This section has given only a sketch of an ontological account of facts and states and leaves still many questions unanswered, such as the question of the conditions under which an entity can be introduced on the basis of sentences not making reference to the entity and the question in which sense such entities exist.

Appendix: Tropes and events as truthmakers

Let me briefly discuss an alternative to the view of tropes and events as implicit arguments of adjectives and verbs. This is the view that tropes and events act as truthmakers. The purpose of this appendix is to sketch an account of adverbial modification based on truthmaking and present a number of arguments in favor of and against such an account.

The truthmaking idea says that for a sentence to be true there must be something, an entity in the world, which makes it true. The motivation for the truthmaking idea is the fundamental intuition that the truth of sentences should be grounded in reality. Roughly, given that grounding is a relation between a sentence and something else, there needs to be an entity which grounds the truth of a sentence, that is, in virtue of which a given sentence is true (Rodriguez-Pereyra 2005). Truthmakers thus are entities that are part of the world. A truthmaker is generally characterized formally in terms of entailment, by the following principle (Armstrong 1997):

(1) Truthmaker Principle
An entity *e* makes a sentence *S* true iff *e* exists and the existence of *e* entails the truth of *S*.

That is, the existence of a truthmaker necessarily entails the truth of the sentence.

The idea of truthmaking is a controversial, but often discussed, idea in contemporary metaphysics. It has rarely been explored for the purpose of natural language semantics, though. At the same time, it is not clear that it can truly be applied in linguistic semantics, a point I will come to later.

The advantage of making use of truthmaking in the context of the semantics of natural language is that the truthmaking relation makes entities available for the purpose of predication and quantification, without those entities acting as referents of referential terms, as implicit arguments, or as results of "reification."

There are quite different views about what truthmakers are. Some philosophers such as Russell and Armstrong take truthmakers to be states of affairs. Others such as Mulligan, Simons, and Smith (1984) take them to be tropes, events, or material objects. The latter obviously is the version to be used for present purposes, since then tropes are truthmakers of sentences with adjectival predicates such as (2):

(2) John is happy.

This version of the truthmaker theory would naturally take events and objects to be truthmakers as well: events for sentences with eventive verbs, as in (3), and objects for existential sentences such as (4b) and perhaps sentences attributing essential properties such as (4b):

(3) John was walking.

(4) a. There was a man in the park.
b. John is a man.

The truthmaking idea, on this version, would allow a straightforward account of adverbial modifiers, namely as predicates of truthmakers. This is indicated for (5a) in (5b), where $\models$ is the truthmaking relation:

(5) a. John is profoundly happy.
b. $\exists t$ (t $\models$ *John is happy* & profound(t))

Adverbials can also act as predicates of an entity that "incorporates" the contribution of another adverbial modifier, such as *suddenly* in (6a):

(6) a. The ball suddenly rolled very quickly.

Using truthmaking, this sentence can be analyzed as below:

(6) b. e $\models$ *The ball suddenly rolled very quickly* iff $\exists$e' $\exists$e"(e $\models$ <SUDDEN, e'> & e' $\models$ e' $\models$ <QUICK, e"> & e' $\models$ <QUICK, the ball>

In (6a), truthmaking is taken to hold not just between an entity and a sentence, but also between an event and a structured proposition, consisting of a property and an object. According to (6b), (6a) involves three truthmakers: the event of the ball's rolling (the truthmaker of the proposition that the ball rolled), the event of the ball's very quick rolling (the truthmaker of the proposition that the ball rolled quickly), and the suddenness of the ball's very quick rolling (which is the truthmaker for the entire sentence).

Let us see what is required of a truthmaker theory for it to be applicable to the full range of relevant sentences in natural language.

First, there is a strong and a weak version of the truthmaker theory. The strong version says that every true sentence needs to have a truthmaker (Armstrong 1997, Restall 1996). A weaker version does not require this for all sentences, for example not for negative sentences (Mulligan, Simons, and Smith 1984). Given that all sentences, including negative ones, can be modified by adverbial modifiers, the strong version of the truthmaker theory is needed for the present purpose.

Furthermore, there are two different views about how "big" the truthmaker of a sentence may be. While many assume truthmaking to satisfy Monotonicity (if e < e' and e $\models$ S, then e' $\models$ S), Rodriguez-Pereyra (2005) argues that a truthmaker should strictly consist only of features in virtue of which a sentence is true. Thus, for example, the sentence *John walks* is made true by a walking event of John, but not by an event that is a walking and yawning of John or an event that is a walking of John and Mary. This notion of a truthmaker is also what is needed for the semantics of nominalizations as well as adverbial modification. For example, *John's happiness*

could not possibly refer to a trope involving any properties on the part of John not constitutive of John's being happy, and it could not possibly refer to John and Mary's happiness. Similarly, *John is profoundly happy* could not possibly be understood as "John is happy and John and Mary's happiness was profound." For this reason, the relation $\models$ should be understood as a relation between an entity *e* and a sentence S that holds iff S is true in virtue of *all* the features of *e*, that is, *e* must be wholly relevant for the truth of S.

There are also different views on what conditions the relation of truthmaking should meet and on what the conditions are for the truthmaking of complex sentences. The following conditions on the truthmaking of disjunctions and existential sentences (formulated with substitutional quantification) are rather uncontroversial:

(7) a. $e \models S \vee S'$ iff $e \models A$ or $e \models B$
b. $e \models \exists x\, S$ iff for all substitution instances of S with respect to "x", $e \models S'$

More controversial are the ways in which the truthmaking of conjunctive and especially universally quantified and negative sentences should be treated. Let us see what conditions would be imposed by the behavior of adverbial modification.

Conjunctions require a possibly different truthmaker for each conjunct. Thus, one might take the truthmaker of a conjunction to be a set of events or tropes, such that each conjunct is made true by a member of that set. The present purpose requires a single truthmaker for conjunctions, though: conjunctions can be modified by a single adverbial, as in *slowly John came in and Mary went out*. The truthmaker of a conjunction thus should better be taken to be the sum of events or tropes making the conjuncts true:

(8) $e \models S \,\&\, S'$ iff there are entities e' and e" such that $e = \text{sum}(\{e', e"\})$, and $e' \models S$ and $e" \models S'$.

(8) presupposes unrestricted composition for events (that is, any two events have a sum).

While existential sentences involve truthmaking just like disjunctions, for universally quantified sentences, a corresponding account is not unproblematic. Mulligan, Simons, and Smith (1984) propose (9) (again formulated with substitutional quantification):

(9) $e \models \forall x\, S$ iff for all substitution instances S' of S (with respect to "x"), $e \models S'$.

However, as Russell (1918/19) and more recently Armstrong (1997, 2004) have already argued, universal quantification involves an irreducibly general fact for its truthmaking, namely the fact that a set is exhaustively included in another or that a set of entities exhausts a set. Such a fact is not reducible to a set of truthmakers of the corresponding atomic sentences. This stronger condition follows from the Truthmaker Principle: a mere sum of truthmakers for the instances does not strictly entail the truth of the universal quantification, but only the conjunction of the instances. Looking at natural language, we can see that the exhaustiveness condition is also needed for adverbial modification of universally quantified sentences, in cases such as the following:

(10) John quickly/carefully corrected every mistake.

What *quickly* and *carefully* may evaluate as the fulfillment of John's intention in (10) is the exhaustion of all the mistakes in John's acts of correction. Thus, the truthmaker of universal

quantification must be a trope or event genuinely supporting the generalization as such. This would also be needed for proportional quantifiers such as *most*.

A concrete proposal for the kind of truthmaker involved in universal quantification has been made by Armstrong (1997, 2004). Armstrong proposes that the truthmaker for the statement "All *P*s are *Q*" is the aggregate consisting of the sum (or aggregate) of the "singular" state of affairs "*d*'s being *P and Q*" and the state of affairs that consists in the aggregate of those singular truthmakers that constitute all states of affairs involving *P*. This proposal can straightforwardly be reformulated for events and tropes rather than states of affairs. The truthmaker of, for example, *all men are happy* will be the aggregate of the tropes of the sort "the happiness of *d*," where *d* is a man, and the relational trope that instantiates the "totaling relation" ALL by this aggregate and the property of being a man. Thus, the following condition would hold for the truthmaking of universally quantified sentences:

(11) $e \models$ *Every* A *is* B iff there are events e' and e" such that e = sum e"'[e"' = e' V e"' = e"], and for any substitution instance S of *every* A *is* B, there is an event e"', e"' < e" and e"' $\models$ S and e' = t(ALL, e", $\lambda e^{\star}$ [$e^{\star} \models$ S, for some substitution instance S of *every* A *is* B]).

In the case of proportional quantifiers as in *most men are happy*, the truthmaker would be the aggregate of tropes of the sort "the happiness of *d*", for, let's say, more than half of the men *d*, and the relational trope that consists in the instantiation of the making-up-half-of-relation by that aggregate and the property of being a man.

Negation is a difficult issue for the truthmaking idea:

(12) John is not happy.

Should negative sentences even have a truthmaker at all? That they do is in fact not only required by the general truthmaking idea, but also, in the present context, by the observation that certain adverbials may apply to a negative VP as in (13), which contains a frequency adverbial, now naturally viewed as a quantifier ranging over truthmakers:

(13) John frequently does not get up before 8 a.m.

Without entering the discussion of truthmaking of negative sentences as such, let us reformulate for the current purpose a proposal of Armstrong (2004) for negative sentences. Armstrong proposes that the truthmaker of a negative sentence *not* S is the state of affairs consisting of the aggregate of all the states of affairs (where none of them makes S true), the property of being a state of affairs, and the "totaling" relation ALL. That is, the truthmaker of a negative sentence is the state of affairs that consists in the condition that the aggregate of all the states of affairs exhausts all the states of affairs there are. Given the present terms, the truthmaking of a negative sentence will be as follows, for *E* the set of tropes or events, *sum* the sum operation, and *t* the function mapping a relation and two arguments to the corresponding relational trope ("the totaling of the property of being an event by the sum of all the events"):

(14) $e \models \neg$ S iff e = t(ALL, sum(E), E) and for no e' < sum(E), e' $\models$ S.

This proposal is suited for the semantics of adverbial modification if the totaling relation need not generally involve all states of affairs (or tropes or events), but rather may involve a contextual restriction to certain tropes or events, for example in (13) a contextual restriction to situations

involving John in the morning. Then in (13) *frequently* ranges over situations that are incompatible with John's getting up before 8 a.m., that is, events in which John gets up after 8 a.m. *Frequently* in (13) thus ranges over sums of events that together make up the contextually given restriction to a certain situation, entities of the sort t(ALL, sum(E), E_C), for some contextual restriction on events *C*.

Adverbial modifiers of universally quantified sentences as in (15a) can now be analyzed as in (15b):

(15) a. *John quickly eliminated every mistake*.
b. e ⊨ *John quickly eliminated every mistake* iff there is an event e', e ⊨ < QUICK, e'> & e' ⊨ <ELIMINATE, John, EVERY MISTAKE>

Here *e'* will be the trope t(ALL, sum e[for some mistake d, e ⊨ <ELIMINATE, John, d>]), λe[for some mistake d, e ⊨ <ELIMINATE, John, d>]).

Definite NPs with trope or event nominalizations should denote the truthmakers of the sentences that correspond to them. For simple nominalizations, the following would be the semantic analysis that comes to mind first:

(16) [*John's happiness*] = ιe[e ⊨ *John is happy*]

That is, *John's happiness* refers to the truthmaker of the corresponding sentence *John is happy*, that is, to the qualitatively minimal trope making that sentence true.

This is not satisfying, however, since it is not a compositional account. (16) makes the semantics of a noun dependent on the syntactic context in which the noun occurs (that is, dependent on which complement or specifier it takes). It is better to focus first on the semantics of nominalizations by using truthmaking as a relation between a trope or an event and a sequence of propositional constituents, as below:

(17) [*happiness*] = λed[e ⊨ <HAPPY, d>]

The denotation of a nominalization now depends only on the relation expressed by the verb or adjective from which the nominalization is derived and thus can proceed in an entirely compositional way:

(18) [*John's happiness*] = ιe[e ⊨ <HAPPY, John>]

However, this account is still not adequate. There may be many tropes that are truthmakers of *John is happy*. For example, some temporal part of a trope that is John's happiness might still make *John is happy* true. Obviously, J*ohn's happiness* refers to the maximal trope that makes *John is happy* true.

Where does the temporal maximality condition come from? The condition could not be a matter of the definiteness of *John's happiness* because it also is associated with quantificational NPs such as *every man's happiness*. It appears that the maximality condition is associated with trope nominalizations because they are mass nouns. *John's happiness* refers to the trope that is maximal with respect to occupying a continuous stretch of time, just as the mass NP *the water in the room* refers to the maximal quantity of water that is in the room (cf. Sharvy 1980). The semantics of trope nominalizations must thus be revised as follows:

(19) [happiness] = λed[e = max e'[e' ⊨ <HAPPY, d>]]

One major advantage of applying truthmaking to the semantic of adverbial modifiers and nominalizations is that it captures well the intuition that a simple subject–predicate sentence such as *John is happy* is just about John, not "John's happiness." "John's happiness" comes to play a semantic role only via the truthmaking relation. The truthmaking relation allows the referent of *John's happiness* to be a concrete entity, more specific than the description used to refer to it, without, though, acting as an implicit argument of the predicate.

However, the application of the truthmaking idea to natural language semantics also comes with serious problems. The truthmaker of a sentence will have to be identified in different ways depending on whether the sentence is negative, quantificational, or conjunctive. This may hold even for simple subject–predicate sentences. The condition on the world that natural language predicates impose may be negative, quantificational, or conjunctive even if the predicate is simple. For example, *clean* is best understood as "absence of any dirt," *dirty* as "presence of some dirt." While the negative or quantificational condition in this case arguably forms part of the lexical content of the adjectives that speakers have learned, in many cases the condition the predicate imposes on the truthmaker may not be part of a competent speaker's knowledge of language. A predicate may ultimately turn out to be negative (requiring the absence of tropes of a certain sort) or quantificational, without any speaker yet knowing that. It depends entirely on what science ultimately says about how such predicates are made true and thus how the truthmakers are to be identified. However, this means, quite simply that the truthmaking idea, at least in its current versions, cannot be used for the semantics of constructions involving adjectives.

A second problem for the truthmaking idea comes from comparatives. We have seen that NPs like *John's strength* cannot just refer to physical conditions. They must refer to tropes individuated also with respect to the order given by the underlying adjectival concept. This means that they cannot just refer to the truthmaker of a sentence consisting of a suitable subject and the adjective. Also for simple comparatives, such as *Mary is weaker than Sue*, the truthmaking idea is in difficulty. The sentence would have to be true on the basis of Mary's condition and Sue's condition. However, the question is, what makes them stand in the relation "weaker than," that is, what in the world is it from which the truth of the sentence *Mary is weaker than Sue* follows? This can only be the ordering that the adjective itself imposes on the physical conditions in question, the ordering given by the content of the adjective *weak*. This again means that the truthmaking idea is not suited for the semantics of adjectives, at least not the gradable ones.

That said, truthmaking might have applications in other areas of natural language semantics. In fact, I will later (Chapter 5) make use of it in a different context, namely for the semantic analysis of transitive intensional verbs such as *need*. I will argue that the semantics of such verbs involve situations satisfying a "need" and that the relation of a situation satisfying a need should be understood as a generalization of the truthmaking relation.