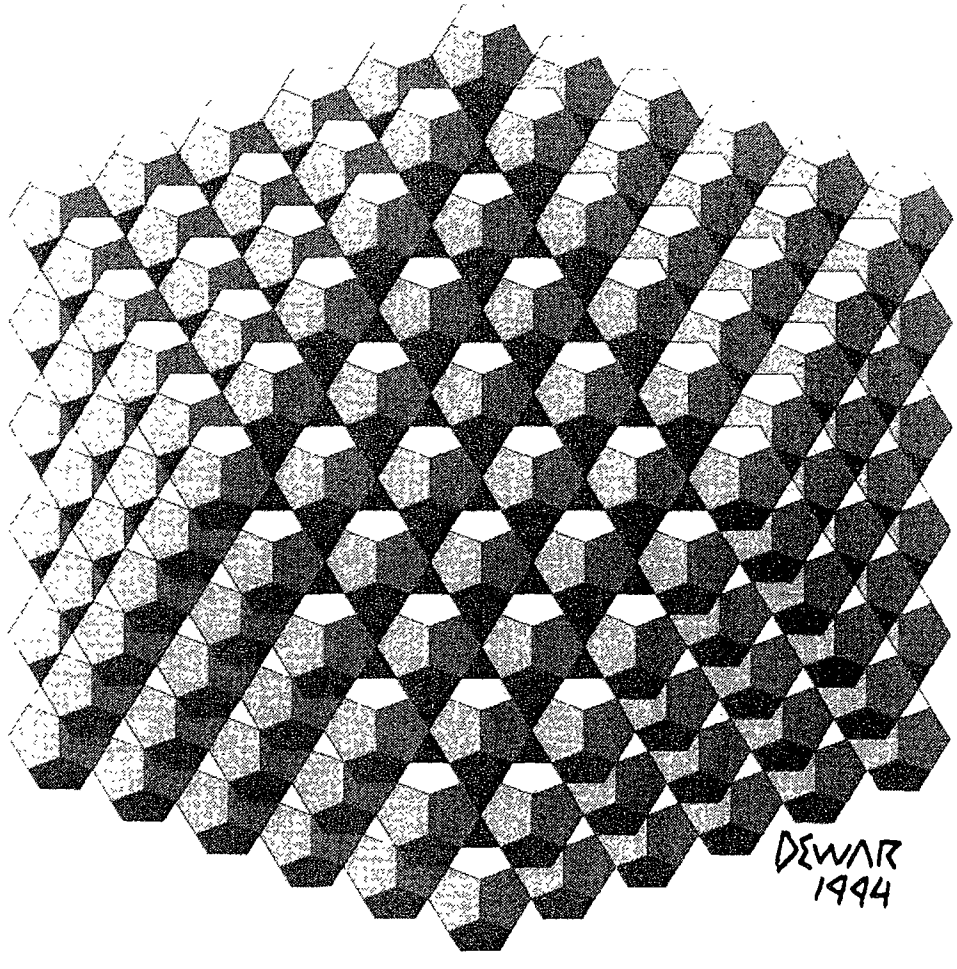
Symmetry: Culture and Science

Symmetry:
Natural and Artificial, 1

The Quarterly of the
International Society for the
Interdisciplinary Study of Symmetry
(ISIS-Symmetry)

Editors:
György Darvas and Dénes Nagy

Volume 6, Number 1, 1995



Third Interdisciplinary Symmetry Congress and Exhibition
Washington, D.C., U.S.A. August 14 - 20, 1995

MECHANICS AND MUSIC OF GALILEO'S AGE:
COMMON IDEAS AND 'REFLEXIVE SYMMETRY' OF KNOWLEDGE

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1. 'Reflexive symmetry' of knowledge and 'Zeitgeist'. All of us are more or less consent that the concept of the 'Zeitgeist' is *per se* a mere substitution for lacking or unclear mechanism of ideas exchange between fields far from each other in geographical or conceptual sense. But no matter whether this mechanism be known or not, the exchange could be possible only in the event that the idea contains certain manysidedness, viz., that it could be applied in many different ways and under different circumstances. The property could be depicted in the term of 'reflexive symmetry' proposed by Russian philosopher Professor Micheal Rozov.

As the wording implies, this kind of symmetry occurs when the same action could variously be reflected (interpreted). In other words, the motivation and results could differ while the same action. 'Reflexive symmetry' is close associated with 'reflexive shift' which notices the event when the same action done by the same person are to reach new targets.

Rozov himself illustrates the interaction of these concepts and their theoretical usefulness on the case of Galileo's astronomical discoveries. As it is known, Galileo was moved to manufacturing the telescopes not by the idea to use them for his astronomical

observation. He was primarily interested in (a) pure technical aspect of the problem: how it is possible to manufacture the telescope (he knew only that it is possible on principle, but did not know how it is possible exactly) and (b) opportunity to improve the sphericity of glasses and therefore the quality of the image. Thus, he managed to produce first instruments which could be used not only as a funny toy but which also admitted use for certain practical needs (for instance, military).

That was the moment for the first reflective shift–the same telescope could be also directed into heaven and applied for the astronomical observation. The discoveries that followed led to the next reflexive shift: telescopic observations allowed for the new foundations of copernicanism.

The Rozov's illustration is easy to be continued. The new discoveries allowed for the new development of mythological emblematic of Medicis' court, which eventually let Galileo be back to Florence and get a high position by the court.

Change-overs of this kind are rather numerous in the Galileo's life. So one can say that they not only play an essential role in history of science but leave room for conceptual and social manoeuvering as well which Galileo could perfectly make use of. The concepts of *reflexive symmetry* and *shifts* permit to put the question of origins of the new science alternatively forth.

2. Common Denominators of Science and Art, or On the Analogy Between the Pitch of Sound and the Velocity of Moving Body. Galileo's father, Vincenzio, was a professional musician, lute player, composer. He figured in the disputes over musical theory and the practices. Two of his books were issued during his lifetime and gave rise to sharp polemics with his former teacher, Gioseffo Zarlino of Venice. Among other things Vincenzio argued that the pitch of sound could change continuously if so changed the length of string, or its tension, and that consonance was what consonance appeared. Besides, in

his view the music scale should be tempered whether it was used for vocal music or for instrumental one.

Similar ideas had been also outspoken before Vincenzio, but they were never properly justified, whereas objections rested upon the ancient tradition ascending to Pythagoras and Ptolemy and generally adopted during Middle Ages owing to authority of Boethius. The property of sounds to make up consonances was considered in this tradition in relation to sacral properties of numbers and cosmological problems. The Pythagorean scale was formed from numbers of tetrad *1+2+3+4=10* from the ratios of its reciprocal multiples: *1:2, 2:3, 3:4, 8:9*. The essence of these ratios supposed to be universal: two sounds were in the interval of octave to each other when in proportion *1:2* were arbitrary physical characteristics of sounding bodies–lengths of strings, weights of hammers, etc.

Experimentally Vincenzio managed to discover that these ratios was not universal and that various characteristics should be in various proportions in order to get the same interval. So he began to form his musical system regardless any right numeric ratios. In their stead he insisted upon some new principles already mentioned above: the continuity of pitch and temperament of scale. Thus experimental reasoning possessed theoretical decisiveness.

No doubts Galileo was aware of all those, moreover it would be natural to supposed that he assisted his father by carrying out the experiments. If this was a case, the opportunity arises to fix a number of invariants of symmetry transformation 'theory of music–theory of motion'.

3. Reflexive Symmetrical Mechanics. The first argument in favour of existence of the analogy in question has been rather well studied. It has been considered and discussed in the writings by D.Walker, S.Drake, M.Lindley, H.Floris Cohen. The first experiment of Galileo when he tried to find the correct relationship between time and path elapsed in free fall was in its essential features the exact repetition of that of his father.

The second argument, just as evident as the first, strangely was not discussed in its direct relation to Galileo. In fact, on the one hand according to the classification of the mathematical sciences that ascends to Boethius that one that deals with proportions is the *music*. On the other hand, Galileo claimed to have created "new science on motion" by having correlated the theory of motion with mathematics, namely the theory of proportions as even superficial acquaintance with his manuscripts shows.

At last the third argument in favour of the invariance is provided by a certain analogy between the pitch of sound and the velocity of moving body. This analogy was already evident in Pythagoras views who is said to believe that all celestial bodies utter sounds, the sharper--the faster. Oresme and Kepler expressed this view more distinct, saying about direct proportionality between *pitch* and *velocity*.

4. 'Zeitgeist' as a Functor (conclusion). Intuitively caught symmetry of knowledge usually referred to as 'Zeitgeist' was variously interpreted by various authors in epostemologic, aesthetic, or pragmatic frameworks. In my view it could be quite adequately depicted in mathematical concepts such as *category* and *functor*. Each category consists of *objects* and *morphisms*. Functors are such associations of categories that objects are associated with objects and morphisms with morphisms, i.e. functors save the structure of categories.

The analogy between the theory of music and mechanistic conception by Galileo represents this property. At the same time common objects in the both categories (such concepts as *continuity*, *uniformity* (*temperament*), *proportion*, etc.) make it possible to speak about invariants that are unchanged by morphisms.