

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

---

Library Philosophy and Practice (e-journal)

Libraries at University of Nebraska-Lincoln

---

October 2006

## Philosophical Views about Digital Information and Relational Schemata

Markos Dendrinis

*Technological Educational Institution of Athens (TEI-A)*, mdendr@teiath.gr

Follow this and additional works at: <https://digitalcommons.unl.edu/libphilprac>



Part of the [Library and Information Science Commons](#)

---

Dendrinis, Markos, "Philosophical Views about Digital Information and Relational Schemata" (2006).  
*Library Philosophy and Practice (e-journal)*. 89.  
<https://digitalcommons.unl.edu/libphilprac/89>

# Philosophical Views about Digital Information and Relational Schemata

Markos Dendrinis

*Associate Professor of Computer Science*

*Technological Educational Institution of Athens (TEI-A)*

*Dept. of Librarianship and Information Systems*

*Ag. Spyridonos*

*122 10 Egaleo*

*Greece*

Philosophy of Information is an active contemporary branch of philosophy, dealing with problems in the analysis of the concept of information, in semantics, in the study of intelligence, in the relation between information and nature, and in the investigation of values[1]. There are many contributions about the ontological nature of information, the definition of data and the philosophical approaches to semantic information; one important publication is the review presentation of Floridi in Stanford Encyclopedia of Philosophy[2], where amongst others he introduces an extension of Mathematical theory of Communication (Sannon's information theory[3]) in the area of semantics.

One of the open problems in philosophy of information presented by Floridi is the problem of *localization*, whether information could be naturalized[4]. The externalists / extensionalists (for example, Barwise[5] or Dretske[6]) have the difficult duty to present how information resides in the world independently of the informee and the sense under which an *external object* constitutes *information*. The internalists / intentionalists (for example, Fodor[7],[8] or Searle[9]) have the opposite duty to explain how the interaction between information and informee is exclusively an internal cognitive operation, where the value of the external stimuli is negligible. We should also mention here the nonmaterial objectivism, where the entities exist in an area perceived only by human mind but not human senses. This is the philosophical position emerging from Platonism, which continues to be today active usually in

mathematicians' and physicists' views, where the 'platonic' patterns are mathematical truths or universal physical laws. Lastly, another branch of philosophers (constructivists) suggest that information is constructed during the learning process, where both the individual and his environment participate.

Harnad has dealt extensively with the *symbol grounding problem*, posing the question "How can the semantic interpretation of a formal symbol system be made intrinsic to the system, rather than just parasitic on the meanings in our heads? How can the meanings of the meaningless symbol tokens, manipulated only on the basis of their (arbitrary) shapes, be grounded in anything but other meaningless symbols?"[10] He suggests a hybrid non-symbolic / symbolic system, a "dedicated" one, in which the elementary symbols are grounded in two kinds of non-symbolic representations[11]. It is a bottom-up scheme of three representation levels: (1) non-symbolic iconic representations, that is the sensory data, (2) non-symbolic categorical representations, that is the concepts constructed within the human mind through abstraction of individual sensory data, which become the elementary symbols and (3) symbolic representations, that is syntactical combinations of the elementary symbols. These levels also indicate the ground-up route from sense data to symbols, answering how the meaningless higher order symbols borrow meaning from the elementary categorical symbols on which they are grounded[12].

Following the hybrid dedicated symbol system of Harnad, information is not internal in the strict sense (parasitic in the mind of the informee), but semi-internal, grounded on semi-internal iconic representations (where both observer and observant take part) and internal categorical representations produced by human conscience.

Trying to reduce the scope of the current investigation, focusing on digitally viewed information, I select as working hypothesis, the "it from bit" theory[13], where information is considered as the ultimate constituent of the universe and the natural processes, including causation, are seen as special cases of information dynamics[14]. Based on this hypothesis, I will try to present a more radical view; that information is placed neither in the external material world nor within us; instead, it exists in digital form, as the constituent of a platonic type nonmaterial world.

In the Platonic allegory of the two worlds[15], the material world we perceive through our senses, represented in *Republic* as a cave, is only a delusion; it is just a copy or reflection of another world, which consists of ideas. The world of ideas is the true world, which is accessible not by the senses, but by the mind. I introduce here an informative version of the Platonic allegory, which I call *Information Platonic Model*. In this model, information, in the form of innumerable combinations of two distinct states

(bits 0 and 1), constitutes the true world, whereas material objects are reflections of these information entities. Therefore, the true world consists ultimately of bits and what we sense is only a transformed image adapted to our perceptual mechanism.

The above concern information as the background substance of anything. What about the nature of the human-driven electronic information, the *instruction codes* produced by human beings and the *digitized data*?

Writing an instruction code, according to a set of rules, could be considered as the conclusion of a long evolutionary course. The natural environment itself avails matter; through the evolution process various material forms proved to be successful in the context of microcosms within the universe; a kind of them, human beings, manifested the extraordinary capability of abstraction; based on it, after a lot of discoveries and inventions, they designed and implemented mathematics, computer arithmetic, and computer languages eventually used in computer programming. According to the *Information Platonic Model*, matter is a phenomenon grounded on binary information; the whole universe reduces to information; all material forms, including human beings are reflections of binary entities. Under this perspective, human beings are both *expressions* of digital material and *producers* of digital material, in the form of instruction codes (software modules); these codes manipulate another form of digital material – *data* - giving results, with a large impact on both human beings and their environment.

How these two kinds of *produced* digital material - instruction codes and data - are related to the *ultimate background* digital material? Are they human-driven entities or independent 'residents' of another world, which are simply met and revealed by human beings? We design and implement certain instruction codes in order to attain specific results. We also sample and digitize texts, numbers, sounds, speech, music, photos, pictures, videos, etc. In the context of the Information Platonic Model, where *every* natural or artificial appearance can be ultimately reduced to combinations of 0 and 1, there is no ground for observers or points of reference. Consequently, both computer software and computer data, though they are human products, are neither objective, nor subjective, neither random nor aimed. They are images of *real* and *existing* binary entities of the true informative world, with not distinguishable nature from the other material objects, including their 'creators'. In this context, binary coded instructions and data are not *invented*; they just *manifest* themselves from an upper level, where all possible combinations of 0 and 1 of any length reside. Digital material under the cover of human form meets again itself in the form of instruction codes and digitized data, as the mythical snake that eats its tail.

Another interesting element of any structure is the relations involved. What is the nature of these relations expressed in the form of *links*? What is their role in the Information Platonic Model frame? I think that they can also be considered as reflections of *real* connections between *real* entities, revealing the dynamic ever-floating structure of the true world of binary information.

## 2. A review of ancient classification schemata in respect to modern relationship types

Conceptual representations are extracted in human mind from the perceptual data through the operations of discrimination and identification. We group a set of *similar* observations, *out of* the total available observations, based on a number of certain characteristics common in all the elements of the set. Then we give a label to the set to be used as representative of any of the included observations. We create in this way a number of abstract noetic entities – concepts - organized in a hierarchical structure of *classes*. Each of the classes both belongs to a higher class, called parent class, and includes a number of lower classes, called descendant classes, except the highest one, which has no parent and the lowest ones, which have no descendants. The lower the class, the larger its depth and the smaller its width. Each class takes the role of *gender* in respect to its descendant classes and *species* in respect to its parent class.

The taxonomy of concepts in *genera* and *species* originates from Aristotle, the philosopher who first systematized (1) the relations between concepts, (2) the structure of propositions and (3) the types of admissible and non-admissible syllogisms in *Categories*, *Topics*, *Prior Analytics* and *Posterior Analytics*. He considers individuals as a distinct category of substances, calling them in *Categories*[16] primary substances, which cannot be predicated of any subject. On the other hand all genera, called secondary substances, can be predicated of relative individuals or descendant genera. For example *John is a man, man is an animal, John is an animal*.

Aristotle continued the work of Plato, who was the first who spoke about the noetic entities under the name of ideas (*εἰδη* or *ιδεαι*) and introduced *dialectics*, the practice of the division of concepts in successive classes in his earlier works *Meno*, *Republic* and *Phaedrus*, and systematically in his later works *Parmenides* and *Sophist*.

In *Meno*, Plato introduces the term *dialectical* in the phrase “The more *dialectical* way, I suppose, is not merely to answer what is true, but also to make use of those points which the questioned person acknowledges he knows.”[17]

In *Republic*, he adds “we have set *dialectics* above all other studies to be as it were the coping stone and that no other higher kind of study could rightly be placed above

it"[18], and he gives the definition of *dialectician* as "the man who is able to exact an account of the essence of each thing".[19]

The human capability of abstraction is presented perspicuously in *Phaedrus*: "a human being must understand a *general conception* formed by collecting into a unity by means of reason the many perceptions of the senses; and this is a *recollection of those things which our soul once beheld*, when it journeyed with God and, lifting its vision above the things which we now say exist, rose up into real being. And therefore it is just that the mind of the philosopher only has wings, for he is always, so far as he is able, in communion through *memory* with those things."[20]

Plato not only presents here the process of abstraction but he also declares explicitly his position, in words of Socrates, that the concepts are not human creatures; they exist independently of man in another world, and they can be recollected by man through the operation of memory. With this phrase he opens a tremendous philosophical subject, which has not ceased to be an object of study and conversation until now, declaring that ideas exist independently in another level beyond material world. The allegory of the cave in *Republic*[21] complements the above statement, through the characterization of the material world as a mirror world of shadows. I will refer to this classical Platonic position of absolute independent ideas as *Phaedrus-Platonic*, so that it can be distinguished from late Platonic positions in *Parmenides* and *Sophist* that face critically that early position.

Later, in *Phaedrus*, he describes the practice of "perceiving and bringing together in one idea the scattered particulars"[22], and he presents the opposite human capability "of *dividing* things by *classes*, where the natural joints are, and not trying to break any part, after the manner of a bad carver"[23]. His remark 'where the natural joints are' is very interesting, since he stresses there that the art of division into classes is a demanding task, taking into account the critical differences among the various differences between the objects to be classified. Plato's more detailed presentation of classification structure takes place in *Sophist*, where he gives a detailed example of defining the practice of sophists through successive division of concepts in further narrower classes, in the form of a reversed tree[24]. I will refer to this Platonic model of successive classes as *Sophist-Platonic*. This classification schema was adopted and systemized later by Aristotle.

The correspondence between material objects and noetic entities was and still remains a very demanding philosophical task. Aristotle tried to reduce the gap between ideas and objects, considering that each individual (primary substance) possesses both *form* (εἶδος) and *matter*[25]. I present next the attacks to the *Phaedrus-Platonic* position

of absolute ideas both in *Parmenides*, within the words of Parmenides, and in *Sophist* within the words of the stranger, which perhaps echo the beliefs of Plato himself in his late philosophical considerations.

In *Parmenides*, young Socrates takes part in a very interesting dialogue with Parmenides[26], the founder of Eleatic philosophy. Parmenides makes Socrates defend his opinion about ideas. This task proves to be very difficult. The term used to denote the relation between sensible things and distinct ideas is 'participating', (Greek terms: μεταλαμβάνειν, μετέχειν). Parmenides takes the hypothesis of things' participating to ideas and leads it to the contradiction that anything participates to both the idea of likeness and unlikeness[27]. Next Parmenides asks explicitly Socrates if he is the man who invented the theory of the abstract ideas distinct from the things that participate to them. And he complements the question, asking him if he considers abstract likeness apart from the likeness we possess[28]. By the positive answer of Socrates, Plato presents him explicitly as the introducer of the fundamental philosophical position, which I called before as Phaedrus-Platonic position. Parmenides does in this point his direct attack to this theory, asking Socrates whether there exists an abstract idea of man apart from each individual person, a distinct idea of fire or a distinct idea of water. Socrates declares that he cannot answer[29]. Then, Parmenides encouraged extends his critique against distinct ideas, asking Socrates whether there exist ideas of ridiculous things, like hair, mud, dirt, or anything else vile and worthless. Socrates answers negatively, saying that he prefers to deal with the important ideas he is sure to exist[30]. This debate reveals the nonsense brought out through the careless extension of a reasonable position. Next, Parmenides uses the trick of the division of an idea into parts, to show that participating to the ideas of smallness, equality or greatness either to the whole or to a part of them lead to contradictions[31]. Then Socrates tries to escape by supporting the possibility that each of these ideas of quantity "may be only a thought, which can exist only in our minds"[32]. This is a very interesting reference that shows that the modern opinion that ideas are but human concepts, residing only in human minds, was not excluded, concerning some ideas, even by Socrates (either Socrates himself or Platonic Socrates), the introducer of the model of distinct ideas. But, later Socrates returns to add an important characteristic of the ideas, their operation as patterns (Greek word παραδείγματα): "ideas exist in nature as patterns, and the other things resemble them and are imitations of them; their participation in ideas is assimilation to them, that and nothing else.[33]" The ideas as *patterns* and the participation as a course of *assimilation* are important components of the traditional Phaedrus-Platonic position. Neither this position remains invulnerable, as Parmenides shows that such a position leads to an infinite series of ideas related to a certain thing[34]. Later Parmenides addressing to Socrates, says: "I think that you or anyone else who claims that there is an absolute idea of each thing would agree in the first place

that none of them exists in us"[35], where Socrates agrees with this thesis. It is the most perspicuous declaration of Phaedrus -Platonic position that the ideas are absolute and they do not exist in us. This position is then seriously attacked by Parmenides, who shows that this opinion leads to the incapability of human beings to know the ideas[36].

*Sophist* is another late Platonic dialogue, where the propositions of the called "friends of ideas"[37] are proved to be insufficient. The stranger here, playing perhaps the role of Plato himself, shows that it is quite unreasonable to consider ideas as absolute still entities, since the truly 'being' is characterized by movement and life[38]. In conclusion the stranger proves the Phaedrus-Platonic position clearly insufficient, introducing a synthetic opinion, bridging the Eleatic school of invariable substance with the Ionian school of dynamic change.

Later, Aristotle continues the critique against the ontological separability of the ideas in respect to the objects, saying "But while they involve difficulty in many respects, not the least absurdity is the doctrine that there are certain entities apart from those in the sensible universe, and that these are the same as sensible things except in that the former are eternal and the latter perishable. For [Platonists] say nothing more or less than that there is an absolute Man, and Horse, and Health; in which they closely resemble those who state that there are Gods, but of human form; for as the latter invented nothing more or less than eternal men, so the former simply make the Forms eternal sensibles."[39].

In spite of the difficulties of philosophical grounding of Phaedrus-Platonic position, both late Plato in *Sophist*, and Aristotle in his works concerning logic, adopt the model of successive classes (Sophist-Platonic model), at least as a tool, due to the efficiency of the taxonomic organization in hierarchical classes of concepts, in various theoretical considerations. The relationship covering all the extension of this scheme is the *BT/NT* (*broader term / narrower term*) relationship, where a term-concept is included in the depth of another term-concept. For example every eagle is a bird, but a bird is not necessarily eagle.

Additionally, we can identify the objects of our environment through the class-concept it belongs to, saying that a certain person is a human being, a certain dog is a dog, a certain flower is a flower of a specific category, a certain table is a table, a certain car is a car of a specific brand. This is the *instance\_of* relationship developed by Aristotle in the various types of syllogism. It means that a real object is an instance of the general concept.

Walking a step further we can make *thesauri*, richer schemes than taxonomies, where we can impose apart from the *BT/NT* relationship between terms of the same hierarchy, the associative or *related term (RT)* relationship, connecting relative terms across hierarchies. *RT* relationship is frequently used for the assignment of the relation between an object and its properties (*has* relationship); for example the terms *poison* and *toxicity*.

There is also the *equivalence* relationship, where two terms mean exactly the same thing under different names or abbreviations (e.g. *beast* and *animal* or *United Nations* and *UN*). The equivalence is denoted by the *USE* and *UF (used for)* fields, where *USE* offers to an unauthorized term a link to the corresponding authorized equivalent term and *UF* accompanies an authorized term with all the equivalent unauthorized terms, that could be used in place of the current term. Other useful relationships are *part\_of* relationship in case of an entity being part of another one (e.g. *finger* and *hand*) and *member\_of* relationship in case of an entity being member of a set (e.g. a *footballer* of a *football group*).

Both *BT/NT* and *equivalence* relationships have the form *subject – is – predicate*. They are presented in detail in *Sophist*, where a lot of conversation was spent in order to discern the exact type of relationship between primary concepts like *being*, *one* and *whole*. *BT/NT relationship* is implied under the expressions ‘possessing the attribute of’ or ‘imposed upon’ or ‘participating’ (Greek terms: *πεπονθός, πάθος ἔχειν, μετέχειν*), and sometimes by the expression ‘being in a way’, (Greek expression: *εἶναι πῶς*); instead *equivalence relationship* is given through the expression ‘the same to’ (Greek term *ταυτόν*).

The conversation takes place between the stranger from Elea holding new radical philosophical opinions (echoing possibly the beliefs of late Plato) and Theaetetus, representing the supporters of the traditional Phaedrus-Platonic position.

The stranger asks Theaetetus “will they say that the whole is other than the one which exists or the same with it?”[40]. Here he wonders if ‘one’ and ‘whole’ are related through the *equivalence* relation, as we conclude by the use of the phrase ‘the same with’.

Next the stranger says “nothing hinders that which has parts from possessing the attribute of unity in all its parts and being in this way one, since it is all and whole”[41]. Here he supports that “what has parts” is “one” in a *BT/NT* relationship between *one* (BT) and *what has parts* (NT); this is implied through the expression ‘possessing the attribute of’ (Greek term: *πάθος ἔχειν*). He ensures next about the type of the

relationship, saying that “But such a unity consisting of many parts will not harmonize with reason”[42], meaning that ‘what consists of many parts’ is not equivalent with ‘unity’ (the one). He concludes with a saying, which in my opinion is the earliest clear declaration discerning the two ways of predication, BT/NT and equivalence: “for being, having in a way had unity imposed upon it, will evidently not be the same as unity”[43]. He affirms BT/NT relationship between *unity (the one)* (BT) and *being* (NT) through the expressions ‘imposed upon’ (Greek term *πεπονητός*) and ‘in a way’ (Greek term *πῶς*). Additionally, he negates equivalence relationship between them through the expression ‘not the same as’ (Greek term *ταυτόν*).

It is interesting to conclude the attempts of Plato to define the relationships between ‘one’, ‘being’ and ‘whole’, by referring Aristotle, who presents the contradictory effects from considering being (Greek word *εἶναι*) and one (Greek word *ἓν*) as predicates of substance (Greek word *ὄν*)[44].

Later, the stranger in *Sophist* says that the greatest genera are ‘being’ (Greek term *ὄν*), ‘motion’ (Greek word *κίνησις*) and ‘rest’ (Greek word *στάσις*)[45]. It is important to identify their relations under the words of the stranger. He declares explicitly that ‘motion’ is descendant of ‘being’, in saying “it is clear, then, that motion really [is not, and also that it] is, since it participates to being”[46]. The term ‘participates’ (Greek word *μετέχει*) shows the BT/NT relationship between ‘being’ (BT) and ‘motion’ (NT). I suppose that the same holds for ‘rest’, the adversary of ‘motion’, since it similarly participates to ‘being’. To make it even more clear the stranger says “According to its own nature, then, being is neither at rest nor in motion”[47], where he might mean that ‘being’ is parent of ‘motion’ and ‘rest’, not a descendant of either, and thus either ‘motion’ or ‘rest’ cannot be predicated by ‘being’.

Next, the stranger concludes the introduction of classes, adding the supposed class of ‘the same’ (Greek term *ταυτόν*) and the supposed class of ‘other’ (Greek term *ἕτερον*). I think that the characterization of ‘the same’ and ‘other’ as classes is somehow misleading in the comprehension of the classification scheme. In my opinion, they do not denote classes, but rather types of relationship. ‘The same’ denotes equivalence relationship, while ‘other’ denotes two disjoint classes. This suggestion might be supported by the saying “certainly motion and rest are neither other nor the same”[48], meaning that ‘motion’ and ‘rest’ refer to classes, while ‘other’ and ‘the same’ refer to relationships. Similarly the obscure phrase “Then it [motion] is in a sense not other and also other”[49] might mean that ‘motion’ can take part in either an equivalence relationship related to itself or a disjoint relationship related with other disjoint terms. And in the phrase mentioned before “it is clear, then, that motion really is not, and also that it is, since it participates to being”, the first negation ‘motion really is not’ means, as

the stranger explains, that 'motion' participates to the nature of 'other'; to use the relationship terminology, it means that 'motion' takes part in relationships with disjoint terms.

Lastly, the stranger gives an excellent description of the object of the science of dialectics, with the remark that "some of the classes will mingle with one another, and others will not, and some will mingle with few and others with many, and that there is nothing to hinder some from mingling universally with all"[50], meaning that the amplitude of predication process (mingling) of concepts depends on their position in the taxonomy.

### 3. Web as an extended-Platonic model

The relationships examined in the previous chapter are the foundations of thesauri systems, which are used widely for effective literal and semantic search and retrieval in the context of texts of a natural language or more usually in the case of a sub-language.

The simple ontological taxonomy is the primitive Sophist-Platonic model of classes interrelated by the BT/NT relationship. The universe of discourse, namely the field of application of this model covers the whole natural environment. Each object of the universe can be connected to a relative concept of the taxonomy, under an instance\_of relationship; all the individuals are connected to the concept of human being, all the dogs to the concept of dog etc. Could a taxonomy be used for identification purposes? The degree of identification would depend on the classification detail. If the taxonomy ended with the class 'dog', we would not be able to identify a certain dog as belonging to a specific race.

Let focus now on the world wide web (www), the universe of interconnected web hypertext pages containing rich text, multimedia data and connections to other pages. Web page management information system includes: (1) index tables automatically derived by software (robot or crawler programs), where the representative indices are keywords extracted from the title, the description, the text or the content declaration fields of the web pages and (2) hierarchies (directories) of thematic categories, where the representative categories have been defined by human beings, based on various semantic views of the content. Therefore, directories are fewer but superior to index tables in terms of content quality.

I consider web as the universe of discourse instead of the natural environment, web pages as the objects of the *material* world accessed in screen or printed form by our

senses, and keywords, extracted from or related to the pages, as the entities of the *non-material* Platonic world. This model could be viewed as an extended Platonic model. I keep the term 'Platonic' to remind that the representative keywords (indices or thematic categories) of the web pages constitute a level different from the level of pages (metadata distinguished from data). Additionally, I put the term 'extended' to remark that this model has a more complicate structure in comparison to the primitive Sophist-Platonic model.

At first I want to refer to the issue of priority. Plato, as I mentioned before, supported that ideas are prior to the objects and they exist absolutely, independently of the objects that depend and participate to them. Aristotle tried to increase the importance of the sensible objects, saying that each object includes both *form* (pattern idea) and *matter*. Later, Alexander Afrodisiensis, the most important annotator of Aristotle, supported that the genera (Greek word καθόλου) are human noetic constructions extracted from the common properties of certain groups of individuals (Greek word καθέκαστα). He contended that the individuals are prior to the genera, which are not self-existent entities, but concepts derived and existing only in human mind. Similarly, in web, keywords (indices or thematic categories) are obviously posterior to the texts, since they are either extracted from the text (indices) or they are made according to the text (categories).

A critical feature of the web model is the multiplicity of connections between an object of the web page world to the keywords of the Platonic world. Instead of the unary relation between a material object and the corresponding idea in the Sophist-Platonic model, a web page is related to a set of literal keywords stored in the index tables, as well as to a set of thematic categories. Additionally, the hierarchies of categories consist of concepts organized through *BT/NT*, *equivalence* and *RT* relationships, while primitive Sophist-Platonic model was restricted to *BT/NT* relationship. Lastly, web management search services use extensively the *USE* and *UF* correspondence tools.

The more the connections between web pages (material objects) and keywords (non-material concepts), the more the *recall* of the retrieved pages. The richer the semantic hierarchies of categories, the more the *precision* of the retrieved pages.

Such a structure explains also the superiority of fuzzy matching to exact matching. In the latter we do locate an object through a fixed correspondence to a certain characteristic; in the former we try to locate it based on a multitude of components with various weights.

## Conclusion

This work was an attempt at exploiting the Platonic model as a tool to face the fundamental issue of the nature of digital information, as well as localization and classification issues. As far as classification is concerned I tried to present a review of the traditional Sophist-Platonic model through the words of early and late Plato in terms of contemporary relationship schemes. A thorough examination of the predicative propositions included in *Sophist* results to an informational view of the ontological theory of late Plato. Lastly, I tried to interpret the structure of web management system as an extended Platonic model. I hope that this study will be a contribution to reveal the diachronic validity of ancient philosophical sayings, when viewed under contemporary information contexts.

## References

- Barwise and Perry, *Situations and Attitudes*. Cambridge: Mass, MIT Press, 1983.
- Dretske, F. *Knowledge and the Flow of Information*. Cambridge: Mass, MIT Press, 1981, repr. Stanford: CSLI, 1999.
- Harnad Stevan, "The Symbol Grounding Problem", *Physica D* 42: 335-346, 1990, also in <http://www.ecs.soton.ac.uk/~harnad/Papers/Harnad/harnad90.sgproblem.html>, viewed in 30/01/06.
- Floridi, "Open Problems in the Philosophy of Information", *METAPHILOSOPHY*, Vol. 35, No.4, July 2004
- Floridi, "Semantic Conceptions of Information", *Stanford Encyclopedia of Philosophy*, also in <http://plato.stanford.edu/entries/information-semantic/>, viewed in 10/02/06.
- Fodor, J.A., *The Language of Thought*. New York: Thomas Y. Crowell, 1975.
- Fodor, J.A., *Psychosemantics*. Cambridge: Mass, MIT / Bradford, 1987.
- Searle, J. R., "Minds, Brains and Programs", *Behavioral and Brain Sciences* 3, no.3: 417-57, 1980.
- Shannon, C. E. and Weaver, W., 1949, *The Mathematical Theory of Communication* (Urbana: University of Illinois Press). Foreword by Richard E. Blahut and Bruce Hajek; reprinted in 1998

Wheeler, J. A., "Information, physics, Quantum: The Search for Links" in Zureck, W.H. (Ed), *Complexity, Entropy, and the Physics of Information*. Redwood City, Calif: Addison Wesley, 1990.

---

[1] Floridi, "Open Problems in the Philosophy of Information", p.554

[2] Floridi, "Semantic Conceptions of Information"

[3] Shannon, and Weaver, *The Mathematical Theory of Communication*

[4] Floridi, "Open Problems in the Philosophy of Information", p.573

[5] Barwise and Perry, *Situations and Attitudes*

[6] Dretske, F. *Knowledge and the Flow of Information*

[7] Fodor, J.A., *The Language of Thought*.

[8] Fodor, J.A., *Psychosemantics*.

[9] Searle, J. R., "Minds, Brains and Programs"

[10] Harnad,

<http://www.ecs.soton.ac.uk/~harnad/Papers/Harnad/harnad90.sgproblem.html>, p.1

[11] *ibid*, p.5

[12] *ibid*, p.8

[13] Wheeler, J. A., "Information, physics, Quantum: The Search for Links"

[14] Floridi, "Open Problems in the Philosophy of Information", p.574

[15] Plato, *Republic*, 7.514a-515d

[16] Aristotle, *Categories*, About substance, English translation by E.M.Edghill from [www.classicallibrary.org/Aristotle/categories](http://www.classicallibrary.org/Aristotle/categories), Section 1, Part 5.

[17] Plato, *Meno*, 75d, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text : “Διαλεκτικώτερον μὴ μόνον τάληθῆ ἀποκρίνεσθαι ἀλλὰ καὶ δι’ ἐκείνων ὧν προσομολογῆ εἰδέναί ο ἔρωτώμενος”)

[18] Plato, *Republic*, 7.534e, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “ὥσπερ θριγκὸς τοῖς μαθήμασιν ἢ διαλεκτικῇ ἡμῖν ἐπάνω κειῖσθαι, καὶ οὐκέτ’ ἄλλο τούτου μάθημα ἀνωτέρω ὀρθῶς ἂν ἐπιτίθεσθαι”)

[19] *ibid*, 7.534b, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “Διαλεκτικὸν καλεῖς τὸν λόγον ἐκάστου λαμβάνοντα τῆς οὐσίας”)

[20] Plato, *Phaedrus*, 249b-c, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “Δεῖ γὰρ ἄνθρωπον συνιέναι κατ’ εἶδος λεγόμενον, ἐκ πολλῶν ἰδὼν αἰσθήσεων εἰς ἓν λογισμῶ συναιρούμενον· τοῦτο δ’ ἐστὶν ἀνάμνησις ἐκείνων ἃ ποτ’ εἶδεν ἡμῶν ἢ ψυχῇ συμπορευθεῖσα θεῶν καὶ υπεριδοῦσα ἃ νῦν εἶναί φαμεν, καὶ ἀνακύψασα εἰς τὸ ὄν ὄντως. Διὸ δὴ δικαίως μόνη πτεροῦται ἢ τοῦ φιλοσόφου διάνοια· πρὸς γὰρ ἐκείνοις ἀεὶ ἐστὶν μνήμη κατὰ δύναμιν.”)

[21] Plato, *Republic*, 7.514a-515d

[22] Plato, *Phaedrus*, 265d, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “εἰς μίαν τε ιδέαν συνορῶντα ἄγειν τὰ πολλαχῆ διεσπαρμένα”)

[23] *ibid*, 265e, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “κατ’ εἶδη δύνασθαι διατέμνειν κατ’ ἄρθρα ἢ πέφυκεν, καὶ μὴ ἐπιχειρεῖν καταγνύναι μέρος μηδέν, κακοῦ μαγείρου τρόπῳ χρώμενον)

[24] Plato, *Sophist*, 264c-268d

[25] Aristotle, *Metaphysics*, 3.1029.a30

[26] This Platonic dialogue was revived to Kefalos by Antifon, half-stepbrother of Plato, who had heard it from Pythodoros, who was present in that meeting.

[27] Plato, *Parmenides*, 128e-129a

[28] *ibid*, 130b

[29] *ibid*, 130c

[30] *ibid*, 130d

[31] *ibid*, 131c-d

[32] *ibid*, 132b, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “ἀλλά, φάναι, ὦ Παρμενίδη, τὸν Σωκράτη, μὴ τῶν εἰδῶν ἕκαστον ἢ τούτων νόημα, καὶ οὐδαμοῦ αὐτῷ προσήκη ἐγγίγνεσθαι ἄλλοθι ἢ ἐν ψυχαῖς”)

[33] *ibid*, 132b, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: τὰ μὲν εἶδη ταῦτα ὡσπερ παραδείγματα ἐστάναι ἐν τῇ φύσει, τὰ δὲ ἄλλα τούτοις εἰκέναι καὶ εἶναι ὁμοιώματα, καὶ ἢ μέθεξις αὕτη τοῖς ἄλλοις γίγνεσθαι τῶν εἰδῶν οὐκ ἄλλη τις ἢ εἰκασθῆναι αὐτοῖς. )

[34], 132e

[35], 133d, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “ὅτι, ὦ Σώκρατες, οἶομαι ἂν καὶ σὲ καὶ ἄλλον, ὅστις αὐτὴν τινα καθ' αὐτὴν ἐκάστου οὐσίαν τίθεται εἶναι, ὁμολογήσαι ἂν πρῶτον μὲν μηδεμίαν αὐτῶν εἶναι ἐν ἡμῖν.”)

[36] *ibid*, 133d, 134b-c

[37] Plato, *Sophist*, 248a

[38] *ibid*, 249a

[39] Aristotle, *Metaphysics*, 3.997b English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “Πολλαχῇ δὲ ἐχόντων δυσκολίαν, οὐθενὸς ἦττον ἄτοπον τὸ φάναι μὲν εἶναι τινὰς φύσεις παρὰ τὰς ἐν τῷ οὐρανῷ, ταύτας δὲ τὰς αὐτὰς φάναι τοῖς αἰσθητοῖς πλὴν ὅτι τὰ μὲν αἴδια τὰ δὲ φθαρτά. αὐτὸ γὰρ ἀνθρωπὸν φασιν εἶναι καὶ ἵππον καὶ ὑγίειαν, ἄλλο δ' οὐδέν, παραπλήσιον ποιοῦντες τοῖς θεοῦς μὲν εἶναι φάσκουσιν ἀνθρωποειδεῖς δε· οὔτε γὰρ ἐκεῖνοι οὐδὲν ἄλλο ἐποιοῦν ἢ ἀνθρώπους αἰδίους, οὔθ' οὔτοι τὰ εἶδη ἄλλ' ἢ αἰσθητὰ αἴδια.”)

[40] Plato, *Sophist*, 244d, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “τί δέ; τὸ ὅλον ἔτερον τοῦ ὄντος ἐνός ἢ ταυτὸν φήσουσι τούτῳ;”)

[41] *ibid*, 245a, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “τό γε μεμερισμένον πάθος μὲν τοῦ ἐνός ἔχειν ἐπὶ τοῖς μέρεσι πᾶσιν οὐδὲν ἀποκωλύει, καὶ ταύτη δὴ πᾶν τε ὄν καὶ ὅλον ἐν εἶναι.”)

[42] *ibid*, 245b, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “Τὸ δέ γε τοιοῦτον ἐκ πολλῶν μερῶν ὄν οὐ συμφωνήσει τῷ λόγῳ”)

[43] *ibid*, 245b, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “Πεπονθός τε γὰρ τὸ ὄν ἔν εἶναί πως οὐ ταυτόν ὄν τῷ ἐνὶ φανεῖται”)

[44] Aristotle, *Metaphysics*, 4.1016a13.

[45] Plato, *Sophist*, 254d

[46] *ibid*, 256d, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “ἢ κίνησις ὄντως [οὐκ ὄν ἐστι καὶ] ὄν [ἐστι], ἐπέιπερ τοῦ ὄντος μετέχει”)

[47] *ibid*, 250c, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “κατὰ τὴν αὐτοῦ φύσιν ἄρα τὸ ὄν οὔτε ἔστηκεν οὔτε κινεῖται”)

[48] *ibid*, 255a, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “κίνησις γε καὶ στάσις οὔθ' ἕτερον οὔτε ταυτόν ἐστι.”)

[49] *ibid*, 256c, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu) (Greek text: “[κίνησις] οὐχ ἕτερον ἄρ' ἐστὶ πη καὶ ἕτερον)

[50] *ibid*, 254b-c, English translation from [www.perseus.tufts.edu](http://www.perseus.tufts.edu)

---



