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THE MEDIEVAL EXPERIENCE OF TIME: ARISTOTLE, UNIVERSALS, AND TECHNOLOGIES

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A great number of scholars, from Marc Bloch and Lucien Febvre to Jacques Le Goff to Gerhard Dohrn-van Rossum, have sought to locate the roots of modern timekeeping and temporal orders in late medieval conceptions of time, and particularly in the idea of the equal hour measured by the mechanical clock. Yet, there is a real tendency for Whiggish thought, concentrating as it does on the antecedents to modernity, to leave *mentalité* by the wayside.[1] Medieval people had a number of ways of thinking of time, not all of which correspond to modern categories. The aim of this paper is to detail a number of ways in which people of the thirteenth and fourteenth centuries conceptualized and theorized their temporal experiences, to explore the rationality of these systems, and to look at the application of these theories. Finally, I will look at the application of medieval time-theory in one early fencing treatise, the Germanisches National-museum MS 3227a, to see how these ideas penetrated into the vernacular mentality.

To begin, I will advance the argument that we may divide thought on time in the thirteenth and fourteenth centuries into three main categories: event-markers, such as knowing the time for mass by a primitive sundial; measures of duration, such as the water clock; and timekeeping in the proper sense, that is, the well-studied domain of the astronomer and the mechanical clock. These first and last categories, as we shall see, depend on the second. I will briefly detail each of these before turning to how they were interrelated—which will bring us to the theorization of time, which was remarkably consistent throughout the period, and thence to some applications. Though we will concentrate on the notion of the hour and the daily cycle, one should also bear in mind that the well-studied medieval idea of the yearly cycle, such as the well-known labors of the months depicted on the western portals of Chartres cathedral and the *Très Riches Heures*, are likewise manifest in this, since the length of the unequal hour varied with the seasons. (Contrast this with the equal hour, which is astronomically defined as one twenty-fourth of the revolution of the heavens.)

The first, and most obvious, medieval event-marker was the common signal. The geography of the medieval city was not only physical, but also social. Like the moving bodies in Aristotle's *Physics*, human events take place in space and time, and foremost amongst the signs urban dwellers looked to in order to navigate their paths through time and space were churches—not only the monolithic Church as an institution, but also the individual parish churches that they interacted with on a daily basis. Rather than relying on posted street names as we do today, they navigated through the zig-zagging, cramped alleyways as the people of all European cities did until relatively recently, by sighting the various bell towers over the roofs of the wood-frame buildings.

Besides their use as spiritual and geographical signposts, these bell-towers also acted as temporal markers. In addition to indicators of "natural" time such as the passage of the sun through

the sky, the rhythm of daily life was measured by the ringing of their bells.[2] Everything from the bustling marketplaces so vividly described by Guillaume de la Villeneuve in his thirteenth-century poem "Les Crieries de Paris" to the work of apprentices and waged labor was regulated by this system.[3] For instance, though the echoes of the bells of Notre Dame ringing Vespers might already have been fading into the dusk, the Parisian leatherworker's apprentices, as per the rules of their guild, could not quit work and close their shop until the rector of their parish church rang his own bell. However, their fellow apprentices in the mailmakers' shops, dependent on their masters' whims and not the bell-system, could continue to work by candlelight, glumly piercing rivet-holes in the ends of the curled and flattened pieces of iron wire that will be linked together into habergeons for the knights of the royal court.[4] Whereas we have internalized and personalized the hour with pocket watches and cell phones, in the communal milieu of the medieval city, such signals were perceived from external sources.

While antiquarians may be able to reconstruct the physical maps of medieval cities, this landscape of sonic chronography—the "acoustic environment" (*akustische Umwelt*), as Doris Stockman put it—remains little-studied.[5] Yet, haphazard as it might seem to our eyes, it was a system of telling time no less systematic than satellite-synchronized clocks.[6] Christianity provided a shared symbolic language and culture, a social support network, and a way of reconciling differing interests in this world while preparing for the next. By extension, the church's bell tower ringing the divine offices did not have one sole interpretation, but was a polyvalent symbol of that had many possible different meanings, depending on viewer and context. To the student, it was the signal that he was late to class; for the worker, it was the cue to begin her daily labors; for the monk, it was the summons to divine service.

Claude Gauvard, in her *De Grace Especial*, made a comprehensive study of the use of hours in Paris in descriptions of crimes found in late fourteenth and fifteenth-century letters of remission and found that, of the roughly one-third of cases that made mention of time, less than fifteen percent used clock-time, but about twice that used ecclesiastical time or another common signal such as the dinner-bell.[7] Overall, it seems as if the communal bells were foremost in Parisian minds—and Parisian mentalities are worth paying attention to, as the city was home to some of the most influential theorists of time.

The question, then, is how Frère Jacques knew to ring his bells. This brings us to a fact long known in the history of science, but often neglected in the social history of time: That horology is derived from astronomy. Because of the requirement to keep the divine offices, astronomical study had never disappeared from the West, but benefited from the thirteenth-century reintroduction of Ptolemaic astronomy and the improvement of the astrolabe, by which a reading of a known star, coupled with knowledge of one's latitude, could be used to determine the hour. The mechanical clock began as an observational aid to time and aid this reckoning. Of course, water clocks existed earlier than this, but these, as with early mechanical clocks, only measured *duration*. They were not *timekeeping* devices in the sense that they gave an objective measurement of an independently occurring phenomenon. Whereas observing the night sky, by comparing observation against a known value, can tell the observer the equal hour, a water clock is filled according to the need of the variable hour: the basin fills up; the bell rings; the whole is reset, and one complete cycle is passed. Tables on the length of the unequal hours for the months of the year are found in many medieval pseudo-astronomical manuals, such as the *Liber Nemroth*, and would have enabled church sacristans to "tune," or *temperare*, their water clocks. Even after the widespread introduction of the mechanical clock, the equal hours still had to be reconciled with the unequal, seasonably variable hours to coordinate the ringing of church bells.

We therefore need to make a twofold division between *timing devices*, which can describe duration, and *devices that tell time*, which give an objective indication of the hour—in other words, which mirror the motion of the heavenly sphere. The astrolabe that shows the equal hours belongs to the latter category; the water clock began as the former. Similarly, music and fencing both make use of relative duration. This is the measurement not of absolute quantities, but of relative judgment, is epitomized by the emblem of dividers so often found in fencing treatises.

But did medieval people recognize the difference between "absolute" and "relative" measurement, or is this distinction merely a modern researcher's hindsight? In fact, the distinction would likely not have occurred to the medieval mind: To the medieval thinker, the equal hour of modern clock-time was only a way, albeit a superior way, to measure duration and thus to coordinate social signals. The measured duration of known events was seen as the essence of timekeeping; the abstract hour was a well-known idea in astronomical writing and would have been known to educated people, but rarely intruded on daily life.

We can see this idea in the writings of such thirteenth-century writers as Guillaume d'Auvergne, Wiliam Rufus, and Robert Kilwardby—specifically, their treatments of the fourth book of Aristotle's *Physics*, where the Stagirite ambiguously states that time is "the number of the motion with respect to the before and after."[8] For instance, Guillaume, Bishop of Paris, who lived from 1190–1249, expresses time as experienced with human faculties as a line segment, infinitely divisible and comparable to other lines yet finite, while eternity is a line without end.[9] Human time is eminently measurable. Likewise, William Rufus (fl. 1238–53) and Robert Kilwardby (c. 1215–1729), in their *Physics* commentaries, see time as a metric that can be measured—albeit something that can only be measured against something known, as a day measures a day or, as a 1280 University of Paris statute on how the election of rectors was to be measured by a candle shows, by a mechanical device:

> *Item, that the election of the rector shall last the duration of one candle. This shall be a regulated candle without deception of one pound of wax above a candle-holder of a weight of eight new silver coins, made with four wicks, as is commonly used, so that those who use it can have it made without difficulty, divided in 26 parts, each of which shall be an eighth of a Parisian yard [ulna]. If a lesser weight of wax is used, it shall be of a similar proportion as above. This candle shall be lit in the entrance of the place where the election is held, and shall continue to burn until it is consumed. If, however, anyone takes away or adds to this, they shall be ineligible for any office of the faculty or any nation for the time of the rector's tenure.*[10]

This was not merely abstract thought, but a linking of theory and the daily experience of time. However, we find a difference in opinion between thirteenth-century realists, for whom time is something abstract; and the fourteenth-century nominalists, whose philosophical position required them to link the idea of time to the universe of moving things. Robert Kilwardby, for instance, first dismisses the notion, which he identifies with Averroes, that time is simply the motion of the heavenly sphere. Rather, he says that the day is merely an abstract measurement used because "the regular motion assumed by art and human people is the motion which is common to all people, is the best known and the most regular."[11] For greater ease of use, we have thus further divided the day into hours, minutes, and seconds, which measure the stars "and finally all the motions of the lower world, such as work, writing, speech, and such like, which are said to

be of an hour, since they last for one hour of the motion of the heavens."[12] However, time itself is something Platonically real.

Compare this to the English Franciscan William of Ockham (1288–1328) for whom time is how we know something moves, and that one thing moves or stands still more or longer than something else.[13] Time, in other words, *is* measurement.[14] We note here something marvelous. Whereas thirteenth-century writers believed in the "reality" of time but thought all measurements to be relative, Ockham, living at the dawn of the age of the mechanical clock, denied the existence of "absolute" time even as he defined the essence of time to *be* the act of "telling time."

The question, then, is what is Ockham's "better-known measure," against which we can compare time? Ockham, like his predecessors, first acknowledges that the sun's daily motion is the most common and standard since it is regular and superior to other motions. When one wants to know the (presumably unequal) hour of the day or to judge another length of time—that is, a duration—one can judge from the sun's motion, just as a yard can be known from a yard of cloth. Such would have probably been the practice of Franciscan brothers saying their daily round of prayer. But Ockham believes that even the sun—the standard of the unequal hours—is not good or regular enough to *really* know time. Unlike his thirteenth-century predecessors, Ockham believes that the invisible outermost heavenly sphere, the *primum mobile* (which in turn affects the movement of the sphere of fixed stars), is the absolute guide by which the motion of every other body is known. What Ockham is expressing is nothing less than a fully theorized *timekeeping* justified by scientific observation: As for Ptolemy, it is the motion of the stars, measured by trigonometry (and mirrored by clocks) that measures all other motions and forms. But it is still a timekeeping based in durations: There is no idea of time "detached in distinct and arbitrary units," as Alain Boureau put it; we are still dependent on measuring the heavenly sphere to know time.[15]

The Parisian academian Jean Buridan was heavily influenced by Ockham, and in turn helped to pass Ockham's ideas on to later generations. Because their mutual nominalism made it incumbent to tie the measure of time to the motion of real things in the material world, time to Buridan was nothing more than motion in space. Even if Buridan's definition of time seems considerably different from Ockham's, the Parisian arts master still owes much to his Oxford predecessor—especially in his well-considered arguments on the problem of the measurement of time. Like Ockham, Buridan believed that time exists because it can be measured. Also like Ockham, he established as his yardstick the most absolute thing in the universe—the physical object closest to the divine, put into motion by the divine hand itself: The outermost sphere. While, as a nominalist and skeptic, Buridan still believes that time can only be measured by the motion of material things, by setting the standard for determining the passage of time as the cosmos itself, he, like Ockham, gave the utmost authority and uniformity he can to the measurement of time.

However, this was not mere stargazing; Buridan also directly relates his thinking to the world of work and production. Even as he recognized that time-measurements in the human world are imperfect and inferior to that of the heavenly sphere, he uses an exemplum that reveals his concern for time-management most explicitly, saying that "common people" (*apud vulgares*) tell time by the sun; that when they can not see the sun (common in northern France during the winter!) handworkers (*mechanici*) often use the duration of their work to tell the time, concluding from the amount of work finished that it is Tierce and time to eat, and also ecclesiastics use clocks to tell time—even if the movement of the clock was not time itself.[16] Buridan, like his predecessors,

shies away from abstraction and directly relates his thinking to the mundane world. What philosophers of the thirteenth and fourteenth century shared in common, no matter what their philosophical stance, was a desire to relate the "number of motion" to the world of experienced and measured things.

Thinkers of the fourteenth century were forced by both practical and philosophical necessity to tie the measure of time to the real world of moving things. On the one hand, the movement of objects (clocks, stars, *et cetera*) is how we know that time passes. On other, the demands of nominalist philosophy said that time only exists insofar as there moving things to be enumerated by the human mind—following what St. Augustine said, "In you, O my soul, I measure time."[17] Moreover, this was no mere Scholastic construct that inquired after angels dancing on the heads of pins, but a real science that could make sense of the world of applied phenomena. Nor did the flow of knowledge go merely from the world of activity to the minds of scholars, but was actively vernacularized and used as a practical technology.

The specific concrete example of applied Aristotelianism I would like to cite is the fencing treatise contained in GNM 3227a. This, a German *hausbuch* written c. 1389, uses Aristotelian terminology to explain the physical skill of fencing. This text, besides containing a number of alchemical and medical recipes, records the mnemonic teaching verses of the fencing master Johannes Liechtenauer.[18] Making explicit use of Aristotelian terminology, Liechtenaeuer tells us that, "Movement, that beautiful word, is a heart and a crown to fencing" (*Motus das worte schone / ist des fechtens eyn hort und krone*). He then speaks of the "before," "after," and "during" of an action (*vor, nach, indes*), following the Aristotelian dictum concerning the "number of the motion."

What this means, in a fencing sense, is the relative timing of an action vis-à-vis the adversary's movement. Fencing is not, as Sidney Anglo maintained in the *Martial Arts of Renaissance Europe*, "a kind of dance," and European fencing masters, unlike music masters, never attempted to regulate motion in such a manner.[19] Following Aristotle, in fencing theory both medieval and modern, one movement is considered to be one "time." Fencing is what is called an "open" movement skill, where one's own action is judged and predicated on what the adversary's motion. What Liechtenaeuer's vocabulary of "before" and "after" does is give is a means of describing this movement. The duration of each movement—whether long or short—depends on the adversary's own movements. One must do the right thing at the right time, and the same movement, done in a different context, can have a very different purpose and tactical effect. For a simple example, a diagonal cut made before the adversary's movement is an attack; made after, it may act as a parry; made at the same time, it might be a counterattack. To emerge the victor, one must have a sense of timing—or tempo, as it is known in fencing, knowing both when to initiate an action and how large or small, fast or slow, the action should be. To teach this, one also needs a language to specify the configuration of actions in space and time.

Thus, when Liechtenaeuer tells us to always make the *vorschlag* in the context of condemning overly-large actions and useless motion, he is not merely saying to seize the initiative and strike *first*, but that we must "gain time" on the adversary—that is, act in such a way that he is always lagging behind our tempo. In other words, if time is the "number of the motion with respect to the before and after," we must master *timing* in order to make a smaller number and be in the "before," that is, one step ahead. If we seize the initiative and strike, our opponent is either hit or parries, in which case we can make yet a faster action to evade that parry and strike to the opening he has created. If he counterattacks, we must respond in an even shorter space of time. If he attacks, our parry or counterattack must be made within the space of time he has made. These are concepts that would be familiar to any modern épéeist, and, indeed, the language of fencing

(along with music) is one of the last remaining vestiges of Aristotelian comparison of durations. Without understanding Aristotelian physics, we cannot understand how to fence.

The Aristotelian use of time is not, however, a mere evolutionary dead-end in Western thought and philosophy to be superseded by the absolute metric of the Enlightenment. Rather, it is significant to later developments in science: What Liechtenaeuer's fencing gives us is nothing less than a vocabulary of describing motion in space and time—an abstraction whose implications are quite separate from its Aristotelian theoretical background.

For a contrast, we can compare GNM 3227a to next-oldest (and in fact oldest known) fencing book, Royal Armouries MS I.33. The bulk of this 34-folio consists of exemplary "plays," or sequences of actions, performed by a fencing master (the *sacerdos*, or priest) and his student (the *scolaris*). In other words, following the common medieval model of education, the reader is expected to follow a model. There is no theorization of time; the action-and-response format described in the manuscript could equally belong to a closed motor skill (such as a sword-dance) as an open motor skill (that is, actual fencing, with its tactical use and variation of time). Such information was probably transmitted in person. On the page, however, the fencing figures of MS I.33, more icon than illustration, participate in the static nature of medieval art.

GNM 3227a transcends this limitation by not relying on images, but on words: Rather than trying to reduce a complicated physical practice to two-dimensional images, it records an oral tradition (Liechtenaeuer's verses) that in turn includes an abstract theorization of space and time that precisely describes how one is to operate. In this, the fencing treatise presages the numeration and mathematical theorization of reality that was a hallmark of the Scientific Revolution, and gives us a concrete example of the application of Scholastic theoretical science to moving things in the real world.

Liechtenaeuer's verses are also one more instance that show that while today, we might ask, "what time is it?" and expect a universally and abstractly true answer, medieval people, through all levels of society, were much more interested in comparisons of duration and in common signals. To the modern mind, used to the absolute hour, medieval ideas of time seem foreign indeed, and truthfully, we cannot easily approach the mental landscape of the Middle Ages: We live in a technologically-determined world of internalized absolute time, not one of shared social experience. It is only in select instances that we can approach the medieval way of seeing time. One is through mental reflection on the abstract: The educated of the Middle Ages strove for a unified worldview under the theory of Aristotle that made itself manifest in such diverse fields as fencing and astronomy. But better is to do so through lived experience—physical arts such as fencing, music, and dance, for instance. To perform all of these activities successfully, we must be coordinated with the relative times of others; if we do not, we are literally out of tempo. This is the essence of medieval relative measurement—to be aware of the times of the movements of the world, and to coordinate ourselves and our activities, from work to liturgical celebrations to swordsmanship with these rhythms. The Middle Ages, after all, valued communal experience over individual.

Endnotes

1. I am here thinking of Lewis Mumford, David Landes, and other historians of science—Bloch and the *annalistes* were more concentrated on the otherness and imprecision of medieval timekeeping. For the latter, see Marc Bloch, *La sociètè fèodale*, 2 vols. (Paris: A. Michel, 1939), 1.117; Lucien Febvre, "Temps flottant, temps dormant," in *Le problème de l'incroyance: la religion de Rabelais* (Paris: Albin

Michel, 1942), 426–434. For the former, see David Landes, *Revolution in Time* (Cambridge, MA: Harvard University Press, 1983); Lewis Mumford, *Technics and Civilization* (New York: Harcourt Brace, 1934), 12–18, and Gerhard Dohrn-van Rossum, *History of the Hour*, translated by Thomas Dunlap (Chicago: University of Chicago Press, 1996) (original *Die Geschichte der Stunde: Uhren und moderne Zeitordnungen*. München: Carl Hanser Verlag, 1992). Jacques Le Goff in his "Au Moyen Age: temps de l'Église et temps du marchand" (*Annales* 15:3 (1960): 417-433) combines the streams, concerned with the change to a preise capitalist mentality from an imprecise medieval one. Bloch, *La sociètè fèodale*, 1.74.

2. Church bells (Latin *campana* or *clocca* from the Irish *clog*, whence French *cloche*, from whence the English *clock*), are of unquestionably ancient date. Guillaume Durand, in Book IV of his *Rationale Divinorum Officorum* (q.v.), attributes the custom of ringing bells to Pope Sabinian (604–06).
3. For Villeneuve, see BnF MS fr. 837, f. 246.
4. For, leatherworkers, see René de Lespinasse and François Bonnardot, *Les Métiers et Corporations de la Ville de Paris: Le Livre des Métiers d'Etienne Boileau* (Paris: Imprimerie Nationale, 1879), 183; for mailmakers, see ibidem, 56.
5. Doris Stockman, "Die Glocke im Profangebrauch des Spätmittelalters," in *Studia instrumentorum musicae popularis* (Festschrift E. Emsheimer), ed. Gustaf Hilleström (Stockholm, 1974), 3:224–232.
6. France adopted World Standard Time on March 9, 1911.
7. Gauvard, *De Grace Especial* (Paris, 1992), 491.
8. *Physics* IV.11.
9. *De universo* in *Opera Omnia* (Paris, 1674) 1.683: *Dico insuper quod aeternitas impartibilis est secundum prius and posterius. . . . In aeternitate non posse esse prius neque posterius secundum successionem aut fluxum, sive desinentiam; quare esse aeternitatis totum simul est. . .*
10. *Historia Universitatis Parisiensis*, ed, by César-Egasse Du Boulay. 3 volumes. Paris, 1665, 3.451 (1280): *Item quod solum per spatium durationis unius Candelae, quae unius totius Candelae vulgariter sine fraude de una libra cerae supra Ellychnium ponderis octo sterlingorum novorum de quatuor filis confectum, ut communiter sine dolo eis operators Candelarum factae. Portio vigesima sexta erit, quae portio in longitudinem habebit octavam partem ulnae Parisensis. Si autem minus pondus cerae accipiatur, iuxta praecendens consimilis proportio observetur. Quae Candela in introitu ipsorum ad locum electionis accendetur, & continue ardebit usque ad consumptionem eiusdem Candelae postestatem habebunt elegendi Rectorem ac infra idem spatium eligere teneantur. Si autem in aliquo istorum defecerint, vel aliquis [in Cod. Gall. Nat. legitur si aliquis defecerit] per totum tempus sequentis Rectoriae ad hoc quod ad quaecunque official Facultatis vel Nationis eligantur vel eligatur, inhabiles aut inhabilis reddantur, seu reddatur.*
11. Robert Kilwardby, *De tempore* edited P. Osmund Lewry (Oxford, Oxford University Press, 1987), 20.
12. *De tempore*, 21.
13. Ockham, *Philosophia Naturalis* (Rome, 1634), 4.2
14. Ibid, IV, 4.
15. Alain Boureau, "La construction ontologique de la mesure chez Robert Kilwardby (ca. 1210-1279)" in Catherine Homo-Lechner (ed.) *La rationalization du temps au XIII^e siècle* (Paris: Créaphis, 1991), 32–45. Boureau was, of course, referring to Kilwardby, but his observation seems truer of Ockham.
16. Jean Buridan *Quaestiones super octo Physicorum libros Aristotelis* (Paris, 1509), 4.12, conclusio 3 [78 v–79r]: *Quarta conclusio est que apud vulgares motus solis compositus ex diurno et proprio magis est tempus quem aliquis alius motis quia sicut per notatum est hoc nomen tempus ultra hoc nomen motus connotat que sit mensura aliorum motuum ideo unusquisque magis habet illum motum per tempore quo magis mensurat alios motus sed maxime vulgares mensurat per dictum motum solis est eis notisimus quia maxime sensui apparens et non est eis notus simplex motus diurnus sed distincte a motu proprio ideo non possunt illo mensurare mensura enim debet esse notior mensurato cum per mensuram debeamus cognoscere mensuratum quantum ipsum sit. Quinta conclusio est que sepe operatores mechanici utuntur sua operatione per motum temporis quia ex consuetudine computatis sue operationis est multum es nota ideo sepe ex ea mesnurant*

alios motus immo motum solis cum enim non videant sole tamen ex comptitante sue operationis concludunt que est hora tertia et tempus comedendi et etiam ecclesiastici horologio utuntur per modum temporis temn non est proprie tempus quare primo indicuit horologium que motus eius solis mensuraet.

17. *Confessions* XI.26.
18. For a full contextual examination of MS 3227a, see Keith Alderson's contribution in this volume.
19. Anglo, *Martial Arts of Renaissance Europe* (New Haven, 2001), 89–90. Anglo has since modified his view; see, for instance, his essay in Tobias Capwell (ed.) The Noble Art of the Sword: Fashion and Fencing in Renaissance Europe (London: Paul Holberton Publishing, 2012), 153, in which he states that figures in combat manuals "were not an attempt to notate complete combats—not even of the past, let alone of the wholly unpredictable future—for, unlike a ballet, serious personal combat is not susceptible to choreography and there can never be a method whereby it might be made so."