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TAKING STOCK: ARGUMENTS FOR THE VERIDICALITY THESIS

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Abstract

According to the Veridicality Thesis, information encapsulates truth. An important implication of this thesis is that misinformation and disinformation are not types of information at all. The first clear formulation of the thesis is provided by Dretske (1981). Floridi (2011), a more recent defender of the Veridicality Thesis, offers two novel arguments in defense of this thesis. His first argument, the argument from splitting, is based on two different usages of adjectives: attributive and predicative. Floridi claims that 'false' in 'false information' is used attributively, which implies that 'false information' is not a kind of information. In his second argument, the argument from semantic loss of information, he argues that without the Veridicality Thesis it becomes difficult to make sense of the ordinary phenomenon of semantic erosion. The literature is lacking in a comprehensive and detailed treatment of Floridi's arguments. In particular, an analysis of his quite lengthy and technical second argument is lacking. This is what I intend to do in this paper. The conclusion of my analysis is, unfortunately, a negative one: neither of the two arguments offered by Floridi is strong enough to establish the desired conclusion. My analysis shows that the argument from splitting commits a basic fallacy, *petitio principii*. As for his second argument, I argue that it is possible to account for semantic erosion even without adopting the truthfulness requirement for information. In short, my analysis shows that the logical structures of Floridi's arguments are not sufficiently strong enough for establishing the Thesis.

Keywords

Veridicality thesis, argument from splitting, argument from semantic loss of information, semantic erosion, Bar-Hillel and Carnap Paradox, Floridi, Dretske.

1. Introduction

According to the Veridicality Thesis, information encapsulates truth. That is to say, any message with non-truthful content does not carry information. Such messages, in Floridi's words, are nothing but semantic junk. An important implication of this thesis is that misinformation and disinformation, despite the fact that they are prevalently used in daily life discourses as well as in empirical disciplines, are not types of information at all. The main

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motivations behind the formulation of this thesis are epistemic concerns. If acquiring information is going to yield knowledge, then the acquired information has to be truthful because truthfulness is a necessary condition for knowledge in the traditional analysis of knowledge.

The first clear formulation of the thesis, within the context of theories of semantic information, occurred in Dretske's 1981 book, *Knowledge and the Flow of Information*. In that book, Dretske starts out with defining the informational content of a signal, and uses this definition to explain representational notions like 'seeing that', 'believing that', and 'knowing that'. His definition is as follows.

> **Informational Content:** A signal *r* carries the information that *s* is *F* if and only if the conditional probability of *s*'s being *F*, given *r* (and *k*), is 1 (but, given *k* alone, less than 1) [*k* refers to background knowledge] (Dretske 1981, p. 65).

Dretske's chief aim in that book was to construct a theory of knowledge based on this definition. Even this aim alone is sufficient to explain why Dretske endorsed the Veridicality Thesis, but he also provided three arguments for the thesis. His arguments are specific to the way in which he defined informational content in which A carries information that B if and only if the conditional probability of B given A (and the background information) is 1. His first argument is known as the Xerox Principle, which is nothing other than transitivity of information-carrying relations. As it is well known, conditional probabilities satisfy transitivity only when the values of those conditional probabilities are 1. Thus, the transitivity of information-carrying relations requires that a value of 1 be assigned to the conditional probability used in the definition of 'A carries information that B.' In a similar manner, Dretske claims that if A carries information that B and A carries information that C, then A has to carry information that (B and C), as well. This property, which Dretske calls the Conjunction Principle, is also satisfied only when the conditional probabilities involved are assigned values of 1. Dretske's third argument is that assigning any value other than 1 to the conditional probabilities that determine the informational content of a message would be arbitrary. On the basis of these three arguments, he infers that assigning a value of 1 to the conditional probabilities involved in his definition of informational content is necessary, and thus only truthful content qualifies as informative content. These three arguments were the very first arguments offered for the truth encapsulation property of information in the literature, and they have been discussed quite extensively.[1] Thus, I shall not attempt to assess the strength of Dretske's arguments here.

[1] Some of the works that discuss Dretske's arguments are Kyburg (1983), Lehrer and Cohen (1983), Loewer (1983), Cohen and Meskin (2006), Demir (2008), Demir (2010).

The first decade of the 21st century has seen a renewed interest in theories of semantic information. It would not be inappropriate to attribute a significant portion of this renewed interest to Floridi's work on the Philosophy of Information. Since the mid-1990s, Floridi has been publishing extensively in this area. It is well known that he is an avid defender of the Veridicality Thesis, and one of the most crucial features of Floridi's Philosophy of Information is that he offers two novel arguments in defense of this thesis. His first argument, the argument from splitting, is based on Geach's distinction (1956) between two different usages of adjectives: attributive and predicative. To put it briefly, he claims that 'false' in 'false information' is used attributively, which implies that 'false information' is not a kind of information. Thus, he concludes, information has to be truthful. In his second argument, the argument from semantic loss of information, he argues that "if false information does not count as semantic junk but as a kind of information, it becomes difficult to make sense of the ordinary phenomenon of semantic erosion" (Floridi 2011, p. 104).

Floridi's arguments have been discussed in the literature to an extent[2], but the literature is lacking in a comprehensive and detailed treatment of his arguments. In particular, an analysis of his quite lengthy and technical second argument is lacking. This is what I intend to do in this paper. The conclusion of my analysis is, unfortunately, a negative one: neither of the two arguments offered by Floridi is strong enough to establish the desired conclusion. My analysis shows that the argument from splitting commits a basic fallacy, *petitio principii*.[3] Despite its fallacious nature, however, Floridi's argument is valuable in bringing the Geachean distinction into the discussion about the veridical nature of information. The Geachean distinction may well turn out to have explanatory power for understanding the use of 'false information' in some contexts. As for his second argument, the argument from semantic loss, I argue that it is possible (and not very difficult) to account for semantic erosion even without adopting the truthfulness requirement for information, i.e. the alethic constraint. While doing that I only use the assumptions/principles that Floridi himself employs in his argument. Because of the possibility of accounting for semantic erosion in an alethically neutral framework, the validity of Floridi's argument from semantic loss becomes questionable. At this point, it is useful to draw the boundaries of the implications of my analysis clearly. My analysis of Floridi's two arguments cannot settle the debate on the veridical nature of information, because my analysis neither proves nor disproves the Veridicality

[2] Some examples are Fetzer (2004), Sequiah-Grayson (2007), Scarantino and Piccinini (2010).

[3] My analysis of this argument is similar to Scarantino and Piccinini's (2010) analysis of the same argument.

Thesis. In other words, the debate on the Veridicality Thesis, even after my analysis, is still at a stalemate. My analysis only shows that the logical structures of Floridi's arguments are not strong enough for establishing the Thesis. This, of course, does not mean that new arguments for the Thesis cannot be constructed on the basis of some of the ideas that Floridi uses in his arguments. There is definitely room for that in the logical space.

I start the paper with a brief section on the Philosophy of Information to set the stage, and then I proceed to analyze Floridi's arguments.

2. Philosophy of Information

Philosophy of Information is a newly established subfield of philosophy. Although the first appearance of theories of semantic information goes back to Bar-Hillel and Carnap's work (1952), the formulation of the problems, methods, and research program that were required for establishment of the Philosophy of Information as an autonomous field of philosophy was done quite recently. Floridi's work, which began in the late 1990s and culminated in his 2011 book *The Philosophy of Information*, has been quite influential in the process of establishing this field. Although there are several different approaches to Philosophy of Information, Floridi's following definition is general enough to be considered as the common denominator accepted by all theoreticians of the field.

> …PI [is] the new philosophical field concerned with (a) the critical investigation of the conceptual nature and basic principles of information, including its dynamics, utilization and sciences; and (b) the elaboration and application of information-theoretic and computational methodologies to philosophical problems (Floridi 2011, p. 1).

This new field is crucial in offering philosophical analyses of new informational and computational technologies, but this is not the whole story. It also has the potential of providing new ontological and epistemological frameworks that can be used for more fundamental philosophical issues. For example, Dretske's information-theoretic epistemology changes the focus of the analysis of knowledge from the traditional focus on the internal state of the knowing organism to the reliable informational connections between the organism and external states of affairs. In a more or less similar vein, Floridi's Philosophy of Information provides a novel metaphysical framework in which our understanding of the ultimate nature of reality shifts from a materialistic one to an informational one, in which all entities, be they natural or artificial, are analyzed as informational entities.

The central notion of the field of Philosophy of Information is that of semantic information. In Floridi's framework, this notion is defined as well-formed, meaningful, and truthful data. A datum is understood as a binary difference that is nothing but a lack of uniformity. Data are well-formed if and only if they are consistent with the syntactical rules of the system and become meaningful when an interpretation is provided. The truthfulness requirement is the result of the Veridicality Thesis, which states that false information is not a genuine kind of information. Let us now turn to Floridi's arguments for this thesis.

3. Floridi's First Argument – Argument From Splitting

One path that can be taken for deciding whether or not false information is a genuine type of information is to compare the use of the adjective 'false' in 'false information' with other uses of the same adjective where we have a better understanding of how the adjective 'false' is related to the noun that follows it. For example, in 'a false proposition,' we are clear about the nature of the entity in question: it is a proposition that is false. However, we are also clear about the nature of the entity in question in 'a false constable': someone who is **not** a constable. One may assess the informational status of false information by asking the following question: whether 'false' in 'false information' is similar to 'false proposition' or 'false constable.' In other words, one could proceed with a conceptual clarification of how the adjective 'false' is used in 'false information.' This is the path Floridi takes in his first argument.

For conceptual clarification, Floridi uses a logical distinction between two types of adjectives introduced by Geach in his analysis of good and evil. Here is how Geach explains the distinction:

> My first task will be to draw a logical distinction between two sorts of adjectives, suggested by the distinction between *attributive* adjectives (e.g. a red book) and *predicative* adjectives (e.g. this book is red); I shall borrow this terminology from the grammars. I shall say that in a phrase 'an A B' ('A' being an adjective and 'B' being a noun) 'A' is a (logically) predicative adjective if the predication is 'an A B' splits up logically into a pair of predications 'is a B' and 'is A'; otherwise I shall say that 'A' is a (logically) attributive adjective (Geach 1956, p. 33).

'Male,' as it is used in 'a male constable,' is a predicative adjective, because the predication splits up into the following pair: 'is a male' and 'is a constable.' An example of an attributive adjective is 'good' as it is used in 'a good constable.' In this case, the expression cannot be split up without semantic loss. A good constable is not necessarily a good person who is a

member of the police force; rather, a 'good constable' is someone who performs all the tasks of a policeman well.[4] Floridi uses this difference between predicative and attributive adjectives as a test for deciding whether or not false information is a kind of information. He concludes that it is not, by the following reasoning:

> When we say that *p* [a proposition] is false, we are using 'false' predicatively. The test is that the compound can be split into '*p* is a proposition' and '*p* is a contingent falsehood' without any semantic loss or confusion. On the contrary, when we describe *p* [a proposition] as false information, we are using 'false' attributively, to negate the fact that *p* qualifies as information at all. Why? Because 'false information' does not pass the test. As in the case of the false constable, the compound cannot be correctly split….. If false information were a genuine type of information it should pass the splitting test. It does not, so it is not (Floridi 2011, p. 98).

Thus, Floridi's reasoning continues, since information has to be truthful, the Veridicality Thesis is true.

This reasoning, however, is a clear case of *petitio principii*. Consider the following three statements.

(1) Information encapsulates truth (the Veridicality Thesis).
(2) False information is not a kind of information.
(3) 'False information' cannot be split up without semantic loss.

I take it to be obvious that (1) is logically equivalent to (2). (2) is also logically equivalent to (3), because if false information is a kind of information, then 'false information' could be split up, as in the case of 'false proposition,' without any semantic loss. It is clear from the quote above that Floridi uses (3) as a premise in his reasoning. His reasoning aims to prove first (2) and then (1). Since (3) is logically equivalent to both (1) and (2), Floridi's reasoning is an instance of begging the question.

Despite its circularity and its failure to achieve its goal, however, Floridi's argument from splitting is not completely useless. In some contexts, 'false' in 'false information' seems to be used as a negation in a natural way (similarly, at least in some contexts the prefix 'mis' in 'misinformation' seems to act like a negation)[5]. The Geachean distinction that Floridi employs in his argument may shed light on how and why the 'false' in 'false information'

[4] It should be noted that Geach intended his categorization to be a categorization of adjectives. Floridi changes the original categorization and treats it as a categorization of different uses of adjectives, because he claims that at least some adjectives can be used both attributively and predicatively depending on the context (Floridi 2011, p. 97). Floridi's different treatment of the original categorization, however, has no significant bearing on his argument or on my analysis of his argument.

[5] This naturalness of using 'false' as a negation in 'false information' in some contexts is explained by Michael Dunn (2008) by appealing to pragmatics. In his view, in actual

seems to be acting like a negation in some contexts. However, this potential use of the Geachean distinction does not undermine the fact that the particular argument that Floridi offers in defense of the Veridicality Thesis is circular. It is, of course, still logically possible to construct a different argument for the Veridicality Thesis based on the Geachean distinction. My analysis above only shows that Floridi's particular argument cannot serve this purpose. In other words, the implications of my analysis are limited; it neither proves nor disproves the Veridicality Thesis. It only shows that proponents of the Veridicality Thesis need an argument different than Floridi's argument from splitting.

4. Floridi's Second Argument: Argument From Semantic Loss of Information

In his second argument, Floridi attempts to provide, in a sense, an indirect proof of the Veridicality Thesis. The following quote gives us a short and concise description of the structure of his argument.

> [T]he general strategy of the argument…is indirect and basically reverses the steps that would be taken in 'slippery slope' reasoning. We shall begin by assuming that opponents of the veridical nature of information are correct. We shall then see that this is too permissive: too many items slip in. We shall then make the definition progressively tighter, until only the items that we wish to include in the definition of information are actually captured, and all the counterintuitive consequences are avoided. At that stage, we shall realize that we have endorsed the veridicality thesis itself (Ibid., p. 99).

In his indirect proof, Floridi starts by assuming that the set of all propositions is identical to the set of information-carrying propositions. Under this assumption, any proposition, be it necessarily true, necessarily false, or contingently true/false, would qualify for having informational content. A corollary of this assumption is that the Veridicality Thesis is false, because even contingently false propositions qualify for having informational content. Floridi claims that this assumption is too permissive; many items that do not qualify for carrying information slip in, and it also allows the adding of mutually inconsistent propositions into the stock information, thus generating a contradictory repository of information (Ibid., p. 101). In order to show these obviously implausible consequences of the assumption, which implies the opposite of the Veridicality Thesis, Floridi uses four fundamental principles that he claims to be "uncontroversial and fairly

usage of 'information' we expect it to be truthful, but this expectation is not a part of the semantics of information; rather, it is a part of its pragmatics.

standard assumptions in information theory and in the philosophy of information" (Ibid., p. 99). These four principles are stated below after an explanation of the notation used in their formulations.

D:	domain of all propositions
S:	domain of instances of information
μ and ***φ:***	propositional variables ranging over D
H(φ):	primary informative content of φ
x:	variable ranging over S
P(x):	probability of x

All other symbols are symbols of classical logic and naïve set theory.

P.1 $\forall x H(x) \geq 0$, *principle of the non-negative nature of information*: no instance of information can have negative primary informative content.

P.2 $\forall x \forall y ((x \neq y) \rightarrow (H(x \cup y) = H(x) + H(y)))$, *additive principle*: for any two different instances of information, their overall informative content is equal to the sum of their informative contents.

P.3 $\forall \varphi (P(\varphi) = 1) \rightarrow (H(\varphi) = 0)$, *inverse relation principle*: any proposition whose probability is 1 has no informative content.

P.4 $\forall \varphi (H(\varphi) = 0) \rightarrow \neg (\varphi \in S)$: any proposition with no informative content fails to qualify as information.

It should be noted that, for now, I accept these principles, which are clearly stated by Floridi (Ibid., p. 98-99), without questioning in order to assess the internal logical structure of his argument. But as we will see in the following sections, contrary to what Floridi claims, they are neither "fairly standard" nor "uncontroversial". For example, P.2 is not the complete specification of *the additive principle*. In its complete specification, P.2 holds only for independent propositions. For propositions that are not independent from each other, or in other words for propositions with overlapping informative content, the overall informational content of X and Y is the sum of the informational content of X and the informational content of Y minus the overlapping informational content (Cover and Thomas 1991, p. 19). In short, in the way it is formulated above, P.2 is incomplete and this incompleteness makes it quite counterintuitive, if not false. As another example, P.3, which directly implies that tautologies have no informational content, is not a commonly accepted principle, either. For example, in the literature, there are now new theories of information based on relevant logics in which tautologies are treated as having informational content[6]. For now, however,

[6] I would like to thank the anonymous referee who brought this point to my attention.

let us leave these criticisms aside and proceed with our analysis of Floridi's argument.

Given the four principles stated above, Floridi attempts to prove that equating *S* (the set of instances of information) with *D* (the set of all propositions) is too permissive in five steps. At each step, he examines one category of the members of *S* and 'proves' that they should not belong to *S*. In the next step, he excludes the category of the members from the previous step, the members of *S* that do not qualify as being instances of information, and moves on the next category. After the five steps are completed, the items remaining in set *S* are those that properly qualify for carrying informative content. The members remaining in set *S*, in Floridi's proof, are just contingently true propositions, and only the members of *S* qualify for having informative content. Thus, he concludes, the Veridicality Thesis is proven.

The next section summarizes the five steps of Floridi's proof. Naturally, in the summary, I have omitted most of the formal details of his proof. I have also taken the liberty of adding some new symbolizations and giving some examples for clarification purposes. None of these omissions or additions, however, affects the essence of Floridi's reasoning.

4.1. *Floridi's Proof*

Assumption: The set of instances of information is identical to the set of all propositions.

> **Corollary:** The Veridicality Thesis is false because even contingently false propositions are in the set of instances of information. In other words, false information is a genuine type of information.

Premises: The four fundamental principles of information theory, P.1 – P.4.

Step 1: Since the probability of a tautology is 1, P.3 implies that tautologies do not have informative content, but since *S*, the set of instances of information, has tautologies in it, it is too permissive.

Step 2 (excluding tautologies): Fixing the problem identified in Step 1 requires that the tautologies be excluded from set *S*. Let S_1 be the new set of instances of information and *T* be the set of tautologies such that $S_1 = S \setminus T$.

S_1 includes contradictory propositions as instances of information, but this is quite counterintuitive, says Floridi, because under this assumption, receiving a contradictory message about an event may increase the amount of information that one receives about the outcome of the event. Thus, contradictions have to be excluded from S_1.

Step 3 (excluding contradictions): Step 2 requires us to exclude contradictions from S_1. Let S_2 be the new set of instances of information and C be the set of contradictions; then $S_2 = S_1 \setminus C = S \setminus (T \cup C)$.

S_2 is still too permissive, according to Floridi, because the corollary that false information is a genuine type of information together with P.2 implies that the informative content of a repository of information increases by adding a proposition that may be inconsistent with one of the members of the repository. To clarify, take two information repositories, one of which has only one member, Q, in it, and the other of which has two: Q and R. Furthermore, assume that Q and R are mutually inconsistent. Because of the corollary that false information is a genuine kind of information, both Q and R count as instances of information. Because of P.2, however, the latter information repository has more informative content than the former one. However, the latter repository is an inconsistent one. This is implausible; an inconsistent information repository must not have more informative content than a consistent one.

Step 4 (excluding inconsistencies): In order to avoid the implausible consequence identified in Step 3, inconsistencies have to be excluded from S_2 so that the new set of instances of information is consistent. Let S_3 be the new set of instances of information and I be the set of some or all[7] members of S_2 that make S_2 inconsistent; then $S_3 = S_2 \setminus I = S \setminus (T \cup C \cup I)$.

For evaluating S_3, Floridi focuses on the possible ways of information loss, i.e. losing informative content. At this stage, says Floridi, an information repository may lose information mainly by syntactical means in the following way.

> Imagine receiving first the proposition that p and then the proposition that $\neg p$. If you are unable to assess which message is reliable, the new proposition $p \vee \neg p$ has no informative content (Ibid., p. 102).

To exemplify Floridi's ideas, let Z be an information repository that has only 2 members: Q and R. Suppose that a new member $\neg R$ is added to the repository, but there is no evidence about as to the reliability of the source that R is received from or the source that $\neg R$ is received from. Thus, according to Floridi, the new repository becomes Q and $R \vee \neg R$ in it. Since the second member is a tautology, it has to be removed from the database

[7] Floridi does not specify a particular way of excluding inconsistencies. One may exclude all the members involved in the inconsistency or some of them; any of these ways is compatible with Floridi's consistency requirement as long as the set that is the outcome of the revision is consistent. Thus, I shall take into account all possible ways of revising a database for making it consistent. Floridi's consistency requirement is stated as a part of equation [9] on page 103 of his 2010 book. I would like to thank the anonymous referee who brought this point to my attention.

because of Step 2. Thus, the new repository has only Q in it. Since both Q and R have non-zero informative content, the original repository, which has Q and R in it, has more informative content than the new one given the *additive principle*, P.2. This is a case of loss of information by syntactic means. For a satisfactory theory of semantic information, however, allowing loss of information by syntactical means is necessary but not sufficient, because, as rightly pointed out by Floridi, "information loss can occur by negation, falsification and by making propositions satisfiable by all possible worlds," as well (Ibid., p. 103). Information loss in such cases occurs due to semantic reasons, not syntactic ones. At this stage, however, Floridi claims, the set of instances of information, S_3, does not allow the possibility of loss of information by semantic means. To give an example, take Z stated above, which has Q and R in it. When Q is falsified, the repository must lose information, but since the Veridicality Thesis is denied, Q still counts as an instance of information. Therefore, it still has to stay in Z. Since the members of the repository are the same, the informative content of Z remains the same even after the falsification of Q, but there has to be loss of information in Z, and this loss of information is not due to syntactic reasons; it is due to semantic means. From this reasoning, Floridi concludes that S_3 has to be revised so that information loss by semantic means is also accounted for.

Step 5 (excluding contingent falsehoods): To fix the problem identified in Step 4, Floridi puts an alethic constraint on instances of information; to wit, only contingently true propositions qualify as being instances of information. The following is Floridi's formalization of the required alethic constraint.

$\forall\varphi((\varphi \in S) \rightarrow t(\varphi))$
where $t(\varphi) = \varphi$ is contingently true.

Under this constraint, says Floridi, "informative content can easily decrease (one merely need to generate an inconsistency or a falsehood)."[8] Thus, given the alethic constraint, contingent falsehoods have to be excluded from

[8] Floridi's claim here naturally calls for the question of how semantic information is being quantified. As it is well known by now, Floridi has a complex methodology for quantifying semantic information. His methodology is based on notions like semantic deviation, inaccuracy, and vacuity. However, he does not employ that quantification of semantic information in his argument from semantic loss. This can easily be seen from the fact that in Floridi's *The Philosophy of Information*, the methodology is first explained in a chapter after the chapter in which the argument from semantic loss is stated. In his argument from semantic loss, as the short quote in the text suggests, he operates with the following: a proper subset of a set has less informative content than the set itself simply because of having a lesser cardinality. This is a direct result of the additivity principle, P.2, which is one of the four fundamental principles that Floridi uses in his proof.

set S_3. Let S_4 be the new set of instances of information and F be the set of contingent falsehoods; then $S_4 = S_3 \setminus F = S \setminus (T \cup C \cup I \cup F)$. Nothing but only contingently true propositions are members of S_4. This means that anything that qualifies as having informative content must be contingently true. Thus, according to Floridi, the Veridicality Thesis is true, because the alethic constraint "is just another way of formulating the veridicality thesis" (Ibid., p. 104).

4.2. *Assessment of Floridi's Proof*

In Step 1 and Step 2 of his argument, Floridi seems to be right in concluding that tautologies and contradictions have to be excluded from the set of instances of information. After all, most theories of semantic information treat tautologies as completely uninformative and treat contradictions as not qualifying for having informative content[9]. The conclusion of his Step 3, that inconsistencies must be excluded, is also to the point, but the reasoning that he provides for it is faulty. The reasoning presented in Step 4 is not justified, either, because it ignores the conclusions derived from Steps 1, 2, and 3 of his proof.

In Step 3, Floridi claims that the *additive principle* together with the rejection of the Veridicality Thesis implies that adding a proposition that is mutually inconsistent with one of the previous members increases the informative content of an information repository. The reasoning here is based on a specification of the *additive principle* that is incomplete. In other words, P.2 is not the correct formulation of the *additive principle*. Here is the correct statement of the principle, as quoted from van der Lubbe's *Information Theory*.[10]

> $H(P)$ is *additive*. If X and Y are two sample spaces, where outcomes in X are independent of those in Y, then we find for the information relating to joint events (x_i, y_i)
>
> $$H(p_1q_1, \ldots, p_1q_m, \ldots, p_nq_1, \ldots, p_nq_m) = H(p_1, \ldots, p_n) + H(q_1, \ldots, q_m)$$
>
> [where p_i and q_i are the probabilities of the outcomes of the events X and Y, respectively] (van der Lubbe 1997, p. 10).

[9] It should be noted that, in the literature, there are now new theories of information in which the situation is different. For example, in theories of information based on paraconsistent logics some contradictions have informative content and in theories based on relevant logics tautologies can be informative.

[10] Floridi also cites van der Lubbe's book in supporting his claim that the four principles, P.1-P.4, that he uses in his proof are fairly standard assumptions in information theory (Floridi 2011, p. 99).

This formulation, which is defined by using events as fundamental units and can easily be rephrased by using propositions instead, clearly implies that the *additive principle* does not apply to mutually inconsistent propositions, because mutually inconsistent propositions are not independent of each other.[11] Thus, contrary to what Floridi claims, the rejection of the Veridicality Thesis together with the *additive principle* does not imply that adding mutually inconsistent propositions increases the informative content of an information repository. This, however, does not mean that Floridi's conclusion in Step 3 is not true. Inconsistencies have to be excluded from the set of instances of information, but the reason for this is that the conjunction of two inconsistent propositions in a repository is false in all possible worlds,[12] which amounts to a contradiction, and at least one of the propositions that lead to inconsistency has to be excluded from the set because of the conclusion of Step 2. Therefore, the conclusion of Step 3 is true, but for different reasons than the ones provided by Floridi.

In Step 4, as stated above, Floridi lists 4 avenues of semantic loss of information, which are not possible before excluding contingent falsehoods according to him. These are: (i) by making propositions inconsistent, (ii) by making propositions satisfiable by all possible worlds, (iii) by negating propositions, and (iv) by falsifying propositions (I have changed Floridi's original order for the ease of presentation). Let me analyze each of these four types of semantic information loss to see if they are possible without excluding contingent falsehoods from the set of instances of information. In all of the examples, an information repository, Z, with two members, Q and R, is used.

(i) **Making a proposition inconsistent:** Suppose that one of the members of the repository, R, is made inconsistent with the other member, Q. Floridi is quite right in expecting a loss of information in Z after making R inconsistent with Q. Contrary to what he claims, however, there is a semantic loss of information in this case, even with the set of instances of information stated in Step 4. This is because R and Q are mutually inconsistent after the operation, and so some or all of the members that lead to inconsistency have to be removed from Z because of the conclusion derived in Step 3. Now, depending on the revision function, one may remove both members (R and Q) that are involved in the inconsistency or one may remove only

[11] It is quite straightforward to show that two mutually inconsistent propositions are not independent by using the independence criterion in the classic probability theory: A and B are independent from each other if and only if $P(A/B) = P(A)$ and $P(B/A) = P(B)$.

[12] My reasoning here is quite similar to Dretske's Conjunction Principle (1981), which is briefly stated in the introduction.

one of them (R or Q)[13]. In both cases, the resultant repository would be consistent. Thus, we have three possible resultant repositories after revising the repository to make it consistent. Let me state the situation before and after revision in more formal terms.

Z_1 is Z before making R inconsistent with Q:

> $Z_1 = \{Q, R\}$
> The informative content of Z_1 is $H(Q) + H(R)$, when Q and R have no overlapping content[14].
> The informative content of Z_1 is $H(Q) + H(R) - H(R, Q)$, when Q and R have overlapping content, which is $H(R, Q)$[15].

Z_2 is Z after making R inconsistent with Q and after removing the inconsistency:

1. $Z_2 = \{\ \}$ when both Q and R removed. The informative content of Z_2 is 0.
2. $Z_2 = \{Q\}$ when R removed. The informative content of Z_2 is $H(Q)$.
3. $Z_2 = \{R\}$ when Q removed. The informative content of Z_2 is $H(R)$.

Because of the *principle of the non-negative nature of information*, i.e. P.1, we know that $H(Q)$, $H(R) \geq 0$. We also know that Q and R are neither tautologies nor contradictions (these possibilities are ruled out because of the previous Steps 2 and 3 of Floridi's proof). Thus, both Q and R have non-zero informative content. Given this, it is an arithmetical fact that in all three possible cases Z_2 has less informative content than Z_1. Thus, there is semantic loss of information after making a proposition inconsistent, and this loss of information does not require excluding the contingent falsehoods from the set of instances of information.

(ii) **Making a proposition satisfiable by all possible worlds:** Suppose that one of the members of the repository, say R, is made satisfiable by all possible worlds. Again, one would expect a loss of information in the repository. Does the set of instances of information stated in Step 4 allow for such a loss? Actually, the answer is yes. In such a situation, R becomes no different than a tautology[16] and has to be excluded from Z because of

[13] As stated in footnote 7, Floridi does not specify a particular revision function in his argument. Any function that removes inconsistency is compatible with Floridi's requirements. Thus, I examine all possible revision functions. This naturally makes the informative content of an information repository relative to a revision function.

[14] This is just an application of the correct specification of the *additive principle*, i.e. P.2.

[15] Please see the version of the *additive principle* for propositions with overlapping content, stated on page 9.

[16] The probability of a statement that is satisfiable by all possible worlds is 1, and by P.3. it has no informative content.

the conclusion of Step 1. Before the operation, say, at time t_1, the repository has Q and R, and at t_1, R is not satisfiable by all possible worlds, which means that R has non-zero informative content. After the operation of making R satisfiable by all possible worlds, say, at time t_2, the repository would have only Q in it. Now by the same reasoning presented in (i), the revised repository after making R satisfiable by all possible worlds (i.e. $Z_2 = \{Q\}$) has less informative content than the repository before the operation (i.e. $Z_1 = \{Q, R\}$). Thus, there is semantic loss of information here, as well no requirement for the exclusion of contingent falsehoods from the set of instances of information.

(iii) **Negating a proposition:** Suppose that one of the members of the repository, R, is negated. The original repository has Q and R, and the new repository after the operation has Q and *not-R*. Since we do not know anything about the relative informative contents of R and *not-R*, for now, let us assume that they have the same amount of informative content. Under this assumption, both repositories have the same informative content; thus, there is no loss of information here after negating R. However, it is absurd to expect a loss of information in this case, because both R and *not-R* are assumed to have the same amount of informative content. One should therefore not expect a loss of information by negating R. As an example, assume that R stands for "the outcome of flipping a coin at time t_1 is heads." Once this is negated, it becomes, "the outcome of flipping a coin at time t_1 is not heads," which is equivalent to "the outcome of flipping a coin at time t_1 is tails." Do we expect a loss of information in the repository if "the outcome of flipping a coin at time t_1 is heads" was just replaced with "the outcome of flipping that coin at time t_1 is tails"? The answer seems to be a clear NO, because both the original statement and its negation have the same amount of informative content. Thus, expecting a loss of information from negating a member of an information repository, when their informative contents are equal, is not right. Now, what if the informative content of R is greater than the informative content of *not-R*? In this case, it is clear that there is semantic loss of information because R is replaced with a proposition that has less informative content. As the last case, what if the informative content of *not-R* is greater than R's? In this case, actually, there is an increase in semantic information, which is only to be expected because R is replaced with another proposition that has more informative content. So, to expect loss of information in this situation is unjustified. As a result, we can conclude that cases of negating propositions do not present a problem for the set of instances of information stated in Step 4, either.

(iv) **Falsifying a proposition:** Suppose that one of the members of the repository, R, is falsified. We cannot take R out of the repository, because

of *R* being false. In Step 4, the set of instances of information still includes contingent falsehoods. Thus, despite the fact that *R* is falsified, we still have to keep it in the repository. This is why Floridi says that semantic loss of information by falsifying propositions cannot occur in Step 4. Now, what does it mean to falsify a member of an information repository? Or, what are the ways of falsifying a member of an information repository? It seems that there are only two ways: either you would add "*R* is false" or you would add "*not-R* is true" to the information repository. Both of these options, however, amount to adding *not-R* to the repository. This is because both of those additions logically imply that *not-R*. Thus, after falsifying *R*, the new repository ends up having three elements: *Q*, *R*, and *not-R*. This is an inconsistent repository, and something has to be removed from the repository to make it consistent. As stated in (i), there are three ways of doing this depending on the choice of revision function: either to remove both *R* and *not-R*, or to remove only one of them. If both are removed, then, by the reasoning presented in (i), there is definitely semantic loss of information. If only *not-R* is removed, then there is no loss of information because the repository stays the same. To expect loss of information in this case, however, is not justified at all, because the repository stays the same as if the falsifying operation has never occurred. As the third and the last case, if only *R* is removed, then the situation becomes identical to the one analyzed in (iii), i.e. comparing {*Q*, *R*} and {*Q*, *not-R*}. By the same reasoning presented there, we can conclude that this case does not justify the move that Floridi wants to make, either, i.e. excluding contingent falsehoods in order to account for semantic erosion.

The ultimate conclusion of the above analysis is that none of the four types of semantic loss of information listed by Floridi justifies the move that he makes in Step 5 of his proof, which is to exclude contingent falsehoods from the set of instances of information. If that is the case, however, set S_3, stated in Step 4 of his proof, remains satisfactory for a theory of semantic information. That set, S_3, excludes only tautologies, contradictions, and inconsistencies from the set of all propositions, and it includes all contingent propositions. In other words, contingently false propositions as well as contingently true propositions still count as genuine instances of information, even after the ordinary phenomenon of semantic erosion is accounted for.

5. Concluding Remarks

In this paper, I have critically examined Floridi's arguments for the Veridicality Thesis and concluded that neither of his arguments is strong enough for establishing his desired goal. My charge against the first argument is

that it commits a basic fallacy, *petitio principii*. For his second argument, I have argued that accepting his principles/assumptions does not force us to accept the conclusion of his argument. In order to justify my claim, I have shown that it is quite possible to account for semantic erosion even within an alethically neutral framework. While doing that, I have only used the four informational principles that Floridi himself employs in his argument. It is perhaps worthwhile to state that I could have formulated my criticism by using the inverse relationship between the probability of a proposition and its informative content. I shunned away from doing that, because Floridi's alethic theory of semantic information is based on the criticism of a seemingly paradoxical implication of the probability-based theories of information. He calls this implication the Bar-Hillel and Carnap Paradox (BCP), because its first clear appearance was in Bar-Hillel and Carnap's theory of semantic information. In that theory, contradictions carry the most inclusive informative content. After identifying this paradox, Floridi concludes that to avoid this paradox requires adopting a theory of semantic information based on the truthfulness of information, because the paradox is a result of defining information instances with probability values[17]. Therefore, it would have been unfair if I had formulated my criticism in terms of the inverse relationship between probabilities and informative content[18].

Floridi's analysis of the BCP is also the basis of his exclusion of contradictions from the set of instances of information. For him, assigning any informative content to contradictions leads to the BCP. At this point, it should be mentioned that there are alternative ways of treating contradictions that do not lead to the BCP. For example, in some theories of information that are based on relevant logics contradictions are treated as non-trivial without leading to a paradox. Throughout the paper, I have assumed that tautologies and contradictions have no informative content, as Floridi does. My purpose for doing so was to assess the internal logical structure

[17] It should be noted that what Floridi calls the BCP may not be as paradoxical as he makes it to be. In Bar-Hillel and Carnap's theory of semantic information, there are three theorems about contradictions that could be interpreted as paradoxical (T4-2.b, T6-4.c and T7-8.c in Bar-Hillel and Carnap 1952). The first two of those theorems imply that contradictions carry the most inclusive content. This implication is not directly related with defining information on probability values. Rather, it is a direct result of defining informational inclusion via material implication. As is known, in classical logic, anything follows from a contradiction. So, the first two theorems of Bar-Hillel and Carnap's theory are as 'paradoxical' as the fact that in classical logic anything follows from a contradiction. The third theorem is directly related to defining information with probability values, and the theorem states that contradictions carry an infinite amount of information. This is very paradoxical, and it is perhaps this theorem that motivated the formulation of the BCP. However, a careful examination shows that this is NOT actually a theorem of Bar-Hillel and Carnap's theory. Bar-Hillel and Carnap simply made an arithmetical mistake! In that theorem, the amount of semantic information assigned to contradictions must be left undefined.

[18] I would like to thank the anonymous referee who brought this point to my attention.

of Floridi's arguments; it was not a strong endorsement of Floridi's view of contradictions. On the contrary, I do think that exploring alternative ways of treating contradictions (and tautologies, for that matter) is quite a promising line of research that will surely enrich the literature on the Philosophy of Information.

References

BAR-HILLEL, Yehoshua and Rudolf CARNAP. 1952. "An Outline of A Theory of Semantic Information". MIT Research Laboratory of Electronics, Technical Report No: 247.

BREMER, M. E. (2003). Do Logical Truths Carry Information? *Minds and Machines*, *13*, 567–575.

COHEN, Jonathan, and Aaron MESKIN. 2006. "An Objective Counterfactual Theory of Information." *Australasian Journal of Philosophy* 84:333–52.

COVER, T.M. and THOMAS, J.A. 1991. *Elements of Information Theory*. New York: John Wiley & Sons, Inc.

DEMIR, Hilmi. 2010. The fundamental properties of information-carrying relations, in *Thinking Machines and Philosophy of Computer Science: Concepts and Principles*, ed. Jordi Vallvardu, IGI Global.

DEMIR, Hilmi. 2008. "Counterfactuals vs. Conditional Probabilities: A Critical Examination of the Counterfactual Theory of Information." *Australasian Journal of Philosophy* 86:45–60.

DRETSKE, Fred. 1981. *Knowledge and the Flow of Information*. Oxford: Blackwell.

DRETSKE, F. (1983). Precis of Knowledge and the flow of the information. *The Behavioral and Brain Sciences*, *6*, 55–63.

DUNN, Michael. (2008). "Information in Computer Science" in the *Handbook of Philosophy of Information* eds. Pieter Adriaans and Johan van Benthem, pp. 581-609, Elsevier B.V.

FETZER, James H. 2004. "Information: Does It Have to Be True?" *Minds and Machines* 14:223–229.

FLORIDI, L. 1999. "Information Ethics: On the Theoretical Foundations of Computer Ethics", *Ethics and Information Technology* (1.1), 37-56.

FLORIDI, L. 2004. "Outline of a theory of strongly semantic information", *Minds and Machines*, *14*(2), 197–222.

FLORIDI, Luciano. 2005. "Is Semantic Information Meaningful Data?" *Philosophy and Phenomenological Research* 70:351–70.

FLORIDI, Luciano. 2007. "In Defence of the Veridical Nature of Semantic Information." *European Journal of Analytic Philosophy* 3:31–42.

FLORIDI, Luciano. 2011. *The Philosophy of Information*, Oxford University Press.

GEACH, Peter T. 1956. "Good and Evil." *Analysis* 17:33–42.

KYBURG, H. E. 1983. "Knowledge and the absolute", *The Behavioral and Brain Sciences*, *6*, 72–73.

LEHRER, K. and COHEN, S. (1983). "Dretske on Knowledge", *The Behavioral and Brain Sciences*, *6*, 73–74.

LOEWER, B. (1983). "Information and belief", *The Behavioral and Brain Sciences*, *6*, 75–76.

SCARANTINO, Andrea, and Gualtiero PICCININI. 2010. "Information without Truth." *Metaphilosophy* 41: 313-30.
SEQUOIAH-GRAYSON, Sebastian. 2007. "The Metaphilosophy of Information." *Minds and Machines* 17:331–44.
VAN DER LUBBE, Jan C.A. 1997. *Information Theory*, Cambridge University Press.

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