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Jun-Ichi Yano

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MJO as a Gestalt

Jun-Ichi Yano

ABSTRACT: Objectively identifying a phenomenon from observation is often difficult. This essay reflects upon this problem from a philosophical perspective by taking the Madden–Julian oscillation (MJO) as an example. I argue that it can be considered as a problem of Gestalt. This concept is introduced by closely following Ludwig Wittgenstein’s two philosophical works, *Philosophical Investigations* (*Philosophische Untersuchungen*) and *Remarks on the Philosophy of Psychology* (*Bemerkungen über die Philosophie der Psychologie*). Reflections upon the concept of Gestalt suggest why an objective identification of a phenomenon is so difficult. Importantly, the problem should not be reduced to that of “pattern recognition.” Rather a given phenomenon must be considered as a whole, including a question of a driving mechanism.

KEYWORDS: Atmosphere; Madden-Julian oscillation

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Corresponding author: Jun-Ichi Yano, jun-ichi.yano@cnr.fr

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What do you see in Fig. 1? This is a typical example of Gestalt problems. The drawing can be seen in two different manners depending on how we look at it, either as a duck or a rabbit. In short, a single drawing can be interpreted in terms of two different *Gestalten*.

Gestalt is a common German word. Grammatically, the word is formed from the past participle of *stellen* (to place, to present). Thus its etymological meaning is “something that is placed or presented.” Although the word is usually translated as “form” or “figure,” this connotation sticks around whenever this word is uttered. For this reason, Duden Dictionary lists as its second meaning “unknown person who is not close enough to be identified.” Keep in mind that there are words in German more specifically referring, respectively, to the form and the figure: *die Form* and *die Figur*. In other words, there are three words in German corresponding to the form and the figure in English. The third is *die Gestalt*. Keep in mind that there is nothing special with the word “Gestalt,” though it may sound exotic to the English ear. To avoid this psychological effect, a reader may wish to read it as “form” or “figure” whenever seeing a print “Gestalt” in the following.

Under the German tradition of philosophy, the word, *die Gestalt*, is often adopted for exploiting its connotations. For this reason, even in translation, it often makes a presentation clearer by retaining this German word without translation. In philosophical discourses, Gestalt means often what we recognize as a “form” by observation. Note that it does not necessarily correspond to a simple form, but it can refer to anything present, as already suggested.

Unfortunately, more often than not, these issues are simply reduced to questions of psychology, because to some extent, it is a matter of how we see things through our own mind. For this reason, studies of Gestalten are often simply tagged as “Gestalt psychology.” psychology.” However, how we see something is not just a matter of psychological subjectivity. This is also a question of how we study a natural phenomenon scientifically in an objective manner.

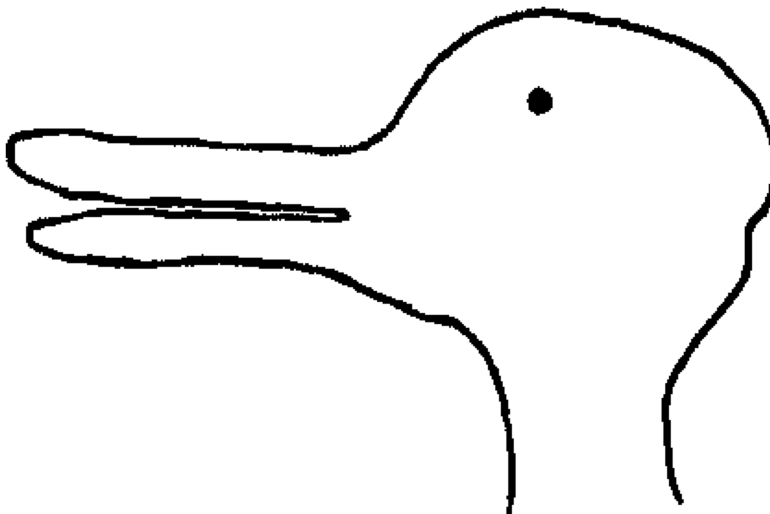


Fig. 1. What is this?

**Ludwig Wittgenstein
(1889–1951)**

To expose the concept of *Gestalt* further, I refer primarily to two works by Ludwig Wittgenstein: *Philosophical Investigations* [*Philosophische Untersuchungen* (PU); Wittgenstein 1953] and *Remarks on the Philosophy of Psychology* [*Bemerkungen über die Philosophie der Psychologie* (BP); Wittgenstein 1980].

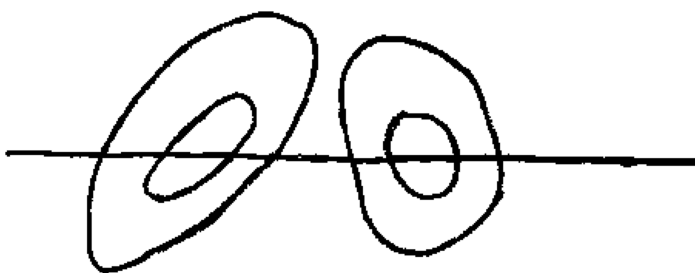


Fig. 2. Can you recognize a number 4?

to an observed phenomenon.” From this perspective, identification of a phenomenon from observation is interpreted as that of a Gestalt found as a particular form or entity in data. Identifying a phenomenon from observation in atmospheric research is also such a problem.

Wittgenstein begins *BP* by asking whether a given (as actually in the text) crudely hand-written “F” can be considered a letter F or a mirror image of F. Especially, when a letter is written by hand in a very unclear manner, such a question becomes totally relevant. This can be considered the most basic form of Gestalt problems. For this reason, Wittgenstein gets back to this question again and again throughout *BP*.

Another Gestalt problem presented in *BP* (volume II, section 41) takes the form of a question of identification: Do you recognize a number 4 in Fig. 2? The answer is given in Fig. 3 below by marking the number 4 with red lines.

This latter Gestalt problem may appear rather artificial. We would never look at a drawing in this manner spontaneously, and a need for looking at a drawing in this manner would only very rarely arise in a real life. In contrast, arguably, the example of Fig. 1 is a real life problem, because we always face a question of identifying an object in front of us with a quick observation. However, it appears to me that the question of identifying a number 4 is a very good prototype problem of how scientific research identifies a phenomenon: e.g., detection of a new elementary particle. In many physical experiments, the noise level of instruments is very high: a particular Gestalt must be built into an analysis method so that a theoretically expected phenomenon can be detected. The procedure could be far more involved than detecting the number 4 from those curves in Fig. 2.

Madden–Julian oscillation

In fact, a problem of detecting a phenomenon from atmospheric data often takes a form analogous to find the number 4 in Fig. 2. Let us take the Madden–Julian oscillation (MJO) as an example. Here, the MJO is taken merely as an example without intending to expose its full picture. The MJO is a tropical atmospheric phenomenon that can be identified as a slow propagation (about few meters per second) of organized planetary-scale convective variability, typically generated over the Indian Ocean. The MJO propagates eastward around the globe, although the convective signal is lost by crossing the date line over the Pacific Ocean.

Examples of such events are shown in Fig. 4 (reproduced from Fig. 1 of Straub 2013) by

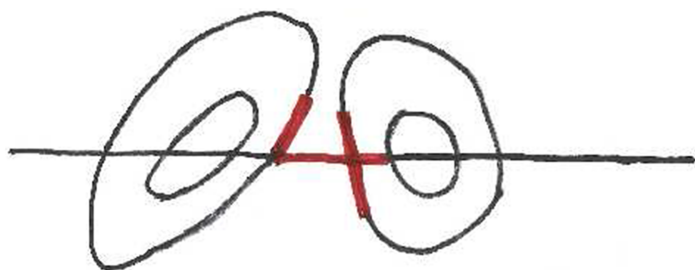


Fig. 3. Here it is.

To analyze raw data from observations, a certain interpretation is required. To make this point explicit, Wittgenstein remarks “Beobachten erzeugt nicht das Beobachtete” in *PU* (volume II, section ix.67). A fully elaborated translation would be, “Observation does not give birth

shades in a section of the longitude (horizontal axis) and the time (vertical axis) along the equator: these events are recognized as blue shades lining from the upper left to the lower right. Here, the shaded field is the outgoing longwave radiation (OLR), which is an integrated measure of infrared radiation

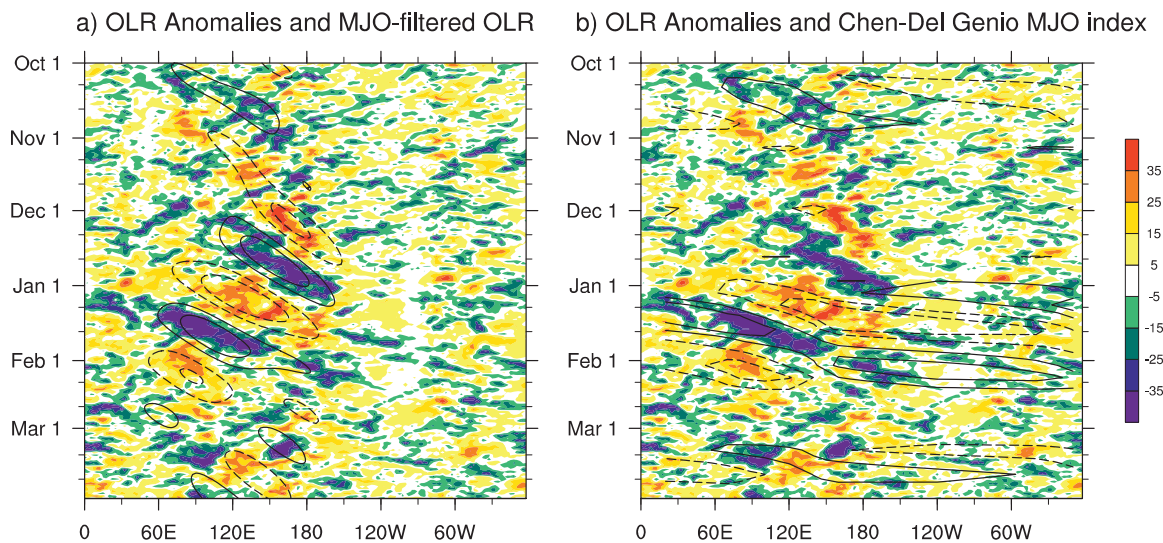


Fig. 4. Examples of MJOs shown by OLR anomalies (W m^{-2}) with color shades (same in both panels). They are also marked by two different identification methods by contours in the two panels (reproduced from Fig. 1 of Straub 2013).

(W m^{-2}) from Earth to space as observed from an Earth-orbiting satellite. More precisely, we only show variabilities of time scales less than 100 days (called anomaly for convenience) by temporally filtering data. MJOs are recognized by the OLR anomaly signals directing right-downward directions over the longitudes of 60°E – 180° (date line).

However, how can we identify this feature more objectively? Two examples of such attempts are indicated by overlain contours in two frames of Fig. 4: based on OLR in Fig. 4a, and the 200-hPa velocity potential (a measure of winds at a tropopause level) in Fig. 4b. These contours essentially depict MJOs as Gestalten in the same sense as a red marking in Fig. 3 depicts the number 4.

Many indices have been developed over half a century for quantifying the MJO [see Straub (2013) for references] in similar spirits as those in Fig. 4. However, which one is, actually, more relevant for identifying the MJO? Efforts for resolving this question further lead to various more technical questions: Can the MJO be defined locally, or must it be longitudinally continuous across the entire tropics? Must MJO initiation be slowly varying, or can a rapid intensification occur? Are dynamics or convection more important in defining the MJO (Straub 2013)? There are already philosophical implications behind these questions.

The Gestalt problem of the MJO is more challenging than standard ones shown by Figs. 1 and 2, because the MJO does not consist of a single variable (say, OLR), but of multiple variables. Eine Gestalt to be identified is even not on a single two-dimensional surface, say, consisting of longitude and time, but also depending on height and latitude. Gestalten of the MJO in Fig. 4 are depicted only by two of those possible variables. The choice of variable obviously matters, because contours in Fig. 4b based on the velocity potential do not follow the shades underneath well: a distribution of the velocity potential is different from that of OLR.

To elucidate the last point better, Fig. 5 (reproduced from Fig. 10 of Straub 2013) visualizes the multivariable nature of the MJO for a different case: here an identical Gestalt based on OLR is overlain both on OLR in Fig. 5a and the zonal wind (i.e., winds in longitudinal direction with positive eastward) at the 850-hPa level (about 1,500 m high) in Fig. 5b. We even do not know how many variables there are, that we must examine. These factors make the MJO Gestalt problem even harder. Recall the two Gestalten of MJO suggested in Fig. 4: the MJO is associated with both OLR and an upper-troposphere wind, thus both methods are equally valid in this sense. However, which one is considered a better identification method of the MJO?

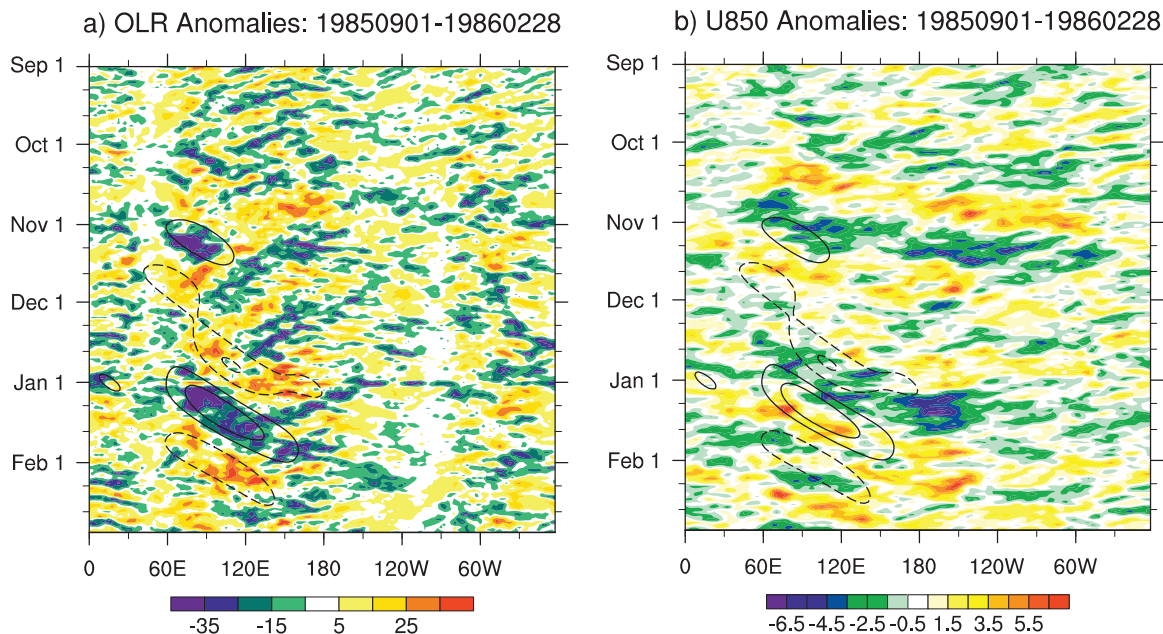


Fig. 5. Visualization of multivariable nature of the MJO for a different case: an identical Gestalt based on OLR is overlain on (a) OLR and (b) the zonal wind (i.e., winds in longitudinal direction with positive eastward) at the 850-hPa level (about 1,500 m high) (reproduced from Fig. 10 of Straub 2013).

After all, is it actually meaningful for trying to identify MJOs by a single index? To reflect upon this question, Wittgenstein's personal experience during World War II (1940–44) may be helpful (cf. Monk 1990): he was involved with an investigation on the so-called wound shock. It appeared that serious injuries were frequently associated with a state of shock, but at that time, there was no obvious single measure to quantify this mental state. The main mission of the team that he joined was to make a recommendation on this issue to the U.K. government. His contribution to this investigation proves his philosophical sharpness: he quickly recognized that a question of identifying a single measure for the shock could be ill posed, because there may not have been a single well-defined symptom that could be called “wound shock.” The final report of this team clearly took his suggestion seriously, and recommended to abandon the notion of “shock.” It, instead, emphasized the importance of observing the actual mental state of an injured patient, and descriptively reporting it rather than reducing its state into a single number. The word “shock” can easily be replaced with the MJO to make the same point, but without intending to suggest that the same conclusion follows.

Johann Wolfgang von Goethe (1749–1832)

The use of the German word, *die Gestalt*, in this manner can be traced back to Johann Wolfgang von Goethe (1749–1832), notably in his studies in *Metamorphosis of Plants* (cf. Monk 1990). In these studies of Gestalt, Goethe even argued that there is a single phenomenon, which could be called *Urphänomen*, constituting an origin of all other phenomena. For example, there are many types of plants in the world. He argued that all these can be reduced into a single prototype, which may be called *Urpflanze*. The same could be said about MJOs: there are many types of MJOs in nature. In short, every MJO is different and unique, but there is a single MJO that constitutes a prototype of them all, say, *UrMJO*.

It may be useful to recall why Goethe plunged into such an investigation: he was deeply dissatisfied with the then-dominant Newton's mechanical view of nature. Newton's mechanics, essentially, reduces our world to a collection of many particles, even down to a level of atoms. Goethe objected to such a view of the world: our real world is much more complex than something simply described in terms of movements of particles, especially regarding

life. Goethe's attempt for alternative science was never fully developed, but his perspective on the nature has seen new lights from time to time, including the notion of Gestalt.

Though the MJO may not be as complex as life, this phenomenon is already so complex that in the view of most researchers, the possibility of understanding the MJO purely in mechanical manner, from a point of view of Newton's mechanics, is clearly excluded: moist convection is an essential part of the MJO, which not only involves moist thermodynamics, but complex microphysics associated with it, as well as the radiative heat transfer process interacting with clouds. It is only recently that a purely mechanical self-contained theory for the MJO is proposed (Wedi and Smolarkiewicz 2010). However, most researchers rather refuse to see the MJO in this manner. The issue is clearly a matter of Gestalt: once you are convinced that Fig. 1 is a duck, it is hard to consider an alternative possibility that actually it is a rabbit. At a level of such reluctance, the issue of Gestalt indeed boils down to that of human psychology: even science is not independent of human psychology, unfortunately.

However, it is important to emphasize again that Gestalt is not merely a matter of subjectivity: no matter how objective we may try to be, we cannot be free from the problems of Gestalt. The very procedure of identifying a phenomenon is precisely a matter of identifying die Gestalt. When we seek to identify an MJO, the question is how we can best identify it as eine Gestalt. At a technical level, this question of the MJO Gestalt takes various different forms: What is the best index for identifying it? What is a main physical field to characterize it? etc. Probably, this series of questions is better considered interrelated to each other to form a single question of identifying die Gestalt.

The study of the MJO is clearly a far more involved endeavor with many facets, as I tried to list, than just a matter of identifying the number 4 in Fig. 2. However, I still believe this analogy is useful and helpful to organize the multifaceted MJO research into a single picture: identification of die Gestalt.

"To see"

In *PU* (volume II, section xi), Wittgenstein talks about two senses of the word "to see" (*sehen*). This distinction is rather immediately realized (and I also realize that this distinction is clearer in English than in German) by a fact that "to see" does not always simply refer to visual projection of an image to eyes, but it also means "to understand." Once we accept the meaning of the word "to see" in this manner, the issue of seeing eine Gestalt, or identifying it, also becomes a matter of understanding it. A remark by Wittgenstein in *PU* (volume II, section xi.356) is probably best understood in this context: "Das Schwerste ist hier, die Unbestimmtheit richtig und unverfälscht zum Ausdruck zu bringen" ("What is most difficult here is to expose the indefiniteness correctly and accurately").

Once we recognize that our action "to see" implicitly includes also an action "to understand," Gestalt is no longer merely a narrow question of identifying an object of a pattern visually, but more fundamentally, the question about how we understand a given object. In context of the MJO studies, seeing an MJO as die Gestalt is not just a matter of identifying it by a certain statistical measure, but to comprehend this phenomenon as a whole. In other words, the question of identifying MJO and to understand it becomes a single inseparable endeavor under the concept of Gestalt.

Wittgenstein takes an example of a knife and fork to make this point (*PU*, volume II, section xi): when we see them, we do not distinguish them simply by their visual appearances, but rather by their functions: Which one works as a knife? By the same token, identifying the MJO as eine Gestalt should not be primarily of a geometrical structure found in time-dependent multivariables in three-dimensional space, but also that of identifying a mechanism.

Wittgenstein also talks extensively in *PU* of the difficulty of seeing as it is. For example, when you see someone's father, you first think they are similar, then at the next moment

realize actually not. Why and how does this happen? By repeating examples of those rather trivial, daily experiences, he tries to convince us how difficult it is to see as it is. The question of seeing as it is naturally leads to questions of visual art (Gombrich 2002), and even more aspects open up from there. Considerations of all those aspects, in turn, will help us to see the real issues behind the MJO identification that would not be obvious otherwise.

Last words

Last few words: please do not begin to talk about a “Gestalt view of the MJO” after reading this essay. That is the least I wish; please do not, even over beer. And please taste wine instead if possible: it sharpens your thoughts better than beer in my personal opinion. This essay is also intended to be like wine.

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