

EXAMINATION OF THE AXIOMATIC FOUNDATIONS
 OF A THEORY OF CHANGE. II

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SECOND PART*

Confrontation with the Thomistic Theory

In the formalization which appeared in an earlier issue of this Journal, we abstained from making any explicit reference to the Thomistic theory of change. It is for the sake of clarity that we chose to present the basic elements of the theory of change without interspersing them with philosophical considerations. Contentwise our axiomatization was aimed at reflecting essentially Thomas Aquinas' doctrine on change. It is now our goal to show this coincidence by reference to pertinent texts of Aquinas.

We quote first the main text which reads: "Some things in the world are certainly in process of change: this we plainly see. Now anything in process of change is being changed by something else. This is so because it is characteristic of things in process of change that they do not yet have the perfection towards which they move, though able to have it; whereas it is characteristic of something causing change to have that perfection already. For to cause change is to bring into being what was previously only able to be, and this can only be done by something that already is: thus fire, which is actually hot, causes wood, which is able to be hot, to become actually hot, and in this way causes change in the wood. Now the same thing cannot at the same time be both actually x and potentially x , though it can be actually x and potentially y ; the actually hot cannot at the same time be potentially hot, though it can be potentially cold. Consequently, a thing in process of change cannot itself cause that same change; it cannot change itself. Of necessity therefore anything in process of change is being changed by something else."¹

*The first part of this paper appeared in *Notre Dame Journal of Formal Logic*, vol. IX (1968), pp. 371-384. It will be referred to throughout the remaining parts, as [I]. See additional References given at the end of this part.

In showing the conformity of our formalization with Thomas' teaching, we shall deal with the following six points: subject, property, act and potency, change, causality and valuation.

1. If we compare the first primitive notion introduced in our monograph, namely "momentaneous subject", with the notion of subject as used in the above quoted text, the coincidence between both is manifest. Although Thomas does not explicitly speak of "momentaneous" subject, he certainly includes implicitly the time element when referring to a subject as bearer of a change. This becomes quite clear when we consider some of the words he uses as, for example, "at the same time" (*simul*), "now and before" (*nunc and prius*), "in each instant of this temporal succession" (*quolibet instanti illius temporis*). Should one pay close attention to the various tenses taken by the verbs under Thomas' pen, he would notice a clear reference to a definite point in time or period of time: e.g., "movetur—movebitur", "alteratum—alterat", "generatur—generabatur", "calefacta—calefacit".²

When Thomas speaks of a subject as bearer of a change, he considers the subject as one whole. For Aquinas, the subject undergoing a change cannot as such and under the same consideration be at the same time mover and moved, otherwise it would be necessary to consider this subject in its parts and the proposition "anything in process of change is being changed by something else" would cease to be valid. Albert Mitterer stressed this point of view in one of his publications, [9]. That Thomas considers the subject of change as one whole is also manifest when dealing with self-movement: "Furthermore, it must be primarily moved. This means that it must be moved by reason of itself, and not by reason of a part of itself, as happens when an animal is moved by the motion of its foot. For, in this sense, a whole would not be moved by itself, but by a part, and one part would be moved by another."³

2. In order to explain the notions "in actu" and "in potentia" with regard to change, we first introduced in our formalization a domain of properties. Following Aristotle, Aquinas speaks of such properties, which are the characteristics of the bearer of change, as, for example, quality, quantity, local presence, and so on. For Thomas, only the material beings are in a strict sense subjects of change: "Movement in the strict sense is applied to bodies, . . .".⁴ Change in this sense always comprises an initial state and a final state, and can be rightly described as a process of the transition from being-in-potency to being-in-act with regard to a certain determination: "Anything in process of change flows from one phase of change into another."⁵ "On the other hand, it is of the very nature of movement for the subject moved to be otherwise now than it was before; and therefore in every now of time which measures movement, the movable subject is in various dispositions, and so in the last now it must have a different form from what it had before."⁶ In other words, for a subject to undergo a change involves the transition between its initial and final states through an arbitrary number of intermediary states. Thomas refers to these states as

“actus imperfecti”⁷. These intermediary states receive their specification from the final state: “Just as a natural thing has its species from its form, so an action has its species from its object, just as does movement from its term . . . since movement derives its species from its terms.”⁸

3. The notions “in actu” and “in potentia” are derived from the dual notions “act and potency” which originate with Aristotle who spoke of “ενεργεία εἶναι, δυνάμει εἶναι”. Act means completion or possession of a property whereas potency indicates a capacity to be completed with respect to a property. When Aquinas explains the dual principles, the potential and the actual, he mentions that being-in-potency and being-in-act are joined in the process of becoming without contradiction. As for being-in-act, the word “act” signifies completion and perfection, thus the form.⁹

A. G. Van Melsen has admirably expressed the meaning of act and potency when he writes: “Aristotle distinguishes between being-in-capacity or being-in-potency and being-in-perfection or being-in-act. Thus if we say that an acorn is an oak, our statement is correct provided we understand it is an oak-in-potency; but it is false if we mean it is an oak-in-act. Hence capacity-for-being is neither simply non-being, nor simply being. It is a being-in-potency, distinct on one hand from absolute non-being and, on the other hand, from being-in-act,” [10]. For Aristotle and Aquinas the notions of act and potency are the logical principles necessary in order to grasp the changes happening in the concrete world.

At first, it would seem that the notions “act and potency” are to be classified both as primitive notions. In our formalization the notion “act” alone is primitive whereas the notion “potency” is a defined notion. While commenting on Aristotle’s metaphysical principles, Aquinas introduces the notion “act” as a primitive notion and the notion “potency” as a defined notion: it is necessary that the intrinsic foundation of the act (completion) precedes that of the potency (capacity), just as the knowledge of the act that of the potency. And that is why . . . Aristotle has defined the potency through the act; the act, on the other hand, he could only circumscribe inductively.¹⁰ Potency or capacity includes of necessity the direction to the act or completion: “Being-in-potency is nothing else as being-in-direction to a completion”.¹¹

It may be of interest to point out here that propositions S5.1 and S5.2 of our formalization together express the following passage of Aquinas’ text: “The same thing cannot at the same time be both actually α and potentially α , though it can be actually α and potentially β .”¹²

4. Let us compare our definition of change with the Thomistic notion of change. It has been our contention that the essence of change does not consist in the continuous process involved in acquiring a new determination, but rather in the acquisition itself of the new determination. This seems to be Thomas’ understanding: “For to cause change is to bring into being what was previously only able to be.”¹³ In his commentary on Aristotle’s *Metaphysics*, Thomas is more explicit: “Anything in process of

change is being in process of transit from being-in-potency to being-in-act; for example, the potentially white becomes the actually white.”¹⁴ There is again another passage where Thomas expresses the same view: “It is of the very nature of movement for the subject moved to be otherwise now than it was before; . . . , and so in the last now it must have a different form from what it had before.”¹⁵ To be changed thus consists in being otherwise, that is, in acquiring a new determination. A change comprises a threefold requirement: first, it sets out that which undergoes the change, the subject; secondly, in the final stage of change, the subject is “in actu” with regard to the new determination; thirdly, during the process of transition, the subject is not in possession of this determination. Concerning the last requirement, Aquinas refers to it by saying that the subject remains “in potentia” with respect to the determination whereas in our formalization we expressed it in a negative form. For example, in arguing for the accuracy of the Aristotelian notion of change, Aquinas in his *Philosophia Naturalis* explains that the subject of change remains “in potentia” with regard to the determination: “Water, prior to being warm, is-in-potency to be warmed and to become warm. While it is being warmed, it is in an incomplete actualization (which constitutes the change) not yet in a complete actualization (which is the final stage of the change), but able to be completed.”¹⁶

5. In our formalization of change, it is intentional that we first did avoid any reference to causality. It is only later with the introduction of the primitive notion A6.1 ($\mathbf{M}\chi\alpha$), expressing the mover-moved relationship, that we made an explicit reference to causality. This relationship is clearly expressed by Aquinas: “To cause change is to bring into being what was previously only able to be.”¹³ The reference here is to the principle of causality according to which no effect takes place without a cause.

In his argument from change, Thomas gives no explicit foundation for the use of the principle of causality. For him, the use of such a principle is self-evident. Commenting on Aristotle’s *Metaphysics*, Aquinas writes: “That which passes from being-in-potency to being-in-act, presupposes a corresponding perfection in the agent of the change.”¹⁷ The principle of causality belongs to the sphere of inductive knowledge and is considered self-evident. We can find a clear formulation of this principle already in Plato’s “*Timaeus*”: “Anything which occurs, has a cause; a causeless happening does not exist.” Applied to change, the proposition would read: every change has a cause; a causeless change does not exist. The axiom A6.7 of our formalization formulates this fact.

We wish to point out here that the required conditions for the numerical unity of a change which are expressed in proposition S5.6 and axioms A6.5 and A6.6 can be found in Aquinas’ writings. In his *Philosophia Naturalis*, to the question as if for the numerical unity of a change the numerical unity of the determination, of the time interval, of the moved and of the mover is necessary, he answers in the affirmative.¹⁸

6. Up to now the confrontation between our formalization and Aquinas' teaching has among other things dealt with the mover-moved relationship and also with what it means for a subject to undergo a change. We wish now to bring up the question as to what it means for a subject to be the mover. To give an answer to this question, we must appeal to the valuation of the real relationship between momentaneous subjects and determinations, as it was expressed in the primitive notion Pn7.1 ($\text{B}\chi\gamma\alpha$). It is thus a question of comparing the degree of share (participatio) in a same determination among two momentaneous subjects, and especially of evaluating the share of the mover and that of the moved in a determination being the final term of the change. In his argument from change, Thomas writes: "A subject can cause a change only in so far as it is a being-in-act." In the above mentioned text of his commentary on Aristotle's *Metaphysics*, Thomas argues: "That which passes from being-in-potency to being-in-act, presupposes a corresponding perfection in the agent of the change." And in his *Philosophia Naturalis*, he says: "Any being-in-potency has a receptive and passive capacity whereas a being-in-act has the active ability."¹⁹ Finally, in the *Summa Contra Gentiles*, we read: "If something moves itself, it must have within itself the principles of its own motion; otherwise, it is clearly moved by another."²⁰ What does Aquinas mean by expressions as "actu", "actum praecedentem", "virtutem activam", "principium motus sui"? These expressions certainly have under Thomas' pen a precise meaning. However, it is not rare to find variations of meaning given to them by translators and commentators. It seems that the different interpretations originate with the notions "actus formalis", "actus virtualis" and "actus eminens". A detailed discussion of these notions does not fall within the limits of our topic. With respect to the above-mentioned expressions even the well-known translations are inaccurate and sometimes misleading as for example: "it is characteristic of something causing change to have that perfection already", or "Bewegen kann aber etwas nur, insofern es irgendwie schon im Ziel steht".

The expressions "actu", "actum praecedentem", "virtutem activam", "principium motus sui" do not indicate explicitly a valuation in the sense of that which we introduced in paragraph 7 of our formalization. Implicitly, however, they do express a valuation as formulated in axiom A7.5. It is necessary for the mover to be "actu" in order to bring into being what was only able to be, that is, the subject causing the change must have at least as large a participation in the determination which he is bringing into being as the subject undergoing the change and also in the final state of change.

Lorenz Fuetscher has come to the same conclusion, when he writes: "Es steht . . . ausser Zweifel, dass wir in einer Wirkung niemals ein schlechthiniges Mehr an Vollkommenheit vorfinden können als in der adäquaten Ursache vorhanden ist. Sonst hätte dieses "Mehr" keinen zureichenden Grund und damit wäre dieses Prinzip tatsächlich durchbrochen", [11].

On the basis of axioms A7.3 and A7.5 it has been possible to show that

if a subject acts as mover with respect to a determination α , it cannot itself be "in potentia" with regard to the determination α . The proposition S7.5 formulates precisely this affirmation which Aquinas expressed as follows: "It is impossible that something could move itself, if not by reason of different parts of itself, so that one part is the mover; and another part is the moved. The reason for this is that to cause a change can be done only by a subject which is a being completed, whereas the subject undergoing a change must be a being not yet completed but able to be completed and, the same subject cannot at the same time be both "in actu" and "in potentia" with regard to the same determination."²¹ Using proposition S7.5, we were able to derive the impossibility for the same momentaneous subject to stand as mover and as moved at the same time and with regard to the same determination (see proposition S7.7). This is stated by Aquinas as follows: "A thing in process of change cannot itself cause that same change; it cannot change itself."²² From there Thomas derives the basic principle: "Anything in process of change is being changed by something else", which principle is formulated in proposition S7.9.

In closing this second part of our monograph, we want to add a comment on the interpretation given by Eugen Rolfes in his book "Gottesbeweise bei Thomas von Aquin und Aristoteles":

"Zunächst ist zweifellos, dass jede Bewegung als passiver Vorgang eine aktive Ursache erfordert. Diese Ursache muss wie jede andere, nach dem Satz vom zureichenden Grunde, die Wirkung, die sie hervorbringt, schon in gewissem Sinne in sich enthalten. Nun braucht aber die Wirkung nicht immer in der Weise in dem Tätigen zu sein, wie sie in dem Leidenden ist: es ist, wie die Schule redet, nicht notwendig, dass sie in dem Tätigen als *actus formalis* sei, sie kann vielmehr auch als *actus virtualis* in ihm sein, als das blosse Vermögen oder die Kraft zur Hervorbringung der Wirkung. . . . Wo nun die Wirkung mit dem Wirkenden gleichartig ist, da kann offenbar nichts die betreffende Wirkung in sich selbst hervorbringen. . . . Wo dagegen die Wirkung ungleichartig ist, da ist sie ihrer Besonderheit nach nicht in dem Wirkenden, und es wäre demnach in demselben noch Raum für sie. Es begleitet dann die *potentia formalis* den *actus virtualis*." [12]

According to Rolfes, it would be possible under certain conditions that the same subject could be with respect to the same determination "actu" and "in potentia" at the same time, and thus able to be the mover and the moved. Our proposition S7.5 excludes such a possibility. We do not think either that Aquinas' text gives way to Rolfes' interpretation. Such an interpretation puts forward an inadequate determination of the notions "actu" and "in potentia" to which the notions "potentia formalis" and "actus virtualis" have misled him.

NOTES

1. *Summa Theologica*, I, 2, 3. "Certum est enim, et sensus constat, aliquid moveri in hoc mundo. Omne autem quod movetur, ab alio movetur. Nihil enim movetur,

nisi secundum quod est in potentia ad illud ad quod movetur: movet autem aliquid secundum quod est actu. Movere enim nihil aliud est quam educere aliquid de potentia in actum: de potentia autem non potest aliquid reduci in actum, nisi per aliquid ens actu: sicut calidum in actu, ut ignis, facit lignum, quod est calidum in potentia, esse actu calidum, et per hoc movet et alterat ipsum. Non autem possibile est quod idem sit simul in actu et potentia secundum idem, sed solum secundum diversa: quod enim est calidum in actu, non potest simul esse calidum in potentia, sed est simul frigidum in potentia. Impossibile est ergo quod secundum idem et eodem modo aliquid sit movens et motum, vel quod moveat seipsum. Oportet ergo omne quod movetur ab alio moveri”.

2. 6. *Phys.*, 1. 5.
3. *Summa contra Gentiles*, I, 13. “Oportet etiam quod sit primomotum, scilicet quod moveatur ratione suiipsius et non ratione suae partis, sicut movetur animal per motum pedis. Sic enim totum non moveretur a se, sed a sua parte, et una pars ab alio”.
4. *Summa Theologica*, I, 73, 2. “Quamvis autem motus proprie acceptus sit corporum, . . . ”.
5. *De Potentia*, III, 3. “Id quod movetur recedit ab uno termino motus et accedit in alterum”.
6. *Summa Theologica*, I, 53, 3. “Sed de ratione motus est quod movetur, aliter se habeat nunc et prius. Et ideo in quolibet nunc temporis mensurantis motum, mobile se habet in alia et alia dispositione. Unde oportet quod in ultimo nunc habeat formam quam prius non habebat”.
7. 3. *Phys.*, 2. 2.
8. *Summa Theologica*, I-II, 18, 2. “Sicut autem res naturalis habet speciem ex sua forma, ita actio habet speciem ex objecto, sicut et motus ex termino. . . . motus enim habet speciem ex terminis”.
9. *Metaphys.*, IX, 3.
10. *Metaphys.*, IX, 7. “. . . est necessarium, quod ratio actus praecedat rationem potentiae, et notitia actus notitiam potentiae. Et propter hoc . . . Aristoteles manifestavit potentiam definiendo per actum; actum autem non potuit per aliquod aliud definire, sed solum inductive manifestavit”.
11. *De Malo*, I, 2. “Esse in potentia nihil aliud est quam ordinari in actum”.
12. *Summa Theologica*, I, 2, 3. “Non autem possibile est quod idem sit simul in actu et potentia secundum idem, sed solum secundum diversa”.
13. *Summa Theologica*, I, 2, 3. “Movere enim nihil aliud est quam educere aliquid de potentia in actum”.
14. *Metaphys.*, XII, 2. “Omne igitur, quod transmutatur, transmutatur ex ente in potentia in actu ens; sicut cum aliquid alteratur ex albo in potentia in actu album”.
15. *Summa Theologica*, I, 53, 3. “Sed de ratione motus est quod id quod movetur, aliter se habeat nunc et prius. . . . Unde oportet quod in ultimo nunc habeat formam quam prius non habebat”.

16. 3. *Phys.*, 1, 2. ‘Sicut aqua antequam incipiat calafieri, est in potentia ad calefieri et ad calidum esse; cum autem calefit, reducitur in actum imperfectum, qui est motus, nondum autem in actum perfectum, qui est terminus motus, sed adhuc respectu ipsius remanet in potentia’.
17. *Metaphys.*, IX, 8. ‘Id enim, quod exit de potentia in actum, requirit actum praecedentem in agente, a quo reducitur in actum’.
18. 5. *Phys.*, 1, 7. ‘Respondeo dicendum, quod ad unitatem numericam motus quatuor unitates potissimum requiruntur’.
19. *Opusculum contra errores Graecorum*, c. 19. ‘Unumquodque, quod est in potentia, secundum hoc habet virtutem receptivam et passivam; secundum quod vero actu est, habet virtutem activam’.
20. *Summa contra Gentiles*, I, 13. ‘Si aliquid movet seipsum, oportet quod in se habeat principium motus sui; aliter manifeste ab alio moveretur’.
21. II *Liber Sententiarum*, VIII, 3, 1. ‘Impossibile est aliquid movere seipsum nisi secundum diversas partes, ita quod una pars sit movens et alia mota; . . . Cujus ratio est, quia nihil movet nisi secundum quod est in actu, nec movetur nisi secundum quod est in potentia, et haec duo non possunt simul eidem inesse respectu ejusdem’.
22. *Summa Theologica*, I, 2, 3. ‘Impossibile est . . . quod secundum idem et eodem modo aliquid sit movens et motum, vel quod moveat seipsum’.

REFERENCES

References [1]-[8] are given at the end of the first part of this paper. See *Notre Dame Journal of Formal Logic*, vol. IX (1968), pp. 371-384. They are now supplemented by:

- [1] Larouche, L., ‘Examination of the axiomatic foundations of a theory of change. I,’ in *Notre Dame Journal of Formal Logic*, IX (1968), pp. 371-384.
- [9] Mitterer, A., ‘Der Bewegungssatz nach dem Weltbild des hl. Thomas und dem der Gegenwart,’ in *Scholastik*, IX (1934), pp. 372-399, 481-519.
- [10] Van Melsen, A. G., *The Philosophy of Nature*, Louvain (1954), 40 ff.
- [11] Fuetscher, L., ‘Akt und Potenz,’ in *Philosophie und Grenzwissenschaften*, IV. Band, Innsbruck (1933), 327 ff.
- [12] Rolfes, E., *Gottesbeweise bei Thomas von Aquin und Aristoteles*, Limburg a.d. Lahn (1927), 25 ff.

(To be continued).

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