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Niko Strobach, *The Moment of Change. A Systematic History in the Philosophy of Space and Time*, Kluwer Academic Publishers, Dordrecht/Boston/London 1998 (= *New Synthese Historical Library*, vol. 45), xii + 302 S., 250 hfl.

When does a change happen? How is change and the time of changing to be described both logically and ontologically? These are the questions at the centre of the problem of the moment of change (MOC). Strobach's book is the first book-length study reviewing the discussion of this long-standing philosophical riddle. Whitehead's remark on the history of philosophy as a footnote to Plato applies here, too (20): Strobach starts off with a thoroughgoing discussion of Plato's doctrine of *exaiphnes* in the *Parm.* 155e-157b (20-47). The profoundest discussion of the MOC, however, is in Strobach's eyes to be found in Aristotle's *Physics* (47-83), which had a strong influence both on the medieval logic of tense and time (84-110) and the modern discussion of the MOC. Some paragraphs on the MOC in Mendelssohn and Kant (who touch on the MOC within a discussion on the eternity of the human soul; 112-121) and Schopenhauer (121-123) conclude the first, historical part.

The second part reviews the discussion about the MOC in the twentieth century (124-197), whereas in the third part Strobach develops his own systematic solution of the problem (198-234). Strobach distinguishes between the description and the classification of change (3). The question of description is: "Which (if any) state obtains at the limit between the old state and the new state?" On the other hand, the question of classification is: "When (if at all) does an *event* of changing take place?" (3; Strobach's italics) Highly important for the classification is a principle that Strobach calls "Plato's premise" (because its oldest formulation can be found in *Parm.* 156c) which is at the base of the riddle of the MOC: "An *event* of changing cannot take place while the old state still obtains; but when the new state already obtains it cannot take place either." (5; my italics)

Combinatorially, there are four options for the description of the MOC. All of them have actually been proposed by philosophers during the twentieth century. R. Sorabji, F. Jackson/R. Pargetter and A. Galton are adherents of the "either/or-option" (124-145), whereas R. Chisholm (following F. Brentano) and B. Medlin adhere to the "either-way-option" (146-160). G. Priest (following G.W.F. Hegel) develops a paraconsistent logic for the "both-states-option" by restriction of the law of non-contradiction (LNC) (161-170), while

Ch. Hamblin sacrifices the law of the excluded middle (LEM) by choosing the “neither/nor-option” (171-182). D. Bostock, B. Russell and N. Kretzmann join in with a fifth position, the “Neutral Instant Analysis” (NIA), which is in fact a bit of a misnomer, because the NIA is a compromise solution: Only for changes between two positive states (“s-change”), e.g. from rest to motion, the NIA opts for “neither/nor”, thus only there is a neutral instant. In case of a Cambridge-change (“C-change”) from p to non-p, e.g. from rest to non-rest, the NIA opts for “either/or”. Both LNC and LEM remain valid without restriction. But the NIA leaves open the question of classification and “induces a *phenomenological unease* when it comes to the question: What does anything *look like* when it is neither in rest nor in motion?” (12; Strobach’s italics) Strobach’s own systematic suggestion (to be discussed in section IV below) is in fact a further development of the NIA that matches these difficulties. According to the historical interest of this journal, I will first focus on the historical part of Strobach’s book and discuss his interpretation of Plato (I), Aristotle (II) and the medievals (III).

I.

When it comes to Plato, Strobach presents six different ways to interpret the short passage in the *Parmenides*, which of course ascribe completely different theories to Plato. The logical status of the change happening at the *exaiphnes* (at the “sudden”) can be described in three different ways: Version A is based on a two-valued logic with classical negation and has to abandon both LNC and LEM for everything happening at the *exaiphnes* (28). The three-valued version B dismisses only LEM, but has to renounce the rule of double negation (29). Version C, finally, uses a special predicate negation that bears some similarity to Aristotle’s concept of privation; both LNC and LEM remain untouched (31-32). Each of these three logical versions can be combined with one of two ontological interpretations (“Plato-1” and “Plato-2”): According to Plato-1, *chronoi* are time instants, whereas *exaiphnes* are extratemporal. Change is thus banished from time (33) and is classified as an extratemporal event (45). Plato-1 describes the MOC using the neither/nor-option, when combined with version C without violation of LEM. According to Plato-2, *chronoi* are periods of time, whereas *exaiphnes* are instants. These periods, however, must not be chosen arbitrarily or be interpreted as “time-atoms” (as C. Strang wants it). Strobach interprets *chronoi* as phases, *i.e.* as “maximal periods of a state” (40). This allows Strobach to defend Plato-2 against objections by D. Bostock and K.W. Mills and to develop Plato-2 into a strong interpretation. Plato-2 describes the MOC by “either/or” and classifies it as “the limiting instant between a

phase of the old and a phase of the new state” (45). Indeed, this is the interpretation preferred by Strobach: “Plato-2 in connection with logical version C best represents Plato’s view” (46). Strobach tries to corroborate his choice with some historical observations (41-45) in Aulus Gellius, Sextus Empiricus (the reference in note 55, p. 251 is false; it should be to *Adv. Math.* IX.269 = *Adv. Phys.* I.269) and Augustine: In their discussion of the MOC, these three authors understand *chronos* according to Plato-2. However, none of these authors cite Plato as their source, whereas Sextus Empiricus traces his version of the riddle back to Diodoros Cronos (in a passage that passed unnoticed by Strobach: *Adv. Math.* X.85 = SSR II F 13 = Döring 123). In terms of time, this leads quite close to Plato, but doxographically it leads to the Megarians and not to the Academy.

II.

Aristotle knows two sorts of times. A time can be a *chronos* or a *nun*, i.e. a period or an instant. A *chronos* is always a period of a certain duration that can be divided into parts that are *chronoi* as well. In contrast to Plato, Aristotle’s *chronoi* may be “state-transcendent” (49). Instants, which are densely ordered, belong to periods as boundaries or fall within periods (49). The key to Aristotle’s treatment of the MOC is his distinction of two kinds of properties: “Comparative properties are properties which are assigned to an object by comparing its states at different instants between which there is always a certain period of time. Non-comparative properties are properties which do not have this structure.” (52) Rest and motion (*kinesis*, *metabole*, and *stasis*) are such comparative properties: They can never be assigned at instants, only at periods (51). For them there is a trivial solution for the MOC: As there is no rest or motion at instants whatsoever, there is also no rest or motion at limiting instants; thus Aristotle decides for the neither/nor-option in this case (55). In the case of non-comparative properties, however, Aristotle chooses the either/or-option, because there is “good reason for regarding the problematic limiting instant as an instant when the target state has in fact been reached” (57). According to Strobach, Aristotle treats substantial change as a non-comparative property: “objects would usually have a first instant of existence, but no last instant of existence (while there is a first instant of non-existence)” (59). This is also “the typical view of the Middle Ages” (59, cf. 92-94).

Strobach proceeds with a reconstruction of the proof in *Phys.* VI.5, 235b17-28 (60-62) and of the four *en ho proto*-proofs in *Phys.* VI.5-8, 235b32-238a36 (63-75). For the latter, two

things are important, as Strobach points out: First, *proton* is used in a hierarchical rather than a temporal meaning. Second, the sentences to be analysed may not carry any adverbs with them indicating a goal of the process in question (70): Only sentences of the form “A moves” are considered by Aristotle, not sentences like “A moves from x to y”. (Strobach calls this “using a verb ‘transitively’ or ‘intransitively’”. This is misleading, for these words normally refer to verbs carrying objects or not, while here we deal with adverbial phrases like “from x to y”, fixing the endpoints of the process. The distinction itself, however, is clear and already prominent in Plotinus’ criticism of Aristotle, 76-77.) Strobach lists three necessary conditions a time must fulfil to be the “prime time” (the *en ho proto*) of such sentences (72; similar criticism applies to the definition, 75). The item (ii) on his list (“There is no part of z which does not satisfy P”) is clearly *false* for sentences like “A moves from x to y”, thus making the explication of the *en ho proto* unnecessarily narrow: There is a minimal period in which A moves from x to y, and in no subinterval of this period A moves from x to y. Why should this not be an *en ho proto* of “A moves from x to y”? For sentences like “A moves”, on the other hand, (ii) is *redundant* anyway, because for such sentences the violation of (ii) implies the violation of (iii).

According to Strobach, Aristotle does not classify the change that happens at the MOC as an event: “Aristotle’s events are extended processes and nothing else” (79). This is objectionable: Life is an event, but living is classified by Aristotle not as a process or *kinesis*, but as an *energeia*; see *Metaph. IX.6*, 1048b18-35. (I argue that *energeiai* are events in: Are Aristotle’s *energeiai* states or events? In: *Analyomen 2. Philosophy of Language. Metaphysics*, ed. G. Meggle. Berlin/New York 1997, S. 369-375.) In any case, there are no instantaneous events of change for Aristotle, and thus he can neglect Plato’s premise. Strobach judges Aristotle’s position as “consistent and thoroughly designed”, while it is “so radical, that one can hardly follow it without coming into conflict with intuition” (79). Aristotle’s account of the MOC entails a systematic reversal of Plato’s terminology (78). However, if Plato is interpreted, as Strobach suggests, in terms of Plato-2 combined with the logic of version C, the Aristotelian theory can coherently be considered to be “a constructive criticism, a further stage in a development that Plato had begun” (82).

III.

Like Aristotle in the *en ho proto*-proofs, Strobach restricts his discussion of the medieval

analysis of the MOC to homogenous events, i.e. to sentences like “A walks” as opposed to sentences fixing the endpoints like “A walks from x to y” (89, but *cf.* 90, where he uses explicitly such a sentence with x and y as constants, and, irritatingly, 91, which however makes sense with x and y as variables). Strobach claims that it “would be possible, but more complicated, to work with constant target and starting positions” (261, n.32). However, as it is not obvious how the solution for constant endpoints should look like, this is a regrettable lack of generality.

As the medievals talk about motion at instants (while Aristotle allows for motion at periods only), Strobach introduces a “State”-prefix, designed to formalize the progressive phrase “being in the course of motion” and similar notions, describing an event in progress (90-91). A prefix is a predicate modifier: When attached to the name of a predicate it yields “a new, complex predicate name, naming another predicate” (14, *cf.* 17). Strobach restricts the application of the “State”-prefix to what he calls “a p-predicate (*i.e.* a predicate which has periods as its domain)”, whereas the prefixed predicate is thought to be “an i-predicate (*i.e.* a predicate which has instants as its domain)” (91). The predicates in question are sentence-predicates, having instants as their domain and truth-values as their range. Seemingly, they are considered to be partial functions, yielding a truth-value only for some temporal object and being not defined for others. But shortly after the naming rule for “State” Strobach allows “that State-P(t) might be true although P(t) is false”: Here, Strobach thinks of both “State-P” and of “P” as (at least) i-predicates, yielding truth-values for the instant t. According to his naming rule, for “State-P” to be well formed, “P(t)” should have been a senseless statement (and thus bare of any truth-value, 179). I would suggest to redefine p-predicates as such sentence-predicates that yield true statements only when applied to periods, and i-predicate analogously as such sentence-predicates that yield true statements only when applied to instants. Then, “i-predicate” is a semantic notion, which should not figure within the syntactic part of the naming rule. Whether “State-P” can be truly applied to periods should not be matter of definition, but a corollary of the definition. But even when this is done, there are still problems when it comes to the application of the “State”-prefix in the analysis of the Latin words “*incipit*” (“begins”) and “*desinit*” (“ends”), which Strobach renders as the prefixes “Inc” and “Desin”, which both take and yield i-predicates (107). But in the naming rule the predicate name “P” is treated as if it designates both a p-predicate (because it is prefixed with “State”) and an i-predicate (because it is prefixed with “Inc” and “Desin”). Strobach should either allow “Inc” and “Desin” to work on p-predicates, too, or else, in the

case of comparative properties (also called “s-properties” by Strobach, the medieval *res successivae*; 90), he is only able to give a truth-condition for “Inc-State-P(t)”. (It should be noted, that Strobach meanwhile presented a different analysis of some of the material of the chapter on the middle ages; the points criticized are not touched in this new account: Die Analyse von ‘Anfangen’ und ‘Aufhören’ und das Wort ‘unmittelbar’ (immediate) in der mittelalterlichen Logik. In: *Entwicklungslinien mittelalterlicher Philosophie*, ed. G. Leibold and W. Löffler. Wien 1999, S. 193-207.)

IV.

Strobach’s own solution of the riddle of the MOC is a refined version of the NIA. It is based on the rejection of what Strobach calls the “snapshot myth” (202), *i.e.* the claim that a complete description of the world can be given by a sequence of “snapshots” of instantaneous states. The snapshot myth is presupposed by e.g. Zeno’s arrow-paradox (not in Aristotle’s wording, but in the formulation given by Strobach, 202, which is thus immune to Aristotle’s solution in *Phys.* VI.9) and by Russell’s view “that talk of rest and motion could be *completely reduced* to talk of places at times” (203, Strobach’s italics). Strobach, however, has good reason to put an end to the snapshot myth: “Both the idea of actually putting together an infinite number of single items and the idea of a ‘picture’ taken with a zero seconds exposure time are absurd.” (205) If there were only instants, the world would be empirically inaccessible, because instants are empirically inaccessible (205). Instead, Strobach takes periods and what we observe within periods as basic. Of course, an observed object is not necessarily unchanged during this period, it may e.g. move from one place to another or change its colour. Thus, we do not necessarily observe clear-cut states within periods, but a whole “span” (207) of several determinate properties that a certain determinable property takes on during this time. Starting from these spans, or so Strobach claims, we get instantaneous states by way of abstraction. Strobach calls this method of abstraction “empirical limes” (212): If we consider shorter and shorter periods both before and after the instant in question, and if in both cases there is a convergence to the same property, we are allowed to ascribe this property at the instant. However convincing this idea is, the formalization presented (212-213 and 216) needs rewording. Central to Strobach’s account is his introduction of two abbreviations, S_V and S_N (presumably dubbed according to the German “vorher” and “nachher”). It seems as if Strobach did not make his mind up whether S_V and S_N should name sets with many elements (*i.e.* infinitely many spans), sets

with exactly one element (*i.e.* the overlap of the infinitely many spans of the first version) or whether they should name this very element. Each of these options is viable, but obviously not in combination with any other.

The application of this empirical limes yields the following description of the MOC (213-224): The either/or-option should be used for s-changes at the beginning and the end of processes and for Cambridge-changes, while the neither/nor-option is to be used for s-changes between a process of change and remaining the same and for discontinuous s-changes (e.g. an instrument's change of pitch). Strobach's classification of change comes along with a dismissal of Plato's premise (225-228). Strobach revises the concept of "happening suddenly" in epistemic terms (229): Changes are sudden, if and only if "for any observer O it is true that O can neither be in the course of observing the old state nor be in the course of observing the new state when the change is taking place" (228). The denial of Plato's premise in its ontological form allows Strobach "to regard all changes as datable, instantaneous events, *i.e.* as events of changing which do not *take* time but which, nevertheless, *take place* in time" (229; Strobach's italics). After this logical analysis, Strobach adds a paragraph on the "phenomenology" of the MOC, for which he gives the following reason: "Logic can only teach us how to cope with the moment of change, without giving up fundamental principles of thought such as the LNC and the LEM. [...] but it does not change the phenomena. It does not change our life." (231) Hence the question: How do we experience changes? Firstly, as change is described as an event in time, we can surely *be present* at a change (231). But, secondly, as changes are instantaneous, we can certainly not *observe* changes (232), though, thirdly, we can *witness* them by observing abutting periods in which the old and the new state obtains throughout (233). Thus, Strobach presents an analysis of the MOC, that does justice both to our logical and our epistemological intuitions.

To add some trivialities: Both author and publisher could have paid more attention to the outer appearance of the book and its layout. The book is structured somewhat inconsistently by two overlapping systems, a decimal structuring and paragraph numbers; in addition, the table of contents does not contain all headings of the subdivisions. The publisher failed to write the author's first name correctly on the coversheet (iii), and staff of publishing houses must not scribble on camera ready prints (18), especially when they charge a fortune for a book. Future readers might want to correct the following major misprints: On p. 45, "Plato-1" and "Plato-2" are to be exchanged in the forth line. On p.90, quantification must be over c in both cases, and the second definition should read "(B2) F is an s-property iff [...]". On p.104,

in the formulae in line 29 and 30 the second closing parenthesis is to be moved towards the end of the formulae. On p.194, line 35 and 38 and on p. 195, line 22 and 24 the conditional signs are to be replaced by conjunction signs to avoid trivialization. In the third line from the bottom on p. 218 read " $\kappa^{\circ}\text{-D}(a, t)$ ", in the first line on p. 219 read " $\eta^{\circ}\text{-D}(a, t)$ ".

By way of conclusion I may say that Strobach's book lives up to what its own sub-title calls a "systematic history" of a philosophical problem. Historical and logical analysis support and enrich each other, not only separately for each author discussed, but also diachronically. At one point, Strobach nicely writes: "Philosophical questions come and go, but logic remains the same whatever it is applied to." (110) His well written study proves that sometimes there is also an astonishing continuity in asking philosophical questions from antiquity to our time, and the MOC turns out to be a marvellous example.