention might be turned to those live coding practices underpinned by principles of slowness as much as speed.⁹ For Christoph Brunner, “Slow Practices deal explicitly with the processes by which situations form; they question how situations result from the play of forces and tendencies. Attention to those processes of emergence is supplemented by a speculative and probing gesture that integrates possible processes of becoming in unfolding a situation” (2011: 59). Moreover, he asserts, “The multilayered temporalities of their processes are significant for Slow Practices. The plurality of temporalities determines their non-linear quality. ‘Slow’ also refers to an ‘Other’ of temporality. A practice with its techniques and intuitions pays particular attention to the inner relations of temporalities — that is, to their self-reference” (Brunner 2011: 61). Indeed, against the privileging of real-time performance — and narrowing of the feedback loop between coding and its execution through technological advancement — I advocate a critical value for the gaps and lags

within live coding performance as reflective intervals for building the capacity for biding one’s time and knowing when to act.

The performance of live coding involves the seemingly contradictory double manoeuvre of a certain slowness or hesitancy practised alongside swiftness or speed; of receptivity with assertion; rupture with affirmation; a capacity for knocking back certain normative or structural forces and pressures at the same time as ushering in the potential of something new, something unexpected, something otherwise. The kairotic performativity of timing and timeliness, the act of biding one’s time and knowing when to act produces — or even is produced in-and-through — a tactical kind of knowing. Indeed, kairos is the mode of temporality associated with technē, alongside an attendant form of cunning intelligence (mētis). Here, technē is not used in its habitual sense where it is taken to mean the skillful art of craftsmanship, of making and doing, but rather is re-conceived as a disruptive, even subversive species of productive knowledge. Tracing its origins within Ancient Greek culture, Janet Atwill notes how technē refers to a particular mode of ‘knowing’ or art capable of responding to situations that are contingent, shifting or unpredictable, in order to affect a change of balance or power by steering the direction of events through wily — even somewhat deviant — means rather than through force. According to Atwill, technē often emerges at the point “when a boundary or limitation is recognized, and it creates a path that both transgresses and redefines that boundary” (1998: 48). She asserts that the aim of technē is to “transform the ‘what is’ into ‘what is possible’” (Atwill 1998: 70). Moreover, it is not a form of knowledge intent on stabilizing or limiting the contingency of unstable, indeterminate forces (nor resisting their pressures), but rather in the transformation of their force towards opportunity. As Atwill suggests, “Because technē defined itself in terms of intervention and invention, it is concerned solely with situations that yield indeterminacies that would allow one to discern the opportune moment and to ‘seize the advantage’” (1998: 70).

To a certain extent, this paper attempts to draw attention to and re-assert a value for those other modes of thinking-in-action operative within practices such as live coding — technē (with its kairotic and mētis forms of intelligence), tacit knowledge, sensuous knowledge modeled on experienced continuity of process rather than discontinuous abstraction, ‘not knowing’, the value of trial and error and of ‘feeling one’s way’ — that have been habitually eclipsed or even marginalized by a knowledge economy that favours a form of abstract, rational logic; moreover, the principle of ‘knowledge exchange’ where knowledge is something that can be transmitted, traded and ‘banked’ as a product, rather than activated as a live and embodied process. Drawing on the Ancient Greek concepts of kairos (opportune timing) and mētis (cunning intelligence), my intent has been to conceptualise live coding as a meditation or ‘thought experiment’ for performing thinking-in-action, for practising the human qualities of attention, cognitive agility and tactical intelligence. My assertion is that certain live coding practices display the properties of technē, requiring a specific quality of alertness or attentiveness to the live circumstances or ‘occasionality’ of their own production, moreover, that these qualities (identified and practised) have the capacity for cultivating a more critical mode of human agency and subjectivity, the capacity to be applied to other situations, indeed to the living of a life.

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10 I further elaborate the relation of live coding to mētis and technē in ‘Live Coding/Weaving: Penelopean Mētis and the Weaver/Coder’s Kairos’, conference paper at ICLC, 2015, University of Leeds, developed as an article for a forthcoming issue of Textile: The Journal of Cloth and Culture.


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