



## Short Communication

# A possible representation of Yin Yang five elements (Yin Yang Wu Xing): Hypothesis of Dual Five-Body-Coordination

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## ABSTRACT

**Background:** The idea of *Yin Yang Wu Xing*, traditionally adopted and practiced in East-Asian medicine, has not been incorporated into the theoretical framework of modern medicine. It is therefore desired to show that *Yin Yang Wu Xing* is a manifestation of a higher-level faculty of cooperating system, thus making it suitable for a modern frame of thought.

**Methods:** A higher-level faculty of the cooperating system is formulated in the scheme of Dual Five-Body Coordination. The stability of this scheme is examined mathematically and the feasibility of its physical realization is estimated.

**Results:** The Dual Five-Body Coordination scheme, which overlaps substantially with the conceptual structure of *Yin Yang Wu Xing*, is stable and has survival merit. An imaginable conjecture based on physical reality confirms its physical feasibility.

**Conclusion:** The Dual Five-Body Coordination scheme has potential utilization in various fields including biology and sociology. Once the theoretical framework is solidified, the Dual Five-Body Coordination scheme can be readily applied in practical research in modern medicine.

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## 1. Introduction

Prominent physiologist Denis Noble<sup>1</sup> stated that there are conceptual holes to fill up in biology on a level vastly more than a collection of cells, which has characteristics of "sociology" (Supplement 1). In this paper, I propose that a conceptual scheme which is vastly more than a collection of cells and has sociology characteristics, may indeed exist, hopefully filling some of the "conceptual holes" in biology. This is the scheme of "Dual Five-Body Coordination." It inhabits biological systems and is consistent with physical laws, but is not deducible from physical interactions observed between cells and organs. Dual Five-Body Coordination is a higher organizational principle akin to social dynamics manifested in sociology.

Although Dual Five-Body Coordination scheme has substantial overlap with the East-Asian traditional concept of "*Yin Yang Wu Xing*," this scheme is not a mathematical remodeling of the concept; rather, it is a conceptual scheme independently conceived in modern terms of thought.

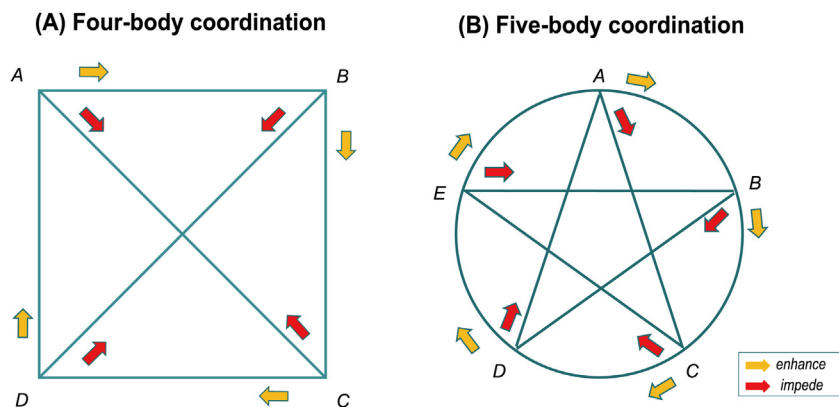
## 2. Hypothesis of Dual Five Body Coordination

## 2.1. "Dual Five-Body Coordination" in a cooperating system

Consider a cooperating system composed of a number of bodies working together to make the system coherent. Each of the working bodies is assumed to have a proper function in a division of labor. This is functional aspect of the cooperating system, which can be elaborated by the normal system analysis. In addition, we presume that another scheme, based on purely organizational principle, is superposed on the functional aspect. This scheme, which we will call "communitality," is a higher-level capacity of the coordinating system, perhaps a later product of the evolutionary process having an additional survival value.

This organizational scheme concerns derivatives, or higher-level quantities, passing through the composing bodies. As a conceptual example, consider a pair of complimentary higher-level quantities called "vitality" and "prudence" as derivatives. Vitality is important for the performance of the bodies to function properly in the system, but too much of it may drain the body. Therefore, we also need a certain amount of prudence to balance vitality. The underlying assumption is that higher-level quantities assigned to the composing bodies can be coordinated in a universal way to give the system an extra stability, independently of the specific functional aspect of the bodies at the lower level.

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**Fig. 1.** (A) Four-body coordination. In the four body community, all the enhance lines (yellow arrows) can be drawn one-way (public) but the impede lines (red arrows) cannot be drawn one-way (conflict of interest). (B) Five-body coordination. The five body community is perfectly coordinated to make all the enhance lines (yellow arrows) and impede lines (red arrows) one-way (public).

We now assume that one body in the coordinating system passes over such derivatives to another body throughout the whole community, that is, the higher-level derivatives have “communality.” For example, one body may enhance the vitality of a neighboring body, while impeding the vitality (by passing over prudence) of another neighboring body. To allow all coordination to be truly communal, we restrict all influences to be public, in that the influencing body cannot be directly influenced by the body it influences, to avoid conflict of interest. If A influences B, then A cannot receive any direct influence from B; A can be influenced by B only indirectly through the other bodies of the community.

To meet such assumptions, we see that at least five bodies are needed to make a viable public community. Consider a four body community with a higher-level enhance-impede scheme shown in Fig. 1A. We see that all enhancing influences are public but impeding influences cannot avoid conflict of interest. In contrast, the five body community shown in Fig. 1B is perfectly coordinated to make all the enhancing and impeding influences “public.”

Compare this to a social community in which everyone has their own business including certain transactions with external agents as well as with each other. These transactions which are mainly performed on a give-and-take basis, can be carried out without any communal relationship. Communality, on the other hand, works at higher-level in which each member carries out its specific communal duty to make the whole community more cohesive, encouraging or discouraging other members in a public way. If such a communal relationship has sufficient stability, it would help to survive as a successful community.

## 2.2. Mathematical expression

Consider an ideal community with five bodies, A, B, C, D, E, arranged in a clockwise circle as shown in Fig. 1B. Each body is assumed to be in a stable state balanced by two contrasting higher-level quantities  $Y$  and  $Z$  in such a way that the ratio  $Y/Z$  maintains an optimum value. However, once a body, say A, happens to have surplus  $\Delta$  in  $Y$ , it can transfer part of the surplus, designated  $\alpha\Delta$ , to the next body B retaining the rest  $(1-\alpha)\Delta$  in itself;  $\alpha$  being the enhance parameter ( $0 \leq \alpha \leq 1$ ). The same can be said for body B, which now has a surplus  $\alpha\Delta$ , and transfers part of it  $\alpha^2\Delta$  to body C, while retaining  $\alpha(1-\alpha)\Delta$  in itself. This can continue for body C, D, and E. Similarly, if body A happens to have surplus  $\Delta'$  in  $Z$  from the one required to maintain the optimum state, it can partially transfer the surplus to another body C, as  $\beta\Delta'$ , while retaining the rest  $(1-\beta)\Delta'$  in itself;  $\beta$  being the impede parameter ( $0 \leq \beta \leq 1$ ). The same can be said for body C, E, B, and D. As shown in Supplement

2, the optimal values of  $\alpha$  and  $\beta$ , which distribute  $\Delta$  and  $\Delta'$  most effectively, are  $\alpha = 4/5$ , and  $\beta = 4/5$ .

Since surpluses  $\Delta$  and  $\Delta'$  on certain bodies can harm the normal functioning of the system, such a redistribution can help maintain the system's normal function. More importantly, if  $\Delta$  and  $\Delta'$  occur concurrently on different bodies, they can effectively be cancelled out through the redistribution process. If a body had a surplus in  $Y$ , it is equivalent to having a deficiency in  $Z$ , and therefore once it get certain surplus in  $Z$ , they will effectively cancel each out, and restore the optimum condition. In situations where certain bodies are not in optimum states ( $Y/Z$  not at optimal value), the redistribution provides them with chances to absorb the opposite surplus, and remedy the situation.

The  $Y$  quantity and  $Z$  quantity may represent many different complementary enhance-impede pairs of “differentials.” In the case of  $Y$  as “vitality” and  $Z$  as “prudence”, the ratio  $Y/Z$  would represent the “degree of vitality moderated by prudence”.

## 2.3. Physical realization

We now ask whether the realization of such a system is physically feasible. We may easily say that it can never be formed and maintained without a long period of biological evolution. For such a sophisticated coordination, the supply of free energy based on a delicate inner structure is prerequisite. It is therefore inappropriate to apply this scheme literally to systems like, for instance, five planets or “five colors.”

After meeting the prerequisite, one might ask about the material substance of  $Y$  and/or  $Z$ . One possible candidate for  $Y$  and  $Z$  is excess quantity of free energy and task to be performed, respectively. Though task to be performed is rather abstract, it is possible to quantify it as the materialistic amount of work. Once quantified, the ratio of those two quantities should then be matched such that  $Y/Z$  maintains an optimum value. This is a fairly crude speculation; however, the fact that an imaginable conjecture based on physical reality is possible should be regarded as a theoretical support for physical feasibility.

The realization of a feasible scheme, on the other hand, can only be achieved through the ingenuity of an evolutionary process. In a system like the human body, thousands of marvelous feasible schemes have been realized once they prove to have survival advantage. It is therefore quite plausible to expect that there would be many realizations achieved on the above scheme in seemingly different guises. We therefore need some generic concepts representing only the internal roles in the scheme despite the differing guises in external form. It would be interesting if such a

system of generic concepts has already been employed somewhere in the human traditional thought, because that would indicate that ancient people somehow recognized them through historical experience.

#### 2.4. Comparison with East Asian concepts

In fact, we do find a system of generic concepts in the East-Asian traditional thought that possibly corresponds to the system introduced as Dual Five-Body Coordination scheme. The candidates for such concepts are *Qi*, *Yin Yang*, and *Wu Xing*. These concepts have been studied extensively in modern times.<sup>2-4</sup> Therefore, we do not need to engage in the full analysis of these concepts, except those portions that correspond rather closely to our scheme.<sup>5-7</sup>

We will start with a brief overview of the correspondences. “Five-Body” obviously corresponds to “*Wu Xing*,” variously translated as “Five Elements,” “Five Activities,” or “Five Phases.” The *Y* and *Z* quantities correspond to the *Yang Qi* and *Yin Qi*, respectively. Through a brief comparison given in Supplement 3, we can conclude that the generic concepts we introduced in the Dual Five-Body Coordination scheme substantially overlap with those in the East-Asian traditional thought, although the latter are much broader and somewhat ambiguous.

The work presented here is in contrast to many attempts found in literature, on the mathematical representation of traditional East-Asian medicine based on *Wu Xing*.<sup>8-12</sup> While we formulated Dual Five-Body Coordination in modern terminology and tried to prove its own existence and realization without regard the traditional *Wu Xing* concepts, most of the works cited above are more or less direct mathematical translations of varying versions of *Wu Xing*-based medical therapies. It is therefore needed to compare our result with the cited works, not only to distinguish our work from others, but also to get possible guide to the traditional medical therapies. Such comparisons are presented in Supplement 4.

It is premature to deduce that ancient East-Asian thinkers somehow perceived the Dual Five-Body Coordination mechanism consciously, but it can be stated that traditional East-Asian thought did not arise out of imagination without any objective ground in nature.

### 3. Summary

The Dual Five-Body Coordination system can be utilized in various fields including biology and sociology, but its best and foremost application can be found in medical research and practice. One reason is that characteristically Dual Five-Body Coordination scheme would rarely be revealed externally when it is working normally. It is only when some bodies are malfunctioning that the problem would be easily exposed or readily observable as a symptom or illness. This makes medicine the best field to explore the system's actual mechanism. Secondly, it has long been utilized in East-Asian medicine with certain proven effectiveness, though the utilization has been more empirical, with theoretical mechanisms being more or less veiled. Therefore, once a theoretical backbone is established, the abundant knowledge and data accumulated in East-Asian medicine will be greatly beneficial in making this scheme more concrete.

### Author contribution

This is the sole author's work.

### Conflict of interest

The author declares no conflict of interest.

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### Ethical statement

Not applicable.

### Data availability

Not applicable.

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### Supplementary material

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.imr.2020.100462>.

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