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please note: There is a longer and more helpful version of this article entitled "Two Dimensional Semantics. The Basics" on my website.

Semantics (two-dimensional)

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Definitions

'Two-dimensional semantics' denotes a family of semantic theories rooted in intensional semantics, held together by shared general ideas, yet divided by deep divergences in semantic aims and philosophical aspiration. 2d-theorists agree that our sentences' truth-values vary with what the facts are, as well as with what the sentences mean. To model this twofold dependence of truth on fact and meaning, 2d-semantics assign our expressions intensions of more than one kind. The resulting formal framework, common to all 2d-sematics, distinguishes one dimension of actual worlds and primary intensions from a second dimension of counterfactual worlds and secondary intensions. (Hence *two*-dimensionalism.) These formal similarities often obscure the deep conceptual rifts between different interpretations of the 2d-framework. Kaplan interprets it to capture context-dependence, Stalnaker understands it to model meta-semantic facts, and Chalmers construes it to display the epistemic roots of meaning.

Description of the Theory

1. Fundamental Ideas of Two-Dimensional Semantics

Traditional intensional semantics assigns a sentence a single intension. This intension captures how the truth of the sentence depends on, and varies with, the respective facts. 2d-semanticists draw our attention to another dependence. A sentence's truth-value also depends on, and varies with, what the sentence means. 2d-semanticists agree that our semantics has to account for this twofold dependence of truth-value on meaning and fact, and they agree that we can capture both dependencies relying on the apparatus of

possible worlds and intensions familiar from intensional semantics. We just need to add the distinction between counterfactual and actual worlds, and we have to make use of the threefold distinction of kinds of intension this effects.

The twofold dependence noted is most pronounced in sentences containing indexicals. Whether 'I am in *Milano*' is true in some possible world depends on the facts in that world, and it depends on who utters this sentence in the first place. If Pavarotti utters it, the sentence is true in a possible world if in that world, Pavarotti is in Milan. If someone else utters it, the sentence has different truth-conditions. Put generally, the truth of an indexical sentence in some counterfactual world depends on what is the case in that world, and it depends on what is the case in the actual world it is uttered in. This inspires a general way to analyse the twofold dependence noted. We can hold that whether a sentence is true in some counterfactual world depends on the facts, depicted by what is the case in that world, and it depends on what the sentence means, determined by what is the case in the actual world. The counterfactual and actual worlds set apart here are not different entities. What gets discriminated are two different roles the very same possible worlds can play (assuming that we specify for worlds considered as actual a centre consisting of a speaker, a place and a time).

The distinction between counterfactual and actual worlds allows 2d-semanticists to distinguish three different kinds of intensions. An expression's *primary intension* assigns it an extension in every *actual* world, determining a function f: $W_A \rightarrow E$ from actual worlds to extensions. An expression's *secondary intension* assigns it an extension in every *counterfactual* world, determining a function f: $W_C \rightarrow E$ from counterfactuals worlds to extensions. An expression's *two-dimensional intension* assigns it for any actual world a secondary intension, determining a function f: $W_A \rightarrow (W_C \rightarrow E)$ from actual worlds to secondary extensions that portrays how the expression's primary and secondary intension interlock.

Assigning these different intensions to a sentence allows 2d-semantics to capture the way its truth-value varies with the actual and counterfactual world, and hence depends on fact and meaning. A plausible assignment of intensions to 'I am in *Milano*' is this: The primary intension of 'I am in *Milano*' yields varying extensions across actual worlds depending on who utters the sentence. The secondary intension yields varying extensions across counterfactual worlds depending on whether or not the one having uttered 'I' is in these counterfactual circumstances in Milan. The 2d-intension com-

bines these two, capturing for each actual world which secondary intension an utterance of 'I am in *Milano*' in this actual world effects.

The resulting formal structure (see figure 1), comprising two dimensions of worlds and three kinds of intensions, is common to all 2d-semantics. 2d-semanticists agree that we can model all representational properties of our language by assigning primary, secondary and/or two-dimensional intensions to our terms and sentences. This consensus extends to the dimension of counterfactual worlds and secondary intensions. 2d-semanticists agree that this dimensions captures how an expression's extension depends on the facts, and they take these worlds and intensions to be the possible worlds and standard intensions familiar from traditional intensional semantics. There is no consensus on the understanding of actual worlds and primary intensions. 2d-theorists agree that this dimension captures how an expression's extension depends on what it means. This claim is open to interpretation, and the paradigmatic interpretations put forth by Kaplan, Stalnaker, and Chalmers exhibit deep divergences in semantic aim and philosophical aspiration. They even yield different answers to the questions (1) 'What are actual worlds?' and (2) 'What precisely do we need actual worlds and primary intensions for?'.

dimension 2
counterfactual worlds →

dimension 1
actual worlds →

	w1	w2	w3
w1*	w	w	f
w2*	f	w	w
w3*	w	w	f

figure 1
A 2d-matrix displaying a sentence's intensions for a small sample of worlds. The diagonal displays a single primary intension. Each row displays a secondary intension. The whole matrix displays a single two-dimensional intension.

2. Kaplan: Actual Worlds as Contexts of Use

Kaplan ([8] and [9]) propounds a semantic interpretation of the 2d-framework. He holds that (1) actual worlds are contexts, or possible occasions expressions can be used in, and he (2) maintains that we need actual worlds and primary intensions to model the context dependence of language.

Kaplan detect an asymmetry between indexical tokens and indexical types. Indexical tokens have reference but no descriptive meaning. An utterance of 'I' in a context refers to an individual. This fact exhausts its meaning. Pavarotti's utterance 'I am in *Milano*' thus expresses a proposition about *him*, i.e. Pavarotti. Indexical types, on the other hand, have descriptive meaning but no reference. The type 'I' does not refer. It still has a descriptive meaning any competent speaker must know. This meaning consists in a conventionally assigned rule dictating that any utterance of 'I' refers to

whoever produces the token in the respective context. Thus the sentence type 'I am in *Milano*' does not express a proposition. But any competent speaker will know which proposition a token of this type expresses *if* it is uttered in a context.

Kaplan concludes that we must distinguish two kinds of meaning. Linguistic tokens have *contents*. The content of a term captures what it refers to, and the content of a sentence is the proposition it expresses. Linguistic types have *characters*. The character of an expression is a conventionally determined rule dictating which content a token of that expression expresses if it is uttered in a context. The characters of terms like 'grandmother' will assign all tokens the very same content. By contrast, the characters of indexicals and demonstratives will assign their tokens varying contents, depending on the respective contexts.

It is this dependence of token meaning (or content) on type meaning (or character) cum context that Kaplan captures by means of a 2d-framework. He models contents as secondary intensions. He models characters as two-dimensional intensions. The character of a sentence type specifies a secondary intension for each actual world, and thus captures how the proposition expressed by a token of that sentence varies with the context the token occurs in.

3. Stalnaker: Actual Worlds as Means for Reinterpretation

Stalnaker ([13] and [14]) offers a meta-semantic interpretation of the 2d-framework. Stalnaker's holds (1) that actual worlds are possible alternative environments we might have introduced our terms in, and he (2) distinguishes the subject matter of the 2d-framework from its application: we need the apparatus of actual worlds and primary intensions to describe meta-semantic facts. But we put it to a pragmatic use.

Endorsing (i)–(iii), Stalnaker finds himself in a quandary: (i) Being necessarily true, the proposition expressed by 'Hesperus = Phosphorus' does not exclude any possibility. (ii) A sentence can be used to communicate contingent information about the world only if the proposition it conveys excludes some possibility. (iii) 'Hesperus = Phosphorus' can be used to communicate contingent information about the world. In order to resolve the puzzle, Stalnaker distinguishes the proposition *conveyed* with an informative use of 'Hesperus = Phosphorus' from the proposition *expressed* in that use. The latter is determined by the standard semantic rules for the sentence, and it is necessarily true. The former is inferred from the speaker's pragmatic communicative intentions, and it is contingent. Reinterpreting the

speaker's utterance to convey this contingent proposition allows the hearer to make sense of his utterance.

Reinterpretation is a familiar pragmatic procedure. If the standard semantic content of an utterance manifestly violates a conversational maxim, we assign it a different content by drawing on the speaker's communicative intentions. This is what the hearer of 'Hesperus = Phosphorus' does, noticing that the standard proposition expressed is ill-fit to convey information. The hearer reasons thus: (i) 'Hesperus' has been introduced as a name for the brightest star in the evening, and 'Phosphorus' has been introduced as a name for the brightest star in the morning. (ii) Which objects these introductions did yield depended on astronomical facts in our actual world. If the astronomical facts in the actual world had been relevantly different, 'Hesperus' and 'Phosphorus' would name two different objects. (iii) What the speaker intends to convey is that our world is one where this is not so. He wants to convey that our world conforms to the proposition *that the brightest star in the evening = the brightest star in the morning*.

It is this dependence of semantic meaning on introductory procedure cum actual world that Stalnaker captures by means of a 2d-framework. He models standard semantic meanings as secondary intensions. Stalnaker models the propositions assigned in reinterpretation as primary intensions (which he calls, in line with figure 1, *diagnonal propositions*). By displaying how an expression's extension varies with the respective actual world, a primary intension captures how a term's standard semantic meaning varies with the circumstances under which it is introduced.

4. Chalmers: Actual Worlds as Epistemic Possibilities

Chalmers ([1] to [4]) offers an *epistemic* interpretation of the 2d-framework. Chalmers (1) maintains that actual worlds are epistemic possibilities, and he (2) holds that we need actual worlds and primary intensions to capture the epistemic dependence of meaning.

Chalmers draws on two ideas. His one idea is that reference and truth are *scrutable*. Given a description of our world cast in neutral terms, a speaker can (in principle) *a priori* infer what her expressions refer to, and which of her sentences are true. From a description of the appearance, make-up, and behaviour of chemical substances that makes no use of the term 'gold', she can *a priori* infer the truth of 'Gold is the chemical element with atomic number 79'. Chalmers' other idea is that *of epistemic modality*. Epistemically possible hypotheses depict ways our world might be for all we can (in principle) know *a priori*, and a complete epistemic possibility depicts an

epistemically possible world. For all we can know *a priori*, gold could be the chemical element with atomic number 55. A world in which this is true hence is an epistemic possibility. Chalmers merges these ideas in his thesis of *generalized scrutability*. Given a description of any epistemically possible world phrased in neutral terms, a competent speaker can (in principle) *a priori* infer what her terms refer to in that world, and which of her sentences are true in that world. This ability reveals that speakers associate epistemic intensions – i.e. functions from epistemically possible worlds to extensions – with their terms and sentences. The epistemic intension associated with an expression is fundamental to the expression's significance. For one, it captures cognitive significance. If a term plays a cognitive role for a speaker at all, she associates an epistemic intension with it that reveals what the term means for her. Secondly, the epistemic intension determines an extension in the actual world. For the actual world simply is the actualized epistemic possibility. Thirdly, the epistemic intension will ground the counterfactual intensions of all terms whose counterfactual intension depends on actual world extension.

It is this dependence of truth and reference on our ability to *a priori* determine extensions in epistemically possible worlds that Chalmers captures by means of a 2d-framework. He identifies secondary intensions with standard truth-conditional meanings, and he employs two-dimensional intensions to model the dependence of secondary intensions on primary ones. Chalmers identifies primary intensions with epistemic intensions. By displaying how an expression's extension varies with the respective actual world, a primary intension captures how a term's actual extension varies with the respective epistemic possibility that is realized in our world.

References

[1] Chalmers D (2002) On Sense and Intension. Philosophical Perspectives 16: 135-182.
[2] Chalmers D (2004) Epistemic Two-Dimensional Semantics. Philosophical Studies 118: 153-226.
[3] Chalmers D (2004b) The Foundations of Two-Dimensional Semantics. In: Garcia-Carpintero M, Macia, J (eds) Two-Dimensional Semantics: Foundations and Applications. Oxford.
[4] Chalmers D, Jackson F (2001) Conceptual Analysis and Reductive Explanation. Philosophical Review 110: 315-360
[5] Kaplan D (1977) Demonstratives. In: Almog J (eds)(1989) Themes From Kaplan. Oxford: 481-563.
[6] Kaplan D (1989) Afterthoughts. In: Almog J (eds)(1989) Themes From Kaplan. Oxford: 565-614.

[7] Lewis D (1981) Index, Context and Content. In: Kanger S, Öhman S (eds) Philosophy and Grammar. Dordrecht: 79-100.
[8] Stalnaker R (1978) Assertion. Syntax and Semantics 9: 315-332.
[9] Stalnaker R (2004) Assertion Revisited: On the Interpretation of Two-Dimensional Modal Semantics. Philosophical Studies 118: 299-322.