

METAPHOR AND NARRATIVE IN SCIENCE: AN INTERDISCIPLINARY APPROACH

PART II – FROM METAPHOR TO NARRATIVE IN MACROSCOPIC PHYSICAL SCIENCE

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**A PRELIMINARY
SUMMARY IN THE
FORM OF SOME
CLAIMS**

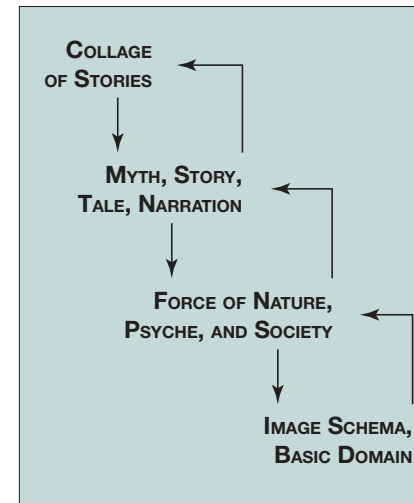
*When confronting **nature at human scale**, we perceive a perceptual unit I call **Force of Nature** — **heat, water, wind, electricity, substances, motion...** are examples of forces of nature.*

*Considering spatial, temporal, and systemic scales, force is a **medium-scale gestalt** between **smaller and larger-scale perceptual units**. Our understanding of it is mediated by smaller and larger imaginative structures such as **metaphor and story**.*

***Forces** are conceptualized as **agents acting in and suffering through events unfolding over time in story worlds...** We can, and should, tell stories of forces of nature. As a formal science, macroscopic physics can be rendered in narrative form: **Models are storyworlds and simulations are stories**.*

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LARGE
↑
SMALL
Scale

1. LINGUISTIC PHENOMENA IN MACROSCOPIC PHYSICAL SCIENCE — TEMPERATURE

- I am in a *warmer place* now.
- Lately, the weather has been *going from hot to cold*.
- His *fever has been rising fast*.
- Such a *high temperature difference* is not good.
- The *temperature* is now *at the lowest level* it's been in a while.
- I am *taking forever to warm up*.
- In front of the fire, the air feels particularly cold—there is a *great imbalance between hot and cold*.
- The *temperature drops over a short distance*. This *steep* gradient *lets heat flow more easily*.
- [...] bodies of water [...] differ in their temperatures, providing a *thermal landscape* which might serve as an orienting cue in fish migration.
- The truth is, all of these *thermal ups and downs* are perfectly normal...

Expressions paint an image of the meaning of temperature concepts with the help of images, figures, or shapes. Observe that expressions contain words and suggest concepts that are embedded in a larger meaning structure...

1. LINGUISTIC PHENOMENA IN MACROSCOPIC PHYSICAL SCIENCE — HEAT

Examples of expressions involving heat. There are no examples of literal use of language:

- All bodies **contain heat**....
- How do you **collect heat** in a passive solar house?
- This means **heat flows** “downhill” from hot to cold.
- ... **heat is an agent** of vast importance in chemical reactions and engineering processes
- Law of the dependence of the active **force of heat** upon the tempera... (Clausius)
- This exterior **heat lets** the crust become crispy
- **Heat makes** me dizzy...
- Clouds and storms follow the warm water, **pumping heat** and moisture high into the atmosphere...
- Heat must **balance** cold...

Expressions for heat use the following schematic constructs:

- ⌋ Container, store, hold, accumulate; lack of, abundance of; collect
- ⌋ Flow, transport, extract emit/absorb, exchange; heat moves
- ⌋ Balance (law of balance of...)
- ⌋ Use, produce, generate heat
- ⌋ Heat as location, landscape; level, intensity, degree, scale of heat
- ⌋ Balance of heat and cold, hot and cold; thermal tension
- ⌋ **Power, force of heat**
- ⌋ **Heat is an agent: Heat causes, drives, makes, counteracts, lets, balances**
- ⌋ **Heat is a patient: Pump, force, make, counteract, block, hold (back), enable, prevent, oppose, let/allow heat**

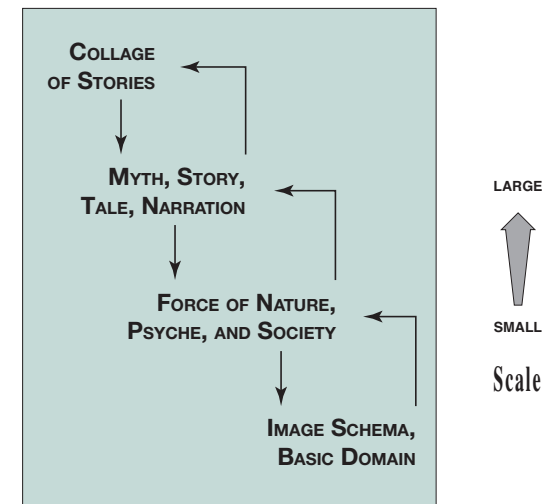
↑ *Heat is a powerful agent...*

1. LINGUISTIC PHENOMENA IN MACROSCOPIC PHYSICAL SCIENCE — SCALES

From small to larger linguistic products...

We say things that can be ordered according to increasing length (of utterances). Longer linguistic products, when analyzed, are seen to contain more figurative elements and more complex imaginative structure...

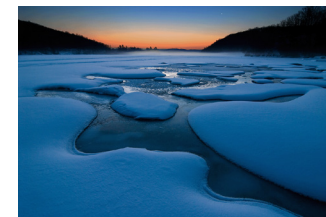
1. It was cold.
2. The temperature fell rapidly.
3. Cold found its way through the cracks in the walls and was collecting inside.
4. For cold it seemed to be fun when it could make a warm place cold.
5. So much cold was sneaking in through the walls that only the roaring fire in the wood burning stove could keep it at bay.



1. LINGUISTIC PHENOMENA IN MACROSCOPIC PHYSICAL SCIENCE — SCALES

From small to larger linguistic products...

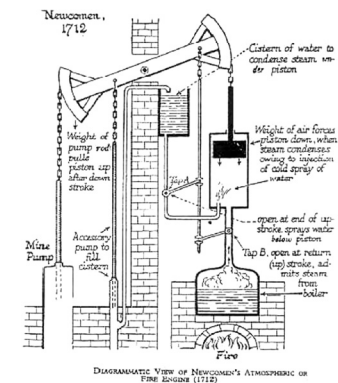
6. *R. Fuchs and H. Fuchs: A Winter Story.* As the last of the warmth of late Fall left the plain surrounding Little Hollow, cold found its way into the area and spread out. [...] The cold of winter knew a good place where it could do its job of making everything and everybody cold [...] It could flow into the hollow where the town had been built. It could collect there and it knew it would not be driven out so easily by a little bit of wind [...] *The people of Little Hollow [...] knew that the cold would find its way into their homes if they were not careful to close windows and doors. The cold could even sneak in through tiny cracks between walls and windows, so the people had learned to build their homes well to make it hard for cold to flow in.* [...] At times when much cold had collected in their town the fires in the furnaces had to work very hard to fight the cold. The people in their homes made sure that the heat produced by the furnaces would always balance the cold so that their homes felt comfortably warm.



1. LINGUISTIC PHENOMENA IN MACROSCOPIC PHYSICAL SCIENCE — SCALES

From small to larger linguistic products...

7. *Sadi Carnot (1824): Réflexions sur la puissance motrice du feu.* Every one knows that heat can produce motion. That it possesses vast motive-power no one can doubt, in these days when the steam-engine is everywhere so well known. To heat also are due the vast movements which take place on the earth. It causes the agitations of the atmosphere, the ascension of clouds, the fall of rain and of meteors, the currents of water which channel the surface of the globe, Even earthquakes and volcanic eruptions are the result of heat.
8. *Sadi Carnot (1824).* According to established principles at the present time, we can compare with sufficient accuracy the motive power of heat to that of a fall of water [...] . The motive power of a fall of water depends on its height and on the quantity of the liquid; the motive power of heat depends also on the quantity of caloric used, and on what may be termed, on what in fact we will call, the height of its fall, that is to say, the difference of temperature of the bodies between which the exchange of caloric is made.



2. FORCES OF NATURE AND THEIR STORIES – ORIGIN AND EXAMPLES

In the previous examples, we recognize a recurring *medium scale cognitive structure* → *Force of Nature*.

This structure has *perceptual origin* → the *Gestalt of Force*.

EXAMPLES...

Heat as a force of nature

Very basically, we perceive **HEAT** as a unit/gestalt. We know when we have a thermal experience...

Examples of forces of nature

Water, wind, light, *heat*, cold, food, motion, substances...

Psychological and social forces

Justice, *music*, knowledge, anger, love...

Music as a force...

Mark Johnson analyzed our experience of *music* in terms of three groups of metaphors: MUSIC AS A MOVING OBJECT, MUSICAL LANDSCAPE, MUSIC AS MOVING FORCE.

← Johnson, 2007, Chapter 11

2. FORCES OF NATURE AND THEIR STORIES – JUSTICE

*Examples of expressions involving **justice**. Examples have been found in the Internet:*

- I don't think there is ***much justice*** in the world.
- The ***source of justice***.
- "Justice denied anywhere ***diminishes justice*** everywhere." (Martin Luther King, Jr.)
- ***Harsh justice*** puts lives in the balance.
- "I have always found that mercy ***bears*** richer fruits than ***strict justice***." (A. Lincoln)
- The ***healing power*** of justice.
- ***Justice compels*** us to help this state find a way to serve all its people...
- Hence ***justice hinders*** theft of another's property.
- Create an ***imbalance*** in our justice system...
- How to ***distinguish justice from injustice*** in our characters.
- He ***got the justice*** he deserved.
- With this move we are ***coming closer to true justice***.

↑
Figure-Ground Reversal

*Expressions for justice use the following **schematic constructs**:*

- ⌋ Container, store, hold, accumulate; lack of, abundance of; collect
- ⌋ Flow, transport, exchange justice
- ⌋ Use, produce, generate justice
- ⌋ Level, intensity, degree, scale of justice
- ⌋ Tension/balance of justice and injustice
- ⌋ **Power, force of justice**
- ⌋ **Justice is an agent: causes, drives, makes, counteracts, lets, balances**
- ⌋ **Justice is a patient: force, make, counteract, block, hold (back), enable, prevent, oppose, let/allow justice**

↑
Justice is a powerful agent...

2. FORCES OF NATURE AND THEIR STORIES — ORIGINS

THE PERCEPTUAL GESTALT OF FORCE

*Force does not just
apply to perception of
natural events—it equally
applies to social and
psychological phenomena.*

*It is possible that we
become conscious of
forces largely because of
perception of an “inner”
world in dreams and
trances the knowledge of
which we transfer to the
world “out there.”*

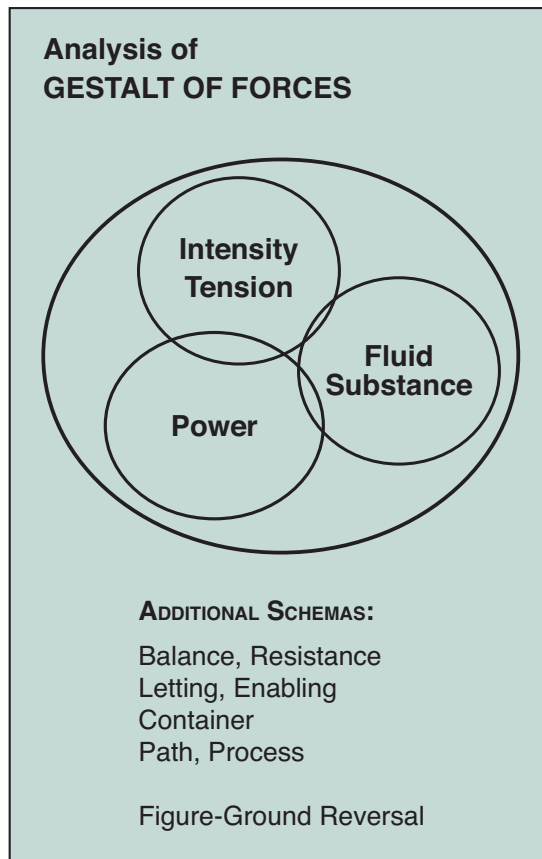
*We may conjecture that
this type of perception
helped drive the
development of language
in mythic societies.*



2. FORCES OF NATURE AND THEIR STORIES – METAPHORICAL STRUCTURE OF COLD

CONCEPTUAL METAPHOR	LINGUISTIC METAPHORIC EXPRESSION
COLD IS A (FLUID) (MOVING) SUBSTANCE/OBJECT	<i>The cold found its way into the area and spread out.</i> <i>Because the plain was so wide, the cold of winter had to spread pretty thinly,...</i> <i>It could flow into the hollow... it could collect there...</i> <i>The cold could even sneak in through tiny cracks between walls and windows...</i>
(THE DEGREE OF) COLD IS A THERMAL LANDSCAPE	<i>Winters in Little Hollow were harsh.</i> <i>So it was not all that cold up there.</i> <i>And it got colder and colder as the winter grew stronger. The temperature fell and fell.</i> <i>When it had become terribly cold and the temperature was very, very low...</i>
COLD IS A POWERFUL AGENT (MOVING FORCE)	<i>The cold of winter knew a good place where it could do its job of making everything and everybody cold...</i> <i>It went into the snow lying on the ground to make it very cold as well and this made the snow drier and harder to work with.</i> <i>It knew it would not be driven out so easily by a little bit of wind...</i> <i>The fires in the furnaces had to work very hard to fight the cold.</i>

2. FORCES OF NATURE AND THEIR STORIES – ANALYSIS OF GESTALT OF FORCE



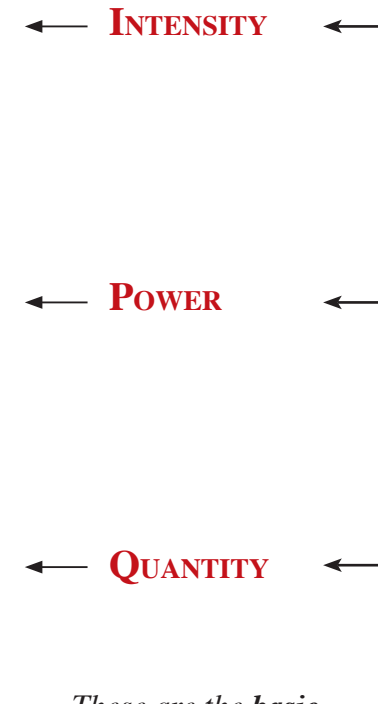
Origin of the ASPECTS of the notion of force...

It appears that the *perception of a polarity* lies at the heart of the notion of a force. Polarity → *tension*: difference of qualities/intensities conceptualized by the SCALE schema.

We further notice that *phenomena/events/processes* are associated with the occurrence of a polarity or tension → *causal interaction* between phenomena resulting from tensions.

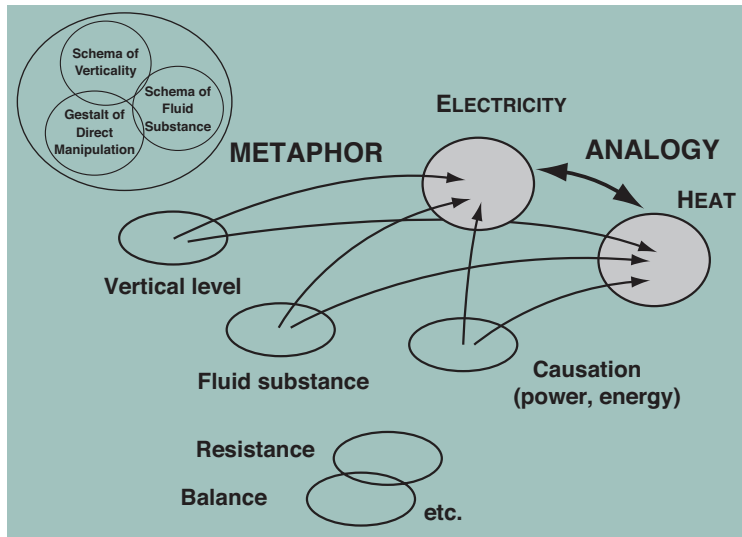
The human mind then seems to construct the image of an associated *agent of certain size* (← Figure-Ground Reversal) *and power*.

ASPECTS...



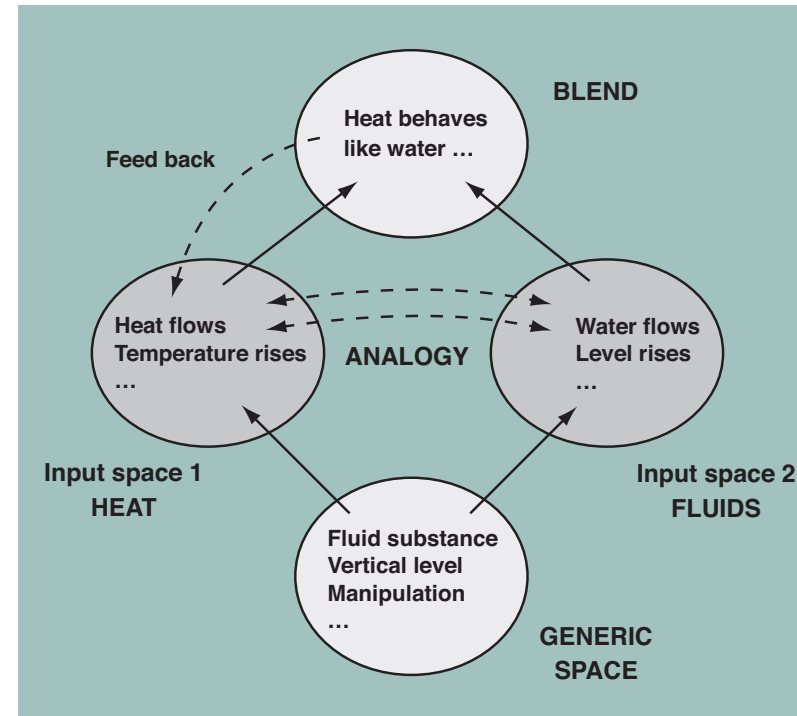
These are the basic concepts used to model processes continuum physics.

2. FORCES OF NATURE AND THEIR STORIES — METAPHORS, BLENDING, ANALOGY



Basic *stable conceptual structure* of the perceptual gestalt of *Force of Nature* applied to different phenomena. The gestalt has three fundamental aspects: *Quality/Intensity*, *Quantity/Size*, and *Power*.

Analogy: Different *Forces of Nature* are *structured metaphorically in the same manner*. This makes them similar to the human mind.



Mirror Integration Network (Turner, 2006, p.101; Fauconnier, 1997, p.18-25) represents structures "popping up" in discourse and thought and eventually lead to *stable conceptualizations*.

2. FORCES OF NATURE AND THEIR STORIES — TOWARD NARRATIVE

EXAMPLES OF STORIES OF NATURE

Birth of a child, a forest fire, hurricane Sandy, the creation of the world... →



FORCES AND NARRATIVES

When interacting with objects in the world and with other *agents*, a force (of nature) creates an *event* that *unfolds over time* and *changes* things in the world → **STORY**.

NARRATIVE FRAMING

In stories, we can *frame natural scenes* where forces of nature live through adventures...

In other words, *content* and *structure* of scientific knowledge are *integral components of stories*.

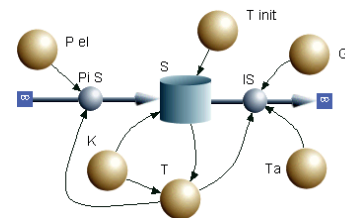


2. FORCES OF NATURE AND THEIR STORIES — MODEL/SIMULATION AND STORYWORLD/STORY

THEORY, MODEL, SIMULATION, AND STORIES OF FORCES OF NATURE

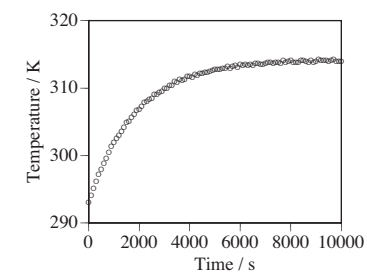
- ⌌ A *theory* is an ordered collection of the basic *properties of forces of nature* plus logical consequences.
- ⌌ A *model* is a rendering of a particular *story-world* (framing of a scene) and...
- ⌌ ...its *simulation* is a *story* (Mary Morgan, Norton Wise).

Story-World & Dynamical Model



Story & Simulation

Once upon a time there was a small town called Little Hollow. Children and grown ups in Little Hollow were waiting for winter...



2. FORCES OF NATURE AND THEIR STORIES — UNDERSTANDING FORCES THROUGH STORIES...

FORCES AND NARRATIVES

Our concept of Forces (of nature) does not just stand by itself; it is not just assembled from smaller scale schemas and their metaphoric projections—*forces* are *embedded in stories*.

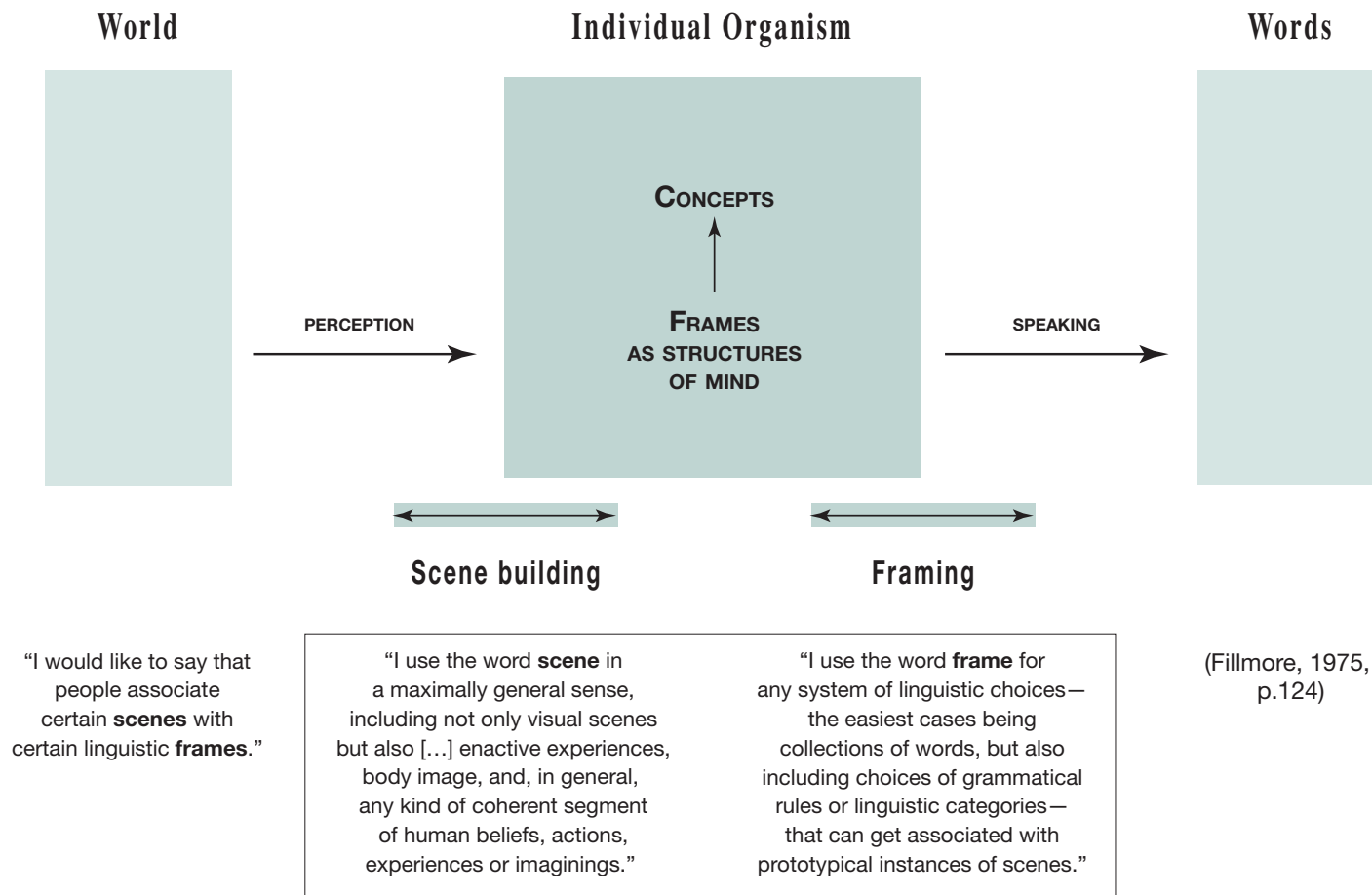
Much of our understanding of the (medium-scale) gestalt of force results from it being *part of larger perceptual units and linguistic products*.

In particular, concepts such as *time, process, agency*... are irreducibly *narrative*.

“... in a narrative, a metaphor is not only in context but also takes a meaning not reducible to what we might associate with it in isolation.”

← Contini, 2015

3. PERCEPTION AT DIFFERENT SCALES — FRAMING



3. PERCEPTION AT DIFFERENT SCALES — NARRATIVE FRAMING

The notion of NARRATIVE FRAMING

We borrow the term *framing* from Fillmore in an early sense of bringing together *perception*, *conceptualization*, and *language use*.

The term *narrative framing* is used in a double sense:

1. It alludes to *enlisting narrative intelligence* in the *perception* of phenomena in nature; and
 2. speaks of the *telling of stories* that contain *conceptual elements* used in the creation of scientific models of these phenomena.
- The notion of *narrative framing* rests upon an assumption of *experience* and *perception at different scales*: experience leads to the construction of *small to large-scale perceptual schemas (gestalts)* that are recruited for understanding. *Large-scale schemas support narrative thought and understanding.*

PERCEPTUAL SCALE...

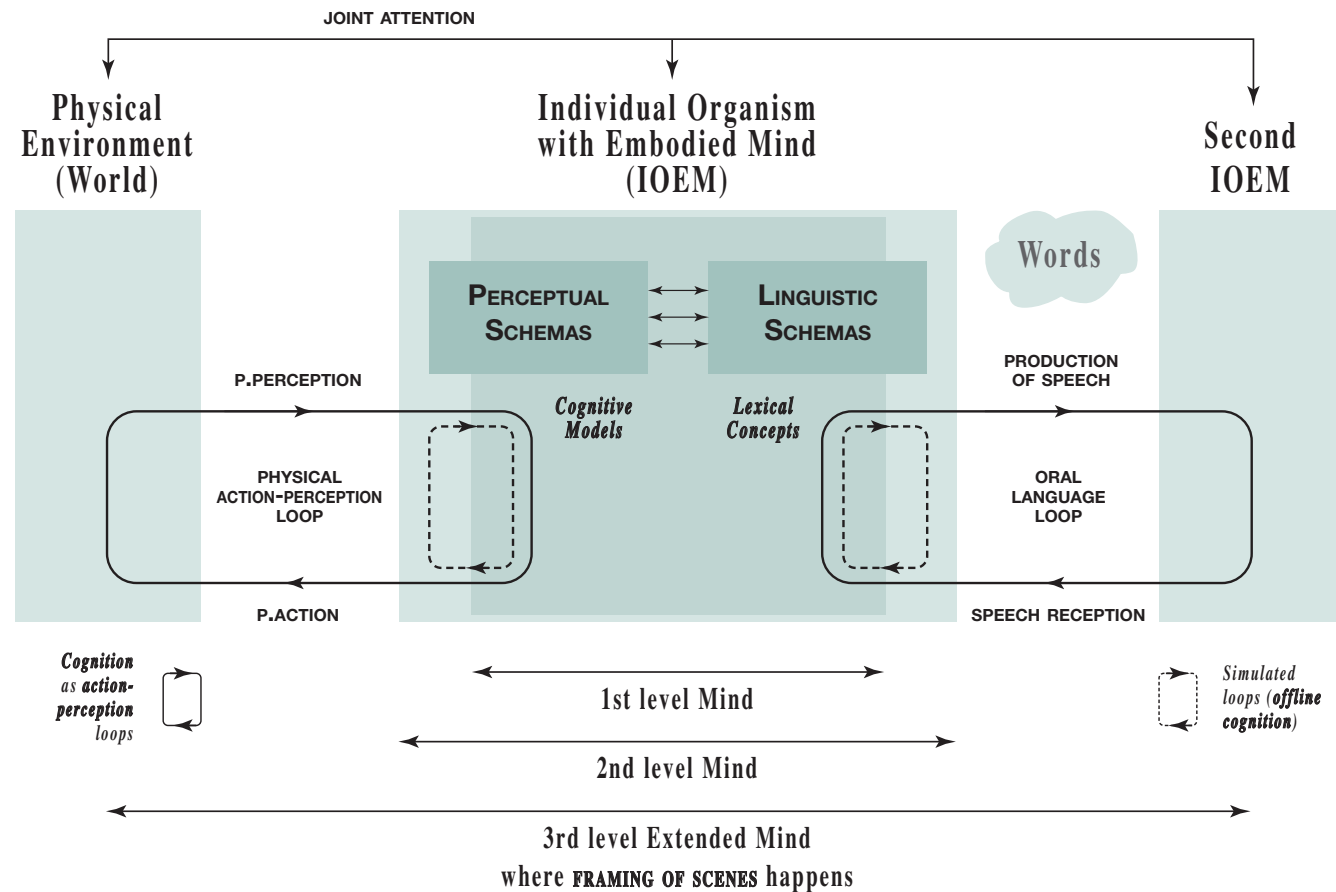
← ... refers to *spatial, temporal, and systemic “size” of perceptual units (gestalts)*

3. PERCEPTION AT DIFFERENT SCALES — ACTION-PERCEPTION-FEEDBACK-LOOPS

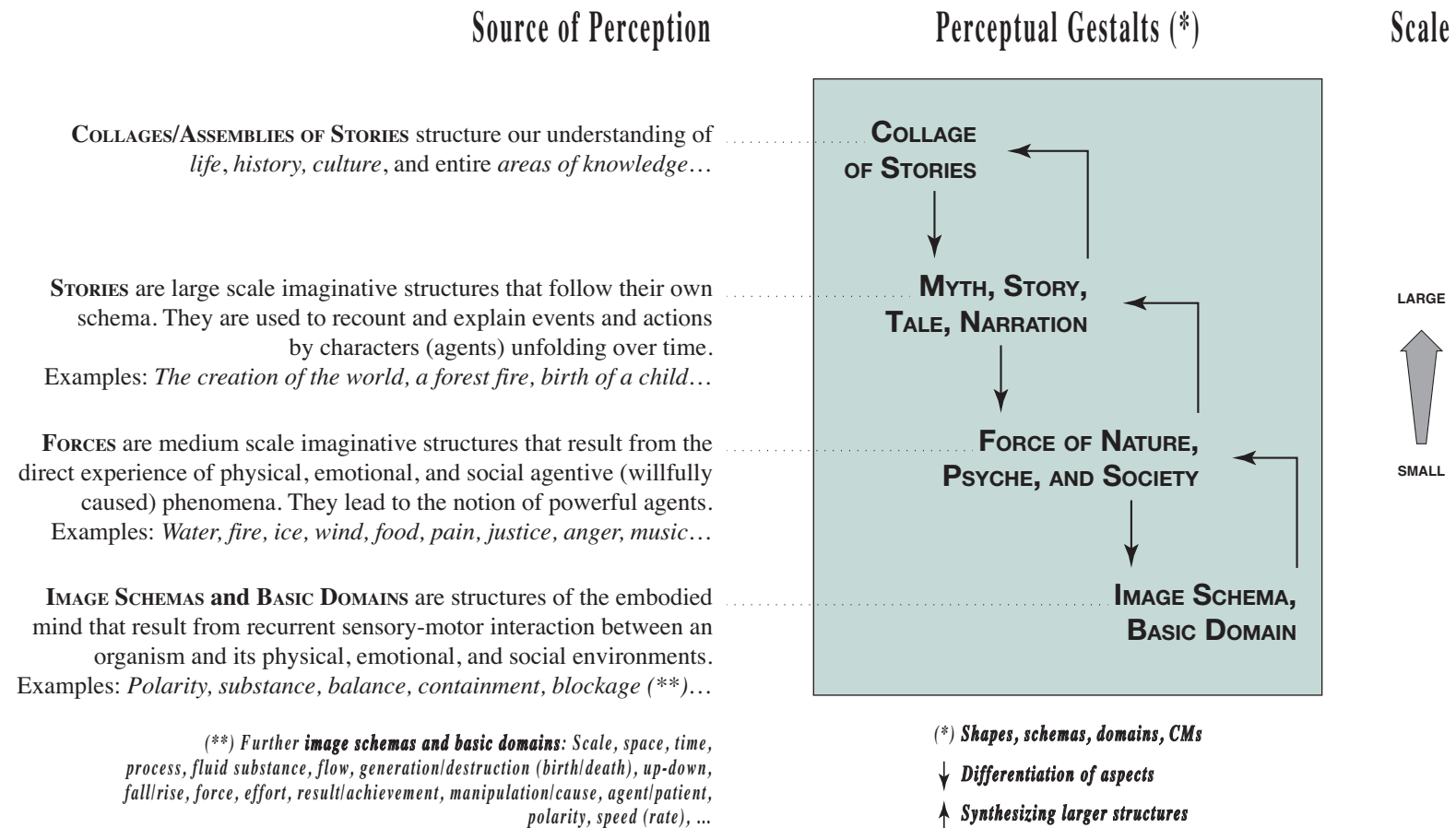
Cognitive semantics and a model of embodied minds

“I mean by framing the appeal, in perceiving, thinking, and communicating, to structured ways of interpreting experiences.”

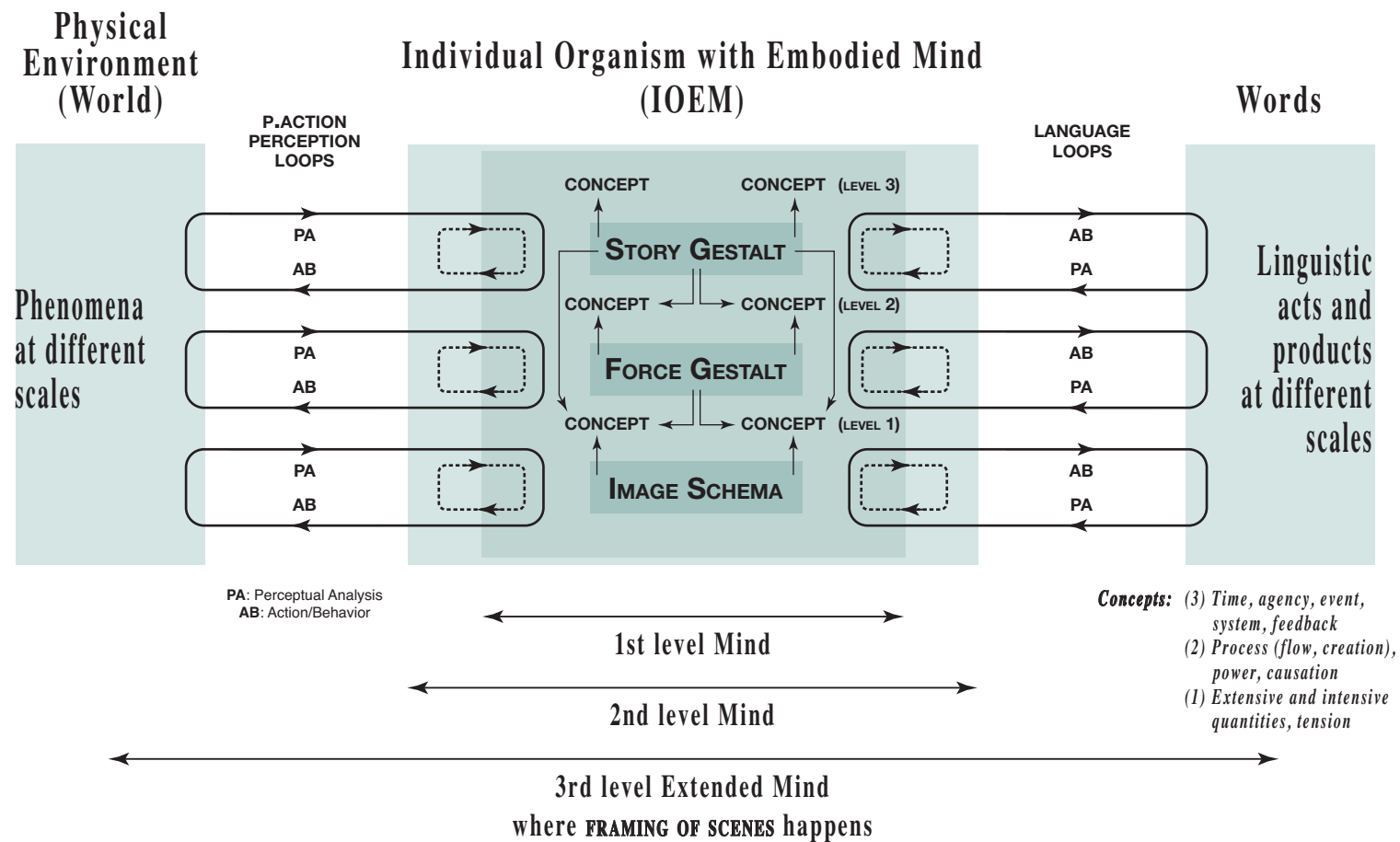
(Fillmore, 1976, p. 20)



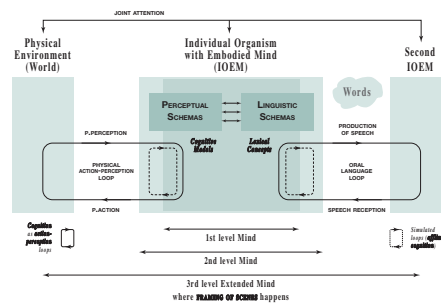
3. PERCEPTION AT DIFFERENT SCALES — SMALL- TO LARGE-SCALE SCHEMAS



3. PERCEPTION AT DIFFERENT SCALES — ACTION-PERCEPTION-LOOPS AT DIFFERENT SCALES



4. SUMMARY QUESTIONS — NATURE AS A COMMUNICATIVE PARTNER



DOES A NARRATIVE APPROACH TO NATURE AND SCIENCE CHANGE OUR INTERACTION/COMMUNICATION WITH NATURE?

The interaction of a human with the physical world is of a particular form—it leads to the schematic structures described by embodied cognition.

Linguistic interaction takes place between humans and has its own form leading to its own abstractions.

So what happens when we use stories of forces of nature? Does the former interaction—the physical one—change? Do we possibly add a new dimension to this interaction?

*I would like to suggest that we see nature in a new light. It is not any longer this world that is so totally different from our fellow human beings. Nature is filled with agents with whom we can interact—communicate. We feel we are put in a position to **understand and predict the behavior of these agents** (folk physics) just as we wish to predict human behavior (folk psychology).*

*It seems we can have **a conversation with nature**. Nature becomes a partner not completely unlike our social partners...*

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