Ritual as Algorithm

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> For although there is more to magic than ritual, the art of ritual makes up the heart of magical technique in nearly all the world's traditions. We can define ritual as *symbolic action*. // John Michael Greer, *Circles of Power: Ritual Magic in the Western Tradition*
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> Computers do not crunch numbers; they manipulate symbols. // Margaret Boden, *Artificial Intelligence and Natural Man*
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> It has often been said that a person doesn't really understand something until he teaches it to someone else. Actually a person doesn't really understand something until he can teach it to a computer, i.e., express it as an algorithm. // Donald Knuth, "Computer Science and Mathematics"

Recall Jesper Sørensen's definition of magic: "Magic is about changing the state or essence of persons, objects, acts and events through certain special and non-trivial kinds of actions with opaque causal mediation."[1] Magic's 'special and non-trivial kinds of actions' are often organized into activities called *rituals*. The word originally meant "related to religious ceremonies" (viz., rites, from the Latin *ritus*). In the 20th century, psychologists began using the word in a more secular connotation meaning "a compulsive act or routine, the non-performance of which results in tension and anxiety" (*OED*), whence it came to be popularly conflated with anything habitual or customary. E.g., you may hear someone speak of her morning coffee ritual, which just means the same way she brews coffee every morning as part of her daily living — which is not, by my use of the word herein, properly a ritual. Taking a daily shower is not a ritual; taking a shower with the intention to purify or rejuvenate your body, mind, and spirit, <u>could be</u>.

In Western scholarship, the term 'ritual magic' is sometimes conflated with 'ceremonial magic' to denote "what are normally fairly long and complex rituals for obtaining a variety of different kinds of benefits to the operator through the conjuring of spirits," and which are distinguished from spells, charms, and folk magic,[2] and also from 'image magic'.[3] All cultures that practice magic have more or less ceremonial rituals, and some magical acts may not appear ritualistic at all, e.g., someone could consult a pendulum or deck of cards, or cast a spell, without there being anything particularly ceremonial about it. In practice, however, many magicians do develop at least minor rituals around their usage of magical tools, and all of these acts are akin to ritual as "actions that appear not to be directly or pragmatically related to the effects they aim to produce"[4] (cf., Sørensen's 'opaque causal mediation'). Although ritual is often associated with routine, regular, or recurring activity, *ad hoc* rituals may never be repeated.

For the purposes of this essay I shall define magical ritual as **any planned sequence of actions representing one or more effects expected to be brought about by the occult agency of or associated with the actor performing the actions, the actions themselves, objects the actions are directed toward or performed with, or some combination thereof.**[5] The activity is largely predetermined before it is performed. The results may not be known beforehand, and some things may occur extemporaneously, but the conceptual structure of the activity, at least generally, has been decided (and often prescribed, sometimes meticulously) before it is enacted. Each ritual is a discrete unit: it has a beginning and ending, one or more boundaries for separating what is of or within the ritual from what is not of or outside the ritual, rules for governing what occurs inside the ritual or what is appropriate to it, &c.

Here are two models of the general structure of ritual magic, from two modern occultists:

Isaac Bonewitz (emphases in original)[6]

- Phase One: Consecrating time and space, and getting people purified, centered, grounded, and unified into a group mind. This makes them ready for…
- Phase Two: Re-creating the cosmos by defining a ritual center and/or opening the *Gates Between the Worlds*, enumerating the various parts of existence and (usually) evoking or invoking entities from them, thus starting a *back and forth* flow of mana through the gates, culminating with…
- Phase Three: Giving the major part of the congregation's mana *to* the primary deity(ies) worshiped on the occasion. This is followed by…
- Phase Four: Receiving and using a return flow of mana *from* the primary deity(ies); and finally…
- Phase Five: Reversing the beginnings of the rite (unwinding the various mana fields woven) and closing the ceremony down.

Peter J. Carroll[7]

- Centring. The magician powers up for magical action.
- Encircling. Connecting with the macrocosm.
- Invocation. Summoning useful forces of power and knowledge.
- Conjuration. Doing the magic, enchantment, divination, evocation, illumination, &c. This part can get a bit lengthy, depending on the desired objective.
- Banishing. This part does not actually get rid of anything; it just sets the magic free to do as the magician has specified.

Both structures prescribe (remarkably similar) sequences of steps for performing ritual magic, without specifying all (or even many) of the details involved. We can imagine that for any of these steps we might enumerate a series of substeps that must be performed in order to complete the step, and further substeps to those substeps as needed. The substeps may vary between implementations without altering the top five steps, e.g., we could specify two very different sequences of actions that satisfy the requirement of "summoning useful forces of power and knowledge."

An [algorithm](#) is a step-by-step procedure for solving a problem or performing a task, e.g., [computing the greatest common divisor](#) [of two numbers](#), or [baking a cake](#) (cf., [heuristics](#), which are employed far more frequently than algorithms, both in and out of the occult). Consider this simple sequence for sorcery:

1. Prepare the ritual space, perhaps with a [banishing ritual](#) (a ritual within a ritual, like a [subroutine](#)).
2. Draw a [sigil](#) representing your intent.
3. Raise magical "[energy](#)."^8 (How do you know when you have raised a sufficient amount?)
4. Use the energy to "charge" the sigil.^9
5. Close the ritual space, perhaps with a second banishing or some other act that signifies *la fin du rituel*.

Again we see that certain things are left undefined, such as the precise method for drawing a sigil or raising magical "energy." If you already know how to do these things, then the algorithm simply reminds you of the order in which to do them. If you do not know how to do them, then it exposes your need for more information before you can perform the prescribed activity.

Algorithms may be expressed symbolically as plain-text descriptions ("do this, next do that"), [flowchart diagrams](#), or computer programs. A computer program is an algorithm that has been written in a special code a computer can interpret and so perform each step in the algorithm. If we translate the sigil magic algorithm into a computer programming language, we can program a computer to perform the ritual:

```
banish();                    // do the first banishing ritual
drawSigil();                 // draw the sigil
while (energy < 1.0) {       // while the amount of energy is less than 100%
  raiseEnergy();             // raise more energy
}
chargeSigil();               // next, charge the sigil
banish();                    // then banish again
exit();                      // finally, quit the program
```

But how does the computer know what to do when it encounters the symbol banish()? So far, that symbol just points to an empty function. Someone would need to instruct (i.e., program) the computer how to banish, how to draw a sigil, how to raise and measure magical energy, &c. We could specify instructions for banish() — say, from the [Gnostic Pentagram Ritual](#):

```
banish() {
  facePreferredDirection();   // typically east
  intoneVowel(i);             // intone a high-pitched 'IEEEEE!' sound
  visualizeRadiance(head);    // while visualizing a radiance of energy in
                              // the head area
  intoneVowel(e);             // intone a lower-pitched 'EEEEH!' sound
  visualizeRadiance(throat);  // while visualizing a radiance of energy in
                              // the throat area
  intoneVowel(a);             // etc.
  visualizeRadiance(chest);
  intoneVowel(o);
  visualizeRadiance(belly);
  intoneVowel(u);
  visualizeRadiance(genitals);
  [...]                       // then go back up the scale, U through I
  repeat(4) {                 // do four times
    drawPentagram();          // trace an upright, five-pointed star in the
                              // air with your finger
    turnLeft(90);             // turn widdershins 90°
  }
  intoneVowel(i);
  visualizeRadiance(head);
  [...]                       // etc. through all the vowels and body areas
}
```

That code is not very efficient, but it illustrates the transformation from human-readable to machine-readable instructions. So now we have defined the function banish() but in so doing we have created many more functions in need of defining! Those such as intoneVowel() and turnLeft() are feasible if the computer is outfitted with a speaker and motorized wheels, but how would a machine compute its preferred direction (we could tell it to always begin facing east and equip it with a magnetometer), and what about visualizeRadiance(): what could it possibly mean for a computer to visualize a radiance of energy in its head or throat area?

This is where the divide between humans and (at least present day) computers becomes enormous. I can tell a human to visualize a radiance of energy in her head and she will more or less understand what I mean. If she does not understand, I can explain it to her and we can either converge on an understanding or finally agree to misunderstand each other, but either way neither of us really completely understands how it is that we can actually do it, how we can visualize a radiance of energy in our heads. I cannot tell someone how to engineer a brain so as to produce the experience; I simply say to her, "do this thing," and she does it. But I cannot tell a computer to do something no one has engineered it to do.^10 Even if I use a program that someone else wrote and I myself do not comprehend how it works, someone does (or did, and — importantly — could again). The question of how

the code input into the computer becomes each and every action the computer performs has an answer; it is not only knowable in principle, but someone actually knows it or can figure it out (this is changing as computers become more complex, and especially as they become complex enough to design themselves).

John von Neumann, one of the pioneers of computing, is alleged to have said that if someone could precisely describe what a computer cannot do, then he would build a machine that does exactly that. It is easy enough to imagine a computer that does magic, but that is because we can dream of even impossible things without having to bother with the mechanics of how those things would actually work outside of our minds, in domains governed by different principles. I can easily imagine magicians shooting fireballs or lightning bolts from their fingertips, but I have yet to meet one who could readily demonstrate such feats. A computer can only do magic to the degree that someone knows how to program it to do so (perhaps this will change as artificial intelligence becomes more complex and autonomous).

Where does occult efficacy reside? Where is its *locus*? It could reside with the sorcerer, the ritual implements and practices serving solely to elicit or amplify her own, intrinsic power. It could reside with the spiritual agents she conjures to implore or compel, or in the patterns of information she performs or embodies in magical artifacts. Whatever the case may be, while empty- or open-handed magic may be possible,^11 it is clear that many magicians, even those esteemed as adepts as the Art, do make use of various artifacts to perform their works of magic. When they do, the artifacts become integrated into the magical activity. Can magic be performed without swords? Surely. Can the Wayland Ritual^12 be performed without one? No, because the sword is an integral part of that particular rite; removing the sword would make it a different ritual. So it is with computers in magic.

In some ways the computer is like the sword: a tool, an artifact, a prop; it changes the interaction within the ritual space. But a computer and a sword are not interchangeable; you cannot program a sword to respond to your voice (that would be a mighty spell, indeed!), and you cannot stab or cut something with a computer. However, you can simulate or represent cutting with a computer, or program a computer to respond when you cut something, or equip the computer with a robotic arm to wield a sword that cuts something. One thing that makes the computer unique among machines is that it can respond — it can sense and act. When designing a ritual involving a sword, one would typically not treat the sword as an actor;^13 one would usually not frame the activity in terms of what the sword does but rather what the magician does with the sword. The magician remains the actor or agent of the action or activity (although the sword may possess some occult agency). That situation begins to change when the sword is replaced with a computer. Although we may frame magician-computer interaction as something the magician does with the computer, the automatic ("self-acting," "self-moving") operation of the programmed computer transcends tool-ness to acquire qualities of an actor.

Control flow statements tell a computer what to do under certain conditions: *if* this *then* that. They allow the computer to not only act but to *re*act. The computer matches inputs to appropriate outputs, or sensations to appropriate actions.^14. Successful magician-computer interaction requires the computer to select appropriate responses to the magician's actions.^15 Appropriate selections must be made from a variety of possible selections and emerge from cooperation of the work's purpose, the computer's technical abilities and limitations, the magician's technical abilities and limitations, and her ingenuity. Just as the sword's morphology permits some applications while it prohibits others (you cannot use a sword to contain a volume of wine, for that you need a cup, but you cannot use the cup to sever a length of cord), each computer is fit for some tasks and not others, and the technomancer finds creative freedom in her technology's constraints.^16 The main things a computer brings to the ritual activity are that it can automatically perform a sequence of steps, and it can receive data and respond to the data it receives. It can step alongside the sorcerer and they can dance together,^17 or it can act in lieu of the sorcerer — again, within the limits of her ability to program it to do so.

'What is the appropriate response?' is a pertinent question to ask when designing magician-computer interactions, but so is *when*. Ritual has a spatial dimension — sacred space — but also a temporal one: sacred time. Rituals are often planned around meaningful or auspicious events, and ritual participants sometimes experience time distortion. Even in elaborately and painstakingly planned rituals there is often room for some things to unfold in their own time. Most people do not begin a ritual with foreknowledge of the precise minute they will achieve a state of gnosis or ekstasis sufficiently powerful to activate the enchantment. If a technomancer needs her computer to do something precisely when she is in a gnostic state, then programming it to act at a preset time is not reliable because she may not be ready by then. It would be better to program the computer to respond to some sign that she is ready. Indeed, this is usually how human actors participate together in ritual: they coordinate their actions, developing a consensus (meaning "to sense together") about which signs indicate what is to be done when ("when I say these words or enact this gesture, you raise this object aloft").

The data that computers can be programmed to respond to may be data about events. Events can be many diverse kinds of things: pressing a key, turning a knob, speaking a word, waving a wand, picking something up, putting something down, &c. An event could be an unconscious change in the magician's heart rate or electrical activity in her brain, or a change in the temperature of the room, or in the position of the sun or moon, or the sudden presence (or absence) of light or an RFID tag. An event is any perceptible change (or absence of change, i.e., sameness) that when sensed can trigger a response. What the computer can sense depends on what sensors it is outfitted with. Sometimes these sensors mimic the sense organs of living things, but simpler mechanisms often suffice. I know when you have placed an object on a table when I see you do it, but if it is too onerous to program computer vision to notice the same thing, then we might instead employ a pressure sensor on the table's surface or an RFID reader beneath the table, to sense when the object has been placed on top.

Feedback occurs when a reaction alters the action its is reacting to. A peculiar example can sometimes be observed in rituals involving multiple participants who are collectively raising "energy" by chanting a mantra or incantation. At some point during the chant, someone will slightly increase her tempo or volume, and then the other chanters will adjust to match, and then someone else will make a change and the others will adjust, &c., until the collective tempo or volume becomes very fast or very loud, signifying an increase in energy that is perceptible as the participants' activity is accelerated by the positive feedback loop

(this activity is guided by the idea that as the intensity of the chanting increases, so does the intensity of the magical "energy" conjured by the chanting). You could do the same with a computerized chanter, programming it to detect changes in volume or tempo and altering its own volume or tempo to match, and occasionally (randomly) increasing its own volume or tempo slightly above that of the group.

As a ritual actor, the computer does exactly what it is instructed to do, and it can do that to a fault. The idea of a computer obeying its programming rigorously and without reflection has inspired narratives of it as a stupid golem or harsh taskmaster, either following or giving orders that become destructive because the computer is blind or uncaring about the consequences of its actions. Such narratives may provoke rebellion against the perceived authority of codified instruction, but these narratives are not inevitable realities, and we must not forget how much freedom is afforded by our ability to effectively communicate well-thought-out and well organized instructions to one another. For someone who cannot perform an act of ritual magic because she does not know how, algorithms such as those listed above empower her to begin somewhere. What must be conserved is the freedom to rewrite the algorithms when they become destructive or no longer serve.^18

In designing rituals that involve computers, the technomancer seeks the optimum point between control flow and the flow of magical experience. The computer will necessarily inform the ritual to some degree, just as the decision to use any artifact in a ritual will inform how that ritual is performed. Rather than engineering the ritual to rigidly adhere to the timing of the CPU's clock, the technomancer may take advantage of the computer's response-ability, programming it to (re)act in an appropriate manner at the appropriate moment.

I shall end this essay with a quote from Bruce Lee that I feel expresses the *san graal* of programming computational (i.e., responsive, interactive) media, albeit in a context of martial rather than magical arts:

> Art is the expression of the self. The more complicated and restrictive a method is, the less opportunity there will be for the expression of one's original sense of freedom! The techniques, though they play an important role in the early stage, should not be too restrictive, complex, or mechanical. If we cling to them we will become bound by their limitations. Remember, *you* are "expressing" the technique and not "doing" the technique. When someone attacks you it is not technique number one (or is it technique number two, stance two, section four?) that you are doing, but the moment you are "aware" of his attack you simply move in like sound and echo without deliberation. It is as though when I call you, you answer me, or when I throw something to you, you catch it. That's all.^19

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1. Jesper Sørensen, *A Cognitive Theory of Magic* (AltaMira Press, 2006), 32.
2. Claire Fanger, *Conjuring Spirits: Texts and Traditions of Medieval Ritual Magic* (The Pennsylvania State University Press, 1998) vii.
3. See Frank Klaassen's *The Transformations of Magic: Illicit Learned Magic in the Later Middle Ages and Renaissance* (The Pennsylvania State University Press, 2013).
4. Claire Fanger, review of *The Problem of Ritual Efficacy*, in *Magic, Ritual, and Witchcraft*, Winter 2011, pp. 235–242.
5. By 'represent' I do not mean something primarily symbolic, although there may be symbolic or other semiotic dimensions to the representation. Also, 'ritual' may label activity that is not natively thought of as being ritualistic. For more about both of these points, see William S. Sax, "Ritual and the Problem of Efficacy," *The Problem of Ritual Efficacy* (Oxford, 2010) 3–14.
6. Isaac Bonewits, *Neopagan Rites: A Guide to Creating Public Rituals That Work* (Llewellyn Publications, 2007) 23–24.
7. Peter J. Carrol, *The Octavo (Roundworld Edition): A Sorcerer-Scientist's Grimoire* (Mandrake of Oxford, 2011) 32–33.
8. The phrase "raise energy" can mean different things in various occult contexts. Here it simply means a kind of ecstatic state typically induced by chanting, drumming, dancing. &c.
9. To "charge" a sigil typically means to gaze at it or hold it in the mind's eye while experiencing an altered state of consciousness that both divorces the sigil from its actual or "inner" meaning while associating its "outer" form with something extremely sensational at that moment. The purpose is to tell the sub- or unconscious mind, "this is important!" while distracting the conscious mind and preventing its deliberation.
10. Generative algorithms are distinguished by producing output that was not specified by the programmer and that possibly could not have been predicted. Such algorithms are still completely deterministic. Cf., pseudorandomness. You can make a computer do something truly random by programming it respond to a truly random signal, but the utility of true randomness is limited.
11. "Empty-handed" or "open-handed" magic denotes an ability to produce magical effects with a simple word, gesture, or thought, rather than a full-blown ritual involving props. Some consider it an advanced form of the Art.
12. Janet and Stewart Farar, *The Witches' God* (Phoenix Publishing, 1989) 143–145.
13. There are exceptions, including animism, and it is not uncommon for occultists to ascribe animistic qualities to their magical artifacts or ritual tools.
14. See Joseph Decken's sensation/action paradigm of computing. Cf., the sensor-actuator loops of microcontrollers, robots, and other interactive devices — see, e.g., p. 25 of Massimo Banzi and Michael Shiloh's *Getting Started with Arduino* 3rd ed. (Maker Media, 2015).
15. Appropriate selection is equivalent to intelligence. See W.R. Ashby, *An Introduction to Cybernetics* (Chapman & Hall, 1957) 271–272.
16. "When a constraint exists advantage can usually be taken of it" — see Ashby (ibid.) s.v. "Importance of Constraint," p. 130. Cf., Ian Bogost's *Play Anything* (NBasic Books, 2015), s.v., "The Pleasure of Limits."
17. The back-and-forth between human and computer in human-computer interaction is sometimes seen as a conversation. E.g., Chris Crawford's *The Art of Interactive Design* (No Starch Press, 2002) models HCI as taking turns *speaking*, *thinking*, and

listening. In *Computers as Theatre* (Addison—Wesley, 1993), Brenda Laurel says, "This simplistic notion of conversation led many early interface specialists to develop a model of interaction that treats human and computer as two distinct parties whose 'conversation' is mediated by the screen" (p. 3), and then she goes on to explain some problems with the model. In "[Paskian Artifacts — Machines and Models of Gordon Pask](#)," Paul Pangaro narrates about Pask's "teaching machines," which were an early kind of computer, and their relationship to Pask's [Conversation Theory](#). I expect Pangaro would object to the assertion that computers are truly conversational agents, as conversation is much more than an exchange of messages, but Pask's artifacts, and Pangaro's affinity for them, demonstrate how our own thinking about conversation *vis—à—vis* input—output relationships can inform and inspire how we model, design, perform, and participate in human—computer interaction.

18. Cf., "read—write" culture vs. "read—only" culture as put forth in Lawrence Lessig's *Remix: Making Art and Commerce Thrive in the Hybrid Economy* (Penguin Press, 2008), and compare also Heinz von Foerster: "We seem to be brought up in a world seen through descriptions by others rather than through our own perceptions. This has the consequence that instead of using language as a tool with which to express thoughts and experience, we accept language as a tool that determines our thoughts and experience" ("Perception of the Future and the Future of Perception," *Understanding Understanding: Essays on Cybernetics and Cognition*, Springer, 2003).

19. Bruce Lee, "My View on Gung Fu," in John Little, *Bruce Lee: Artist of Life* (Tuttle Publishing, 2001) 30.