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The Title of the Thesis

A FORMAL TREATMENT OF EXPLICATURE AND THE PRAGMATICS OF CONDITIONAL STATEMENTS

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CERTIFICATE OF ORIGINALITY

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Content

Abstract

In this thesis, we argue for a situation-theoretic regularity model of communication. Based on this conception of communication, we bring the relevance-theoretic concept of explicature (the best hypothesis of explicit speaker meaning) to fit this regularity model, thus paving the way for formalization. A formalism is then built for the explicating process using the channel model developed in Barwise & Seligman (1997) *Information Flow: The Logic of Distributed System*, which finally leads to a formal definition of explicature. After this formal part, the thesis turns to the pragmatics of conditional statements. In contrast with the traditional truth-conditional approaches, we argue for a regularity approach to the semantics of conditionals and develop an explicature analysis for their pragmatics. Upon this analysis, background conditions associated with conditionals and world knowledge of the hearer are found to be two crucial sources of contextual information to the comprehension of conditional statements because they frequently participate in the identification of their explicatures. We demonstrate that an explicature analysis for conditional statements is adequate for the resolution of semantic paradoxes arising from the material conditional theory. We also show that the phenomenon of conditional perfection favors an explicature analysis rather than Gricean implicature analyses.

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Introduction

WE SHALL GIVE an outline of the thesis as follows, presenting our motivation and main ideas. Consider the utterance: ‘John has eaten dinner.’ The speaker utters some sounds to the hearer. The hearer receives his message, and knows what she should do; perhaps she decides to find a friend other than John to accompany her to dinner. A theory of communication has to explain how a speaker’s message can be conveyed with some sounds (or ink marks, gestures) and received by the hearer.

The explanation offered by modern pragmatics is more or less like this. Each word, phrase and finally the whole sentence *John has eaten dinner* has its encoded meaning specified by a grammar (depending on one’s grammatical theory). Having access to these encoded meanings of words, phrases and the sentence, the hearer is able to receive the speaker’s message: that John has eaten dinner. Communication between the speaker and the hearer is achieved. If we insist that the hearer has to supply by herself the temporal element ‘tonight’ before understanding is achieved that is necessary for decision making, then adding the role of inference to the story would seem to be sufficient for an adequate explanation for successful communication.

In Chapter 1 of this thesis, we try to argue with the claims of situation theory that communication does not work that way. On a situation-theoretic view, the first and foremost question needed to be addressed by a communication theory should be: How is communication possible? Our answer is this: It is the *regularities between types of situations* that make communication (verbal and non-verbal) possible. This is because communication can be seen as a kind of information flow, and according to situation theory it is regularities that allow information to flow.

The situation-theoretic story of the communication with the sentence *John has eaten dinner* is as follows. There is a systematic, regular relation (regularity) between the type of situations in which someone uttered the sentence *John has eaten dinner* and the type of situations in which the person John has eaten dinner, so that the first type will involve the second type (Figure 1).

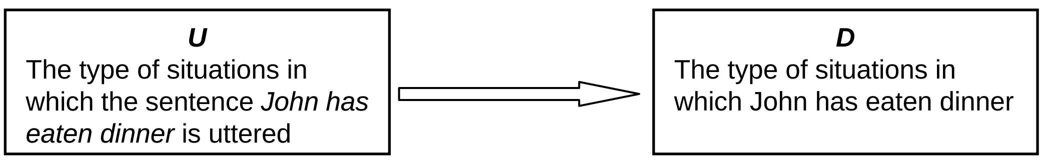

Figure 1

Such a regularity is a kind of conventional regularity, much the same as the ring of the classroom bell signals that the lesson ends. As a member of a speech community, we all know the conventional regularities provided by the language of that community. Now, it is the regularity '*U* =>*D*' that makes the speaker's message that John has eaten dinner flow to the hearer. To see this, when the speaker utters the stream of sounds ‘John has eaten dinner’ in a concrete situation, this situation belong to type *U*. With the presence of the regularity ‘*U* =>*D*’ provided by the sentence, the hearer immediately infers that what the speaker is describing or referring is a concrete situation of type *D*, i.e. a concrete situation in which John has eaten dinner (Figure 2). Communication is therefore possible and achieved. In Chapter 1, we shall argue for this regularity model of communication.

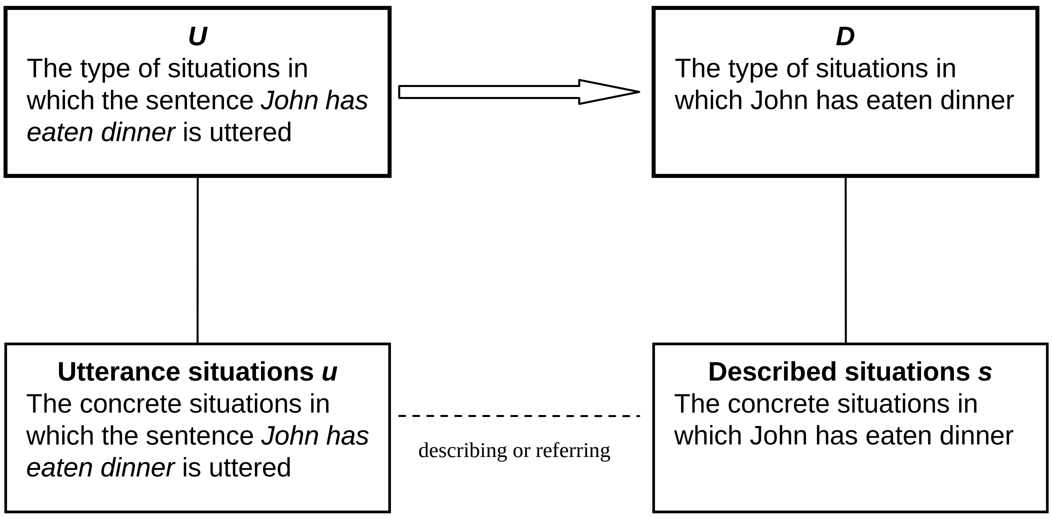

Figure 2

However, how is communication possible for the utterance ‘He has eaten.’? After all, there is an indexical ‘he’ and an ellipsis part ‘dinner’ with this utterance. How does the hearer know immediately this time that what the speaker means is ‘John has eaten dinner.’? We shall claim in Chapter 2 that the regularity model of communication still works when the semantic value of a sentence used in an occasion underdetermines the speaker meaning, but the simple model needs to be extended. The insight of relevance theory gives us a way to extend our regularity model to the communication of explicit meaning of the speaker.

Relevance theory claims that when people comprehend utterances, they search for the relevance of those utterances, and it is relevance that guides utterance comprehension. When the semantic value of a sentence underdetermines speaker meaning, the hearer will draw from the context whatever they need (i.e. making contextual assumptions) to enrich or semantically complete the uttered expression with the guidance of relevance. For example, in the case of 'He's eaten' the hearer will probably take *He* as referring to John since, say, John is the current topic, and will take 'eaten' as 'eaten dinner' since, say, the speaker is asking whether someone has eaten dinner or not. Once the hearer found the content expressed by the enriched expression most relevant (i.e. largely matching her expectation of relevance), she will take it as the explicit meaning of the utterance. In relevance-theoretic term, this content is known as the *explicature* of the utterance, which is the best hypothesis made by the hearer of the explicit speaker meaning.

In Chapter 2, we shall argue that the regularity model also works with explicature. We shall claim that in an occasion of exchange, the *input* utterance by the speaker, the *context* that the hearer chooses in comprehension, and the *conclusion* drawn by the hearer from the utterance, is regular enough, and it is this Input-Context-Conclusion regularity that make possible the flow of contextual information to the hearer for her derivation (or identification) of the explicature. In this way, the intuitive relevance-theoretic framework of explicit meaning comprehension can be remodeled to fit the situation-theoretic regularity model (Figure 3).

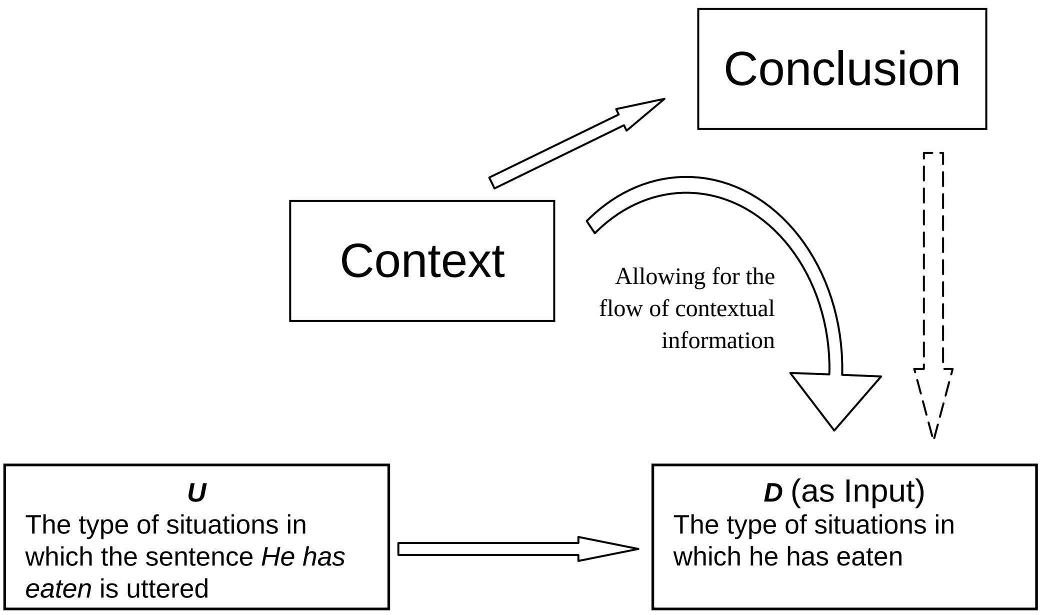

Figure 3

What is the added advantage of this regularity model? The advantage is that it provides a way to formalize the explicating process. Given that Barwise & Seligman (1997) have developed a formal theory, the channel model, of regularity for information flow, we shall in Chapter 3 and 4 take advantage of this channel model and try to adapt it to the case of explicit meaning communication. We shall analyze two concrete examples of simple verbal exchanges and demonstrate how to formally describe the explicating processes with the channel model.

It should be emphasized that although we use only two simple English examples as illustrations of how our model works, the model is meant to be language independent because the situation-theoretic conception of communication is for communication in general, both linguistic and non-linguistic. And in principle our channel-theoretic model can also apply to the kinds of explicatures other than those discussed in the two examples.

The first four chapters of the thesis can be seen as a work on the interaction of the concepts of regularity and explicature. We continue this theme in Chapters 5 and 6 by studying the semantics and pragmatics of conditionals. In Chapter 5, we compare the truth-conditional approaches with the regularity approach to the semantics of conditionals. We critically review two truth-conditional semantic theories: the material conditional theory and the Event theory, and discuss their problems and inadequacy. We then introduce the regularity approach and argue for its plausibility in terms of explanatory power for linguistic data and ability to resolve semantic paradoxes.

In Chapter 6, we develop a pragmatic analysis for the meaning of conditional statements and study its implications. We shall highlight the fact that when a conditional statement is made, it is invariably associated with background conditions. For example, when one states ‘If you turn on the switch of a flashlight, the bulb will light,’ the speaker is assuming that the batteries are charged, among other known or unknown conditions. Assumptions of this kind are preconditions or presuppositions for the successful statement of a conditional. We shall argue that background conditions and world knowledge are two crucial contextual factors that affect the comprehension of conditionals. They are particularly important in the analysis of the phenomenon of conditional perfection, whereby a conditional like ‘If you mow the lawn, I will give you $5’ frequently invites the inference of ‘If you don’t mow the lawn, I won’t give you $5.’ We argue for an explicature analysis against a Gricean implicature analysis in explaining this phenomenon. The argument reveals that scholars favoring a truth-conditional theory of conditionals tend to lose sight of their informational significance.

Chapter 1

The Regularity Model of Communication

HOW IS COMMUNICATION possible? Modern pragmatics tends to equate this with the questions of what is communicated and how to recover the communicated message. In this chapter, we shall argue that modern pragmatics fails to provide an adequate model for communication, simply because it has not addressed the issue of possibility of communication. In contrast, we shall show from a situation-theoretic perspective how the *regularities* between *types of situations* provide the possibility of communication, serving as the 'vehicle' of communication. From a situation-theoretic point of view, communication is a flow of information, and it is the presence of regularities that provide a structure for information to flow. Call this the regularity model of communication. In this chapter, we shall first contrast the code-inferential mixed model of communication in modern pragmatics with the regularity model. Then we shall review the basic concepts and claims of situation theory on which the regularity model is based. We shall review some prominent evidence in the literature and supply further examples or illustrations pertaining to language to demonstrate the usefulness of these basic concepts. Finally, we explain how the use of a declarative sentence to communicate fits the regularity model.

1. Language, Regularities and Communication

The main idea of this section is this (Figure 1-1): (i) language provides regularities for information to flow, (ii) thereby making verbal communication possible, and (iii) it is in this sense that language is a vehicle of communication.

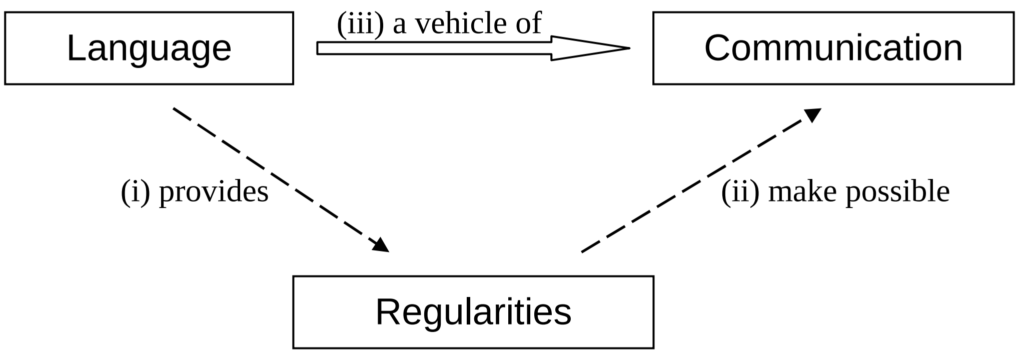

Figure 1-1

1.1 Why Language Is a Vehicle of Communication

It is sometimes said that natural language is a vehicle for communication between humans (e.g. Goldstein 1999: 35; Bell 1991: 8). In fact, it seems natural that any form of communication, verbal or non-verbal, human or non-human, needs a vehicle to convey messages from one destination to another. The existence of such a vehicle explains why information can flow. However, being a vehicle of communication is only a metaphorical description of the communicative nature of language. The pertinent question is: In virtue of what is language a vehicle for communication? Further, what serves as the vehicle in general communication?

It is important to note that these questions are independent of, and in fact, prior to two other related questions: (i) what message is communicated via such a vehicle? (ii) how is the message recovered? (Sperber & Wilson 1986/95: 1)[1] These two latter questions pertain to the identification by the hearer of the message communicated by a speaker, and have been the major concerns of modern pragmaticists, who focus largely on the ways or principles governing *how* the message is being identified (e.g. whether by encoding-decoding or inference or both), and *what* message is thereby recovered (e.g. what is said or what is implicated). But the question of *why* messages can possibly be conveyed is largely ignored or taken for granted. In contrast, Barwise & Seligman (1997: 4) and elsewhere in Barwise & Perry (1983) suggest that in the study of information flow it is the *possibility* of the conveyance of meaningful contents that should be addressed in the very first place. This seems natural because a message (of whatever content) being identified (in whatever ways) presupposes the very possibility of the conveyance of that message.

We therefore know that it is the possibility of conveyance of message that

[1] Although Sperber and Wilson posed the second conjunct as ‘how is communication achieved?’ what they were actually thinking of was how the speaker message is recovered. They regarded the achievement of communication as merely the successful identification of the speaker message.

underlies the vehicle of communication. In the case of verbal communication, language is a vehicle of communication in virtue of the possibility it allows for the conveyance of messages or the flow of information. We shall argue below that it is the regularities offered by language that make communication possible.

1.2 The Code Model of Communication

A description of the process of communication with the use of a system of codes is called the code model, a version of which is given in Sperber & Wilson (1986/95). On their account, a code is a signal which is encoded with a meaning. For example, the Morse code is a system of such codes. It is also widely assumed that bees use flying patterns or 'dances' as codes to communicate.[2] Communication with the use of codes works in this way. The sender encodes his intended message with codes, which are then sent through a channel to the receiver. The receiver gets back the message by decoding. Communication is then achieved and guaranteed. According to relevance theory, human languages are systems of codes which associate thoughts or meanings to sounds:

> The source and the destination are central thought processes, the encoder and the decoder are linguistic abilities, the message is a thought, and the channel is air

[2] von Frisch (1967)

which carries an acoustic signal. (Sperber & Wilson 1986/95: 5; emphasis added)

Relevance theorists and other pragmaticists have demonstrated that the code model is inadequate, either as an explanation or as a conception of the process of human verbal communication. One major reason is that the speaker message is seldom fully encoded in the sentence used to convey it (Austin 1962, Grice 1989, Sperber & Wilson 1986/95).[3] It is almost a consensus now that communication typically involves an element of inference, making the code model inadequate as an explanation for the process of communication. In fact, there are even cases of purely inferential communication involving no code at all.

1.3 The Purely Inferential Model

Relevance theory has actively pursued and developed an important idea of Grice (1957), proposing an inferential model of communication. The essence of Grice's idea is that communication can be achieved with the recognition (by the hearer) of the speaker's intention to inform. Relevance theory calls this intention to inform the informative intention (Sperber & Wilson 1986/95: 29). According to relevance theory, the inferential model for (overt) communication works in this way: the 'communicator provides evidence (e.g. acoustic signals, gestures, or an utterance) of

[3] This will be discussed in detail in Chapter 2.

her intention to convey a certain meaning, which is inferred by the audience on the basis of the evidence provided' (Wilson & Sperber 2004). The following example can illustrate.

> Jack went to Thailand to learn snorkel diving with a local coach. Along with many other learners, he dived into the sea. Unfortunately, he had a difficulty and was about to be drowned. He was struggling in the water and waving his hands above the surface of the water as hard as he could to draw the attention of others, presumably the coach and the lifeguards. The couch saw him, and immediately came to his rescue. His life was saved.

According to the inferential communication model, communication between Jack and the couch was achieved through the recognition of Jack's intention to inform. Jack's waving of his hands was surely a piece of strong evidence signaling his intention to inform a message, which was most likely 'Help! Help!' He would have been drowned to death if his intention to inform had not been recognized by the coach in time. Since his informative intention was recognized, the coach, being a guy with normal inferential ability, knew almost immediately that Jack was in a very difficult situation and was badly in need of help. Jack's message was thereby got. Communication was successful, and his life was saved.

1.4 The Code-Inferential Mixed Model

Although the code model is inadequate and the inferential model is in principle sufficient, relevance theory noted that in most cases of human communication both coding-decoding and inferential processes are involved. It claims that human communication is best explained by both models working together (call this the mixed model). First, relevance theory maintains that the two modes of communication are essentially different; decoding process cannot be regarded as inferential process. Second, it maintains that the inferential model alone is inadequate as a full account of human communication (Sperber & Wilson 1986/95: 24-28).

1.5 The Regularity Model: Making Communication Possible

If the code-inferential mixed model can provide, as claimed, an adequate description for communication, how is the vehicle of communication got reflected in it? There are two ways to conceive this vehicle in the mixed model. One way is to think that the system of codes is the vehicle. Thus, one might regard the physical codes in the form of sounds as the vehicle (Verschueren, 1999:103)[4], or simply the codes themselves (the sound-meaning pairs) as the vehicle. However, since there are cases of purely inferential communication, which involves no code, messages from senders would be

[4] Codes may also be in visual form.

able to travel to receivers without vehicle. If we choose to insist that communication needs a vehicle to be achieved, then the physical words cannot be the vehicle. Consequently, there is a difficulty of treating a system of codes as the vehicle of communication.

Another way is to conceive the air or the space as the vehicle, which has been suggested by Sperber and Wilson in the above quotation. The sender's message coded in words is carried by air particles (or light particles in written message) to the receiver, who processes the input stimuli by decoding and performing inferential tasks to recover the message. In the case of purely inferential communication, sounds or gestures as evidence of intention to inform also travels through the air or the space to the receiver for processing. This view of vehicle apparently handles both the mixed mode and the purely inferential mode of communication. However, such a view seems to commit a fundamental mistake: physical substances cannot be regarded as the basis of the possibility of a phenomenon. In the case of physical phenomena, it is the physical laws that provide the possibility for those phenomena. Air and light particles cannot be the sources of possibility of the conveyance of sounds and visual images. It is the physical laws governing acoustics and optics that make the carriage of sounds and images by air and light particles possible, not the particles themselves. In the same way, it is the physical laws governing electrons that make electricity possible, not the electrons themselves. It is logically possible that the generation of electricity would no longer be carried out by the electrons but by other kinds of particles. So, in the case of communication, we would expect some abstract laws to provide the possibility of communication, serving as the carrying vehicle.

As a result, there is a difficulty in figuring out the vehicle of communication with the code-inferential mixed model. We take this as a piece of evidence for the inadequacy of the mixed model in explaining the nature of communication.

According to situation theory (Barwise & Perry 1983, Barwise & Seligman 1994, 1997), it is the regularities (i.e. systematic, regular relations) between types of situations that provide the possibility of the flow of information.[5] Since communication can be regarded as a kind of information flow, we therefore take this idea as providing a model for communication, the *regularity model*. On this model, regularities form the basis of the vehicle of communication, making conveyance of messages possible (we shall see how the model works in section 2 and 6). Indeed, in the case of verbal communication, the linkage between the utterance situations in which a linguistic expression is used and the described situations is, according to situation theory, a conventional regularity provided by a language. For purely inferential communication, speaker intention and the behavior used to convey this

[5] In the early phase of development of situation theory, regularities are called constraints.

intention are not arbitrarily linked (Wilson 2004); they are systematically linked, exhibiting regularities.[6] Thus, the nodding of one's head is systematically related to one's expression of approval. Such an intentional behavior may not be regarded as a code, but its relation with the expression of approval seems regular enough to be conceived as a regularity.[7]

To sum up, according to the situation-theoretic regularity model, it is the regularities between types of situations that provide the possibility of communication. In other words, regularities form the vehicle of communication. In the case of verbal communication, the regularities provided by language serve as the vehicle of communication.

1.6 Two Ways to Conceive of Communication Failure

A case of communication failure may help to highlight the difference between a regularity analysis and a processing analysis (like the one purported by relevance theory) of communication. Inspired by Barwise & Seligman (1997: 7), we look at another scenario for Jack, the Chinese snorkel diving learner:

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[6] We will discuss this point in detail in Chapter 2, Section 6.

[7] In the case of verbal codes, Sperber & Wilson (1986/95: 26-27) argued that these codes are genetically determined rather than conventionally agreed upon among the members of a speech community. However, there is much controversy about this issue. A critical discussion (from a Wittgensteinean perspective) of the 'symbolic paradigm' in cognitive science, of which Fodor's approach is one, can be found in Goldstein & Slater (1998). Note also that some philosophers (e.g. Goldstein 1999) interpret Wittgenstein's famous slogan 'meaning is use' as saying that the meaning of a word arises from the regularity of its usage.

> When Jack had a difficulty in water and was about to be drowned, he kept waving his hands above the surface of the water and yelling out *jiu ming* as loudly as he could. To his dismay, nobody came to his rescue and he was drowned. When the coach and other local lifeguards were questioned by the police about the accident, they said they had thought that the man was just playing around happily and was so excited that he shouted loudly.

It is clear that the coach and the lifeguards did not recognize Jack's intention because they were illiterate of the Chinese language.[8]

There are two ways to explain the communication failure. Modern pragmatics would regard it as a failure *at the processing level*. On this account, the yelling out of 'jiu ming' as a stimulus had been conveyed (with the help of acoustic laws) to the coach and the lifeguards, but they did not know how to process the stimulus. They either had got the wrong interpretation, or had thought that it was not relevant to them and ignored it. However, although the stimulus itself was conveyed, the information content had not been conveyed. It seems controversial to say that the information content had flowed to the receivers but was not unpacked during processing. Another approach is to regard the communication failure as one *at the regularity level*. Although the regularities between Chinese words and their conventional meanings

[8] Incidentally, this is a tragedy adapted from a true story which happened a few years ago.

always exist, the Thai coach and the lifeguards were just not aware of or *attuned* to such regularities. To them, such regularities are essentially non-existent; Jack was merely seen as playing around but not asking for help. Without the help of regularities, Jack's information could not flow to them, let alone being processed.

The example seems to demonstrate from another perspective that it is regularities that make the flow of information possible, serving as the vehicle of communication.

2. An Overview of Situation Theory

According to situation theory proposed in Barwise & Perry (1983) and Barwise (1989), meaning in general and linguistic meaning in particular should be studied within a general theory of information flow. This idea is what situation theory called the *relation theory of meaning* (Barwise & Perry 1983: 14, 16):

> Meaning arises from regular relations [regularities] holding between types of situations.

We think that this important piece of insight has been unfortunately obscured by the controversies over the slippery notion of meaning among linguists and language philosophers. In the present study, we try to revive the relation theory of meaning by repackaging it into a formalized treatise of explicit communication. To understand the notion of regularity and how it supports the flow of information, we now turn to the elements of situation theory.

2.1 Situation Theory Defined in the Present Study

By situation theory that we conceive in the present study, we mean the theory that builds on the notions of situations, properties and relations, which are the primitives of the theory.[9] In its early days of development, situation theory used set theory to model the notions of situations, types of situations and other core notions. The theory of linguistic meaning that was based on situation theory was called situation semantics. After the publication of *Situations and Attitudes* (Bariwse & Perry 1983), this early version of situation theory and situation semantics met some difficulties revealed by a number of commentators. Having reviewed its development, Barwise (1987b) decided to give up modeling these basic concepts with set theory. Instead, he directly took situation, property and relation as primitives that need not be modeled by some meta-language.[10]

In the present study, we do not distinguish between situation theory and situation semantics, but bring all theories, semantic and pragmatic ones which employ the concepts of situations, types of situations and regularities under the rubric of situation theory.

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[9] Mature versions of situation theory can be found in Barwise (1989a) and Devlin (1990).
[10] Barwise (1987b), Barwise & Perry (1999), Devlin (2004) and Perry (1997) reviewed the history and development of situation theory and situation semantics.

2.2 Three Central Claims of Situation Theory

According to situation theory, it is regularities and cognitive agents' attunement to them that allow the information carried by concrete situations to flow to the agents for their use (Barwise & Perry 1983; Barwise & Seligman 1994, 1997). Thus, a concrete situation may carry both observable and unobservable information. The unobservable one carried by a situation is relative to some regularities. When an agent is attuned to these regularities, he or she can get hold of that information. It is in this sense that information can flow. The central claims are summarized as follows:

(i) *Situations* carry information (1997: 27);

(ii) The information carried by a particular situation *s* is that: a situation *v* being of a certain *type* (ibid: 27)[11];

(iii) Regularities holding between types of situations make the carriage of information possible (ibid: 8).

We shall use these claims to develop a formal theory of explicit communication in Chapters 3 and 4. Here, we shall give examples to illustrate the ideas of these claims.

Example A

Barwise & Perry (1983: 14) gave the following classic example that frequently

[11] Note that *v* may be the same as *s*.

appeared in situation-theoretic literature. Suppose that a man saw smoke pouring out of a building. Then he knew that this building was on fire. How did he get hold of the information that this building was on fire, given that he had not seen any blaze of light? The story goes like this. Smoke pouring out of that particular building at a particular time was a specific situation. Thanks to his knowledge that there is a regular relation holding between two types of situations: 'smoke pouring out of a building' and 'a building being on fire,' in such a way that the first type of situation typically involves the second type. The man therefore immediately knew that this specific situation carried the information that it was of a certain type, the type of being on fire, and so the information was that the building was on fire. The next time the man saw smoke pouring out of a building (might be the same building he saw previously), he met a new situation. This new situation and the one he saw previously were of course two distinct situations, but they shared a common feature: being of the same type, the type in which smoke pouring out of a building. And because of the associated regularity, the information that this second building was on fire was immediately conveyed. This is an example of a physical regularity that supports the flow of information.

Example B[12]

When Peter saw the traffic light change to green, he resumed driving. What made him

[12] Examples that are not acknowledged with sources are the author's own.

know that he was supposed to move his car on at that moment? That particular traffic light changed to green at that moment was a particular situation. This situation carried the information that Peter was in a situation of some type, the type in which one has to move one's car. This is because there is a conventional regularity holding between a certain type of situations, that of the presence of a green light, and another type of situations, that of moving on one's car. This is an example of a conventional regularity that underwrites information flow.

Example C

When Jack, the snorkel diving learner, was struggling in the water and kept waving hands above the surface of the water as hard as he could to draw the attention of others, a particular situation was displayed. This particular situation carried the information that Jack was possibly about to be drowned. What made the information flow? The answer lies in the fact that there is a systematic relation holding between the scene displayed (a type of situation) and someone about to be drowned (another type of situation), a relation that the coach and the lifeguards, and presumably everyone, were attuned to.

Example D

When Jack kept shouting 'Help' in the water and, this was a particular situation involving the use of the word *Help*. Since there is a regularity that whenever this word is uttered someone must be in need of help, so the coach and the lifeguards knew immediately that Jack, the utterer (or someone connected to him) needed help. According to situation theory, the meaning of a word (e.g. *Help*) is a conventional regularity holding between two types of situations, the utterance situations in which the word is uttered and the external situations that the word describes (in the case of *Help*, the situations described are those in which someone needs help).[13] So, this is a case in which a verbal conventional regularity makes communication possible.

These examples show that situations, types of situations and regularities are three important notions in understanding the nature of information flow in general, and verbal communication in particular. We are going to review these three notions below.

3. Situations

According to situation theory, situations are 'limited parts of reality that we perceive, reason about and live in;' they consist of 'individuals having properties and standing in relations at various spatiotemporal locations' (Barwise & Perry 1983, 1999). Thus, when the snorkel diving coach was monitoring his students' performance, he saw various scenes. These scenes were visual situations, and were limited given the field of vision of a normal human being. The scenes he perceived might cause him to have

[13] Note that it is not the aim of the present study to address the issue of speech acts performed by words and sentences, so we will stop our analysis beyond their descriptive contents.

various kinds of thought. For example, having seen someone struggling in the deep water out there, he might reason that that someone might be in trouble, and would decide to pay particular attention to his or her situation. And the coach was, of course, situated or lived in a larger situation, say, the beach. In this larger situation, there were individuals like people, sands, boats, water, etc, having properties and standing in relations to each other. For instance, some people were having sunbaths, others were swimming, still others were rowing boats; the beach water was cool; the sands were fine; a man was smearing suntan lotion for his wife; a little girl, Rose, told her mother: 'There is a boat'; etc.

There is some evidence in logic and reasoning that supports a useful notion of situations.

Example E

In a famous study in Bransford, Barclay & Franks (1972), it has been shown that it is the situations described by sentences rather than their interpreted deep structures[14] that affect sentence memory. We take this result as evidence supporting the claim by situation theory that the semantic value of a statement is the situation described by the statement rather than its truth value (as proposed by the philosopher Frege). Bransford et al. found that during the process of sentence memory, the information that listeners

[14] This is a concept in interpretive semantics within the tradition of transformational grammar.

retain are not about the linguistic structures of the sentences but rather the situations that the sentences described. The empirical evidence shows that listeners construct situations when they hear sentences. This view is still maintained by some scholars in their recent studies of discourse semantics (Tomlin et al. 1997 in van Dijk 1997: 68).

In their work, Group A of students was presented with a list of sentences like (1a), and Group B was presented with sentences like (1b). After that, they were asked whether they had seen a number of sentences before, including the key one (1c), which in fact was not seen by either group.

1a. *Three turtles rested* ***on*** *a floating log, and a fish swam beneath them*

b. *Three turtles rested* ***beside*** *a floating log, and a fish swam beneath them*

c. *A fish swam beneath a floating log*

They found that Group A students, who had seen (1a) before, were more likely than Group B students, who had seen (1b), to say that they had seen (1c) before. A possible explanation for the result is that the students had constructed the situations described by (1a) and (1b) when they were presented with these sentences. The situation described by (1a), but not by (1b), necessarily implies that described by (1c), causing a bias in the memory of Group A students.

Example F

Barwise (1980) have shown that the notion of situation sheds some light on a puzzle of naked infinitive (NI) perception statements. Consider the following utterances:[15]

2a. Ralph saw a spy hide a letter under a rock

b. Ralph saw that a spy hid a letter under a rock

c. Ralph saw a spy hide a letter under a rock, but thought she tied her shoe

d. *Ralph saw that a spy hid a letter under a rock, but thought she tied her shoe

e. I see the King of France comb his hair

f. I see that the King of France combed his hair

The puzzle is that: there seems to be two different kinds of seeing or perceiving, as exemplified in (2a) and (2b). To see this, (2b) seems to be entailed by (2a), but in fact it is only a pragmatic inference from (2a). This is because one can assert (2c) to cancel that inference; but (2d) is not assertible. This observation makes some scholars (e.g. Dretske 1969) propose that there might be two kinds of seeing: the epistemically neutral one expressed with NI sentences, and the epistemically positive one with *that* embedded clauses. However, Barwise found that it is rather unintuitive to claim that there are two kinds of seeing. Moreover, he observed that if the NI perceptual statement is made by the first person, as in (2e), then it is difficult to see from (2e) and (2f) that there are two different kinds of seeing.

To solve the puzzle, Barwise proposed that what the entity seen or perceived in

[15] In the present study, utterances are typeset in a different font (Arial Narrow), while sentences are in italics (Times New Roman).

an NI perception statement is a visually perceptual situation, i.e., a *scene*. Thus in (2a), the speaker is stating that Ralph saw a scene in which the spy hid a letter under a rock. And in (2c), Ralph saw this scene (which the speaker also saw) but was not aware of the fact that the spy had hid a letter under a rock; he (Ralph) just thought that the spy had tied her shoe. On the other hand, Ralph in (2d) *was* aware of the fact that the spy had hid a letter under a rock, and so he could not at the same time thought that the spy had tied her shoe; (2d) is therefore unassertible. This means that the speaker, who reports someone's perception, is merely using an NI-expression *a spy hide a letter under a rock* in (2a) and (2c) to refer to a visual situation, without committing himself to saying that Ralph has been aware of the fact that the spy had hid a letter under a rock. But if the speaker is the first person, as in (2e), it is difficult to see there is no such commitment. What Barwise's analysis of NI perceptual reports shows is that situation is a useful notion.

4. Types of Situations

Situation theory drew insights from Gibson (1979) and has proposed the notion of types of situations. According to Gibson, information arises out of the interaction of animals (i.e. cognitive agents) and the environments in which they are situated. His idea is that the survival of an organism is impossible if it does not classify the ever changing reality it perceives and lives in into manageable types according to similarities among situations. After classification, the organism can cope with new situations that keep arising. By being able to be attuned to regular relations between types of situations, the organism can pick up information that it finds important to its survival and well-being (Barwise & Perry 1983: 10-11). Thus, when flocks of rats went up to highlands or hills, they were probably attuned to a type of situations that carries the information of another type, a type in which a tsunami was coming. If we human are attuned to the regularity linking the type of situations in which flocks of rats or other animals go up to highlands and the type in which a tsunami is coming, we will save our lives in case of a tsunami.

Unlike situations, which are limited parts of the reality perceived and lived in by cognitive agents, types of situations depend on the ways of classification and are therefore not something inherent in situations. In some sense, situation types are artificial, because the ripping apart of the reality into types of situations is relative to the cognitive agents concerned and depends upon the purposes of classification (Barwise & Perry 1983: 10-11). To an almighty being, if it exists, flocks of rats going up to highlands might not be a type of situations he concerns very much about. He would not even be conscious of such a situation if he ever met one. But this type of situations would be very important to us human beings.

Types of situations are also relative to the purpose of classification. Consider an event that usually happens in an office. A clerk, Peter, is talking on the phone. To his colleague, it is a situation in which Peter is talking on the phone, and carries the information that one would be impolite to disturb him. This pertains to a social purpose. But to Peter's boss, it is a situation in which Peter is slacking in his work, and carries the information that it is a very good opportunity to issue a third warning to Peter before laying him off. This probably serves the boss' purpose. Indeed, it is sometimes said that a boss classifies things into only two types of situations in his or her office: 'hardworking' or 'slacking off'. Peter's colleague and his boss perceive the same situation, but it can be classified differently according to different purposes.

There is some evidence in natural language use and communication phenomena that supports the notion of types of situations.

Example G

Drawing on the work of Chomsky (1972), Barwise & Perry (1983: 77) and Barwise (1984, 1986a) noted that there is a situation-theoretic semantic difference between gerundive nominals and derived nominals. Consider the following sentences or fragments:

3a. *Cat hair being in the butter* (gerundive nominal)

b. *That hair in the butter* (derived nominal)

c. <u>*Cat hair being in the butter*</u> *always means a cat is in the house*

d. <u>*Cat hair being in the butter*</u> *means a cat is in the house*

e. <u>*That hair in the butter*</u> *means a cat is in the house*

f. */? <u>*That hair in the butter*</u> *always means a cat is in the house*

They found that gerundive nominals are used to refer not only to situations, but also to types of situations. However, derived nominals seem to be used to refer only to specific situations. Thus the gerundive nominal in (3c) are used to refer to a type of situations; that in (3d) can refer to both a type of situations or a specific situation. While the derived nominal in (3e) refers to a specific situation, that in (3f) seems not appropriate for referring to a type of situations, making (3f) sound odd.

Example H

The contrast between situations and types of situations can also be seen in the usage of articles. A difference between the use of the indefinite article *a/an* and that of the definite article *the* in English can be summarized as the distinction between classifying and identifying (Yule 1998: 33). According to this distinction, to classify is to 'name a thing' as a member of a class. Thus, when Jack says 'Rose is a student,' he means that Rose is a member of the class of students, implying not a member of the class of housewives or the class of cats or some other classes of individuals. On the other hand, to identify a thing from a given class is to 'refer to' that particular thing.

Jack can use the statement ‘Rose is the student’ to respond to the question ‘Which student breaks the vase?’

It is interesting to note that there is a special form of usage of articles, the use of *zero* articles (i.e. absence of article) on count nouns. When Jack says ‘He goes to school by bus,’ he is using the zero article for the noun ‘school’ and ‘bus’. Contrasting with the use of indefinite and definite articles, the use of zero article might signal that it is not relevant or necessary for the entity concerned to be classified or identified, or is understood conventionally as referring to ‘kinds of activity’ (Yule 1998: 36-37).

It is arguable that the use of zero articles refers to types of situations. Consider the following sentences:

4a. *John goes to school by bus*

b. *John has gone to the school by a bus*

c. *Mary would rather stay at work than go to church*

d. *Mary would rather stay at the work than go to the church*

While (4b) can be used to describe a specific situation in which there is a particular school (not necessarily the one John usually attends) and a particular vehicle for this transportation, (4a) is used to describe a type of situations that John normally engages in. There is also a concomitant difference in the use of tense and aspect. In the case of referring to specific situation as in (4b), the present perfect is used; it also allows the past, but must not be the simple present. When referring to a type of situations as in (4a), it is the simple present that is used. Note that one can also use the present perfect in (4a), but the resulting sentence becomes referring a specific situation, no longer referring to types of situations. (4c) admits two readings. One reading means Mary prefers to engage in one type of situations rather than another type. The other means she prefers to stay in a particular situation rather than in another particular situation. But in (4d), one can only use it to mean that she prefers to stay in a particular situation rather than in another.

It is also observed that zero articles are frequently found in texts providing instructions, like (5a) (Yule 1998: 41). Note that we can also place an article before the nouns, as in (5b). There are two ways to conceive of the presence and absence of articles in the two texts. According to Yule, there is no semantic difference between the two. The presence of articles in (5b) is considered irrelevant or unnecessary, and can therefore be deleted. Another way is to maintain that there is a subtle difference. We choose the second approach. In terms of situation theory, each step in (5a) seems to *invite* the reader to engage in a type of situations. In contrast, (5b) is more like giving demonstrations or issuing orders for participants in a concrete situation. The absence of article is therefore more suitable in texts, since a text issuing instructions is much like a virtual speaker waiting to be put into use by a reader. On the other hand, the presence of articles is more frequently found in real and concrete demonstrations, in which cases it would seem odd to use zero article form.

5a. *Grasp drumstick. Place knife between thigh and body; cut through skin to joint. Remove leg by pulling out and back. Separate thigh and drumstick at joint.* (from Yule 1998)

b. *Grasp* a/the *drumstick. Place* a/the *knife between* the *thigh and* the *body; cut through* the *skin to* the *joint. Remove* the *leg by pulling out and back. Separate* the *thigh and* the *drumstick at* the *joint.*

Example I

When numbers are treated as types of situations, we can solve some semantic puzzles involving numerals. This shows that type of situations is a useful notion. Things as simple as numbers can be very problematic. Consider utterance (6a):

6a. John has three children

b. John has at least three children

c. John has at most three children

d. John has exactly three children

What is the meaning of the number 3? Or in general the number *n*? One approach claims that the entailment meaning of (6a) can be paraphrased as (6b) (Levinson 2000a: 88). On this Gricean approach, the meaning of the number *n* is 'at least *n*,' not ‘exactly *n*.’ But how could such an approach square with the intuition that (6a) means (6d)? The strategy of this approach is that by uttering (6a), the speaker *implicates* that John has no more than three children. This is because if he did have more than three children he would have said so given the Quantity Maxim of ‘saying as much as you can’ in Gricean theories. Therefore, (6a) implicates (6c); and then (6c) with (6b) will force the meaning that John has exactly three children. An alternative approach claims that the encoded (i.e. conventional) meaning of the number *n* is ‘exactly *n*’, not ‘at least *n*’ (Carston 1988). How to choose between these two approaches?

With the insight of situation theory, we think that it is more appropriate to treat the semantic content of *n* as ‘exactly *n*’. We shall list three arguments to show that the ‘at least *n*’ interpretation is unreasonable.

The first argument. In terms of situation theory, the number *n* can be treated as representing a type of situations. To see this, suppose that there are (exactly) four red marbles on a table. This is a concrete situation. That there are four green one is another concrete situation. That there are four bottles in a box is yet another one. However, these three distinct situations share a common feature: they all contain four objects, and can be regarded as situations of the same type. The number 4 can therefore be conceived as an abstract entity representing a type of situations. Similarly, the number 5 can be seen as the type of situations in which there are five objects.

Now, suppose that there are 4 rows of marbles on a table, each row containing 5 marbles. In this scenario, we immediately know that the number of marbles on the table is twenty, without bothering to check by counting. How did we come to this conclusion, and can be so sure? In fact, this can be explained from an information flow perspective. The entity 4×5 can be considered as a type of situations exemplified on the table. The law *four times five equals twenty* ($4 \times 5 = 20$) can be regarded as a regularity holding between two types of situations: the type 4×5 and the type 20. With this regularity, the situation on the table carries the information that this situation is also of type 20. Since type 20 represents situations of twenty objects, we therefore concluded that on the table there are twenty marbles. Our everyday calculations are just flows of information in disguise. The upshot is that: if we interpret *n* as 'at least *n*', we are not sure how we could build a user-friendly arithmetic system for everyday use. Think of (8 – 4). Will the result be positive or negative with the at-least-interpretation? Is ($8 \div 4$) equal 2, or larger than 2, or smaller than 1? Indeed, with the at-least-interpretation, they can be *anything*! Thus (8 - 4) can be ten if 8 is assigned sixteen and 4 assigned six.

The second argument. It is important to note why (6a) could be paraphrased as (6b) in the Gricean line of reasoning. Presumably, this is because the proposition that John has at least three children is frequently said to entail the proposition that John has three children. To be concrete, consider the proposition (7):

7. John has five children

It is said that, in any circumstance, if John has five children, he also has three children. With this, if one states that a person has three children, then he may have exactly three or more than three children (e.g. five); in any case, he has at least three children. This seems to be the major reason why (6a) could be paraphrased by (b), thereby encouraging the claim that the semantic content of *n* is 'at least *n*.' So, the Gricean reasoning is based on a truth-theoretic consideration.

We shall argue that the above reasoning, though widely accepted, is in fact problematic, making the claim that *n* is 'at least *n*' lose its foundation. Consider the situation in which there are 100 marbles on a table. How do we describe such a situation? We simply say that there are 100 marbles on the table. It seems odd to say that there are 2 marbles on the table, though we can surely say that there are 2 marbles, say, near the upper right corner of the table. In other words, there is actually a shift of background situation from stating 'There are 100 marbles on the table' to 'There are 2 marbles on the table.' In the latter case, the speaker is focusing on or seeing a narrower area on the table: the upper right corner, while the statement 'There are 100 marbles on the table' focuses on the whole table. It is therefore misleading to say 'There are 100 marbles on the table' entails 'There are 2 marbles on the table.' As we shall see in Chapter 2, situation theory construes a proposition as composed of two components: a fact (or state of affairs) σ (e.g. the fact that there are 100 marbles) and a situation s supporting this fact, formally represented as $s \models \sigma$. This offers two parameters s and σ for a proposition (Barwise 1988a), providing more room for manipulation (see the third argument).

The third argument. One might ask that if the semantic content of *n* is 'exactly *n*', how could we accommodate the alleged cancelability of implicature in the Gricean approach? Consider the following utterance (Levinson 2000a: 56-57):

8. John has two children and, in fact, a total of three.

On the Gricean approach, the implicature that John has exactly two children arising from the first conjunct of (8) is said to be cancelled by the second conjunct 'in fact, a total of three'. However, it seems misleading to say that the implicature (if exists at all) has been cancelled just because (8) is assertible. As noted above, from a situation-theoretic perspective the proposition expressed by the use of the sentence *John has two children* has a hidden component of situation s_1 supporting the fact 'John has two children.' When the speaker later changed to state that John has a total of three children, the situation s_2 supporting this latter fact 'John has a total of three children' cannot be the same as the previous s_1 (demonstrated in the Second argument).

An advantage of the two-parameter approach to proposition offered by situation theory is the strategy that we can retain the fact σ but change the underlying situation *s*. Thus we can retain treating the semantic content of 2 as ‘exactly two’ in (8) but change the underlying situation for the second conjunct. The Gricean approach does just the reverse: retain the underlying situation, and change the semantic content of 2 to ‘at least two’ in order to accommodate (8).

In summary, the notion of types of situations offers a plausible way to decide on the semantic contents of numerals, and is therefore a useful notion.

Example J

How do we communicate with divinities? This might appear irrational in an academic study. However, given that such a cultural phenomenon is pervasive throughout the history of mankind, it is hardly affordable not to touch upon the issue in the discussion of communication. If we take the objective fact that people do participate in fortune telling activities and interpret the ‘messages’ given (or as if given) by super beings, then these people are in fact playing the role of hearers. It is interesting to find out how such a kind of communication is possible.

It is all too easy to forget that when we humans use a natural language sentence to communicate, we are actually using a type of situation to achieve the job. Since sentences are used to describe or refer to situations, they actually represent types of situations. For example, the sentence *She is eating lunch* represents a type of situations in which there is a female eating lunch: that Rose is eating lunch is a situation of this type; that Mary is eating lunch in the canteen is another; etc.

It is amazing that divinities use a finite number of types of situations as tools to communicate with worshippers. To see this, we describe how worshippers in Chinese temples that provide fortune sticks use these sticks to ask for information about their future. This is known in the Chinese communities as ‘qiu qian’, one of the many kinds of fortune telling activities dated back as far as several thousand years ago. The worshipers first kneel down before the god or goddess, then pray for the information about their own or their family members’ future by asking questions, and shake a bamboo cylinder containing fortune sticks until one falls out. The fallen out stick is seen as chosen by the divinity, and the information attached represents the answer to the question. On each fortune stick is attached a poem about the story of a prominent ancient Chinese figure. A bamboo cylinder in the Wong Tai-sin Temple in Hong Kong has one hundred fortune sticks, providing one hundred stories of Chinese figures. Linguistically, the stick that falls out represents the ‘utterance’ of the god or goddess. The story attached represents the situation in which the worshipper finds him/herself, though just how exactly the situation is related to him/her is ambiguous among various interpretations. The worshipper has to choose an interpretation thought to have been intended by the divinities.[16] This is no easy task without the help of professional fortune tellers. It is really amazing and fascinating to note that there are only a finite number of sticks, say, 100, in the bamboo cylinder that can be, will be and have been used to answer infinitely many questions of all kinds from worshippers. In other words, divinities use a fixed and finite set of types of situations as tools to communicate with worshippers in this kind of fortune telling.[17]

5. Regularities

A regularity is defined to be a systematic relation holding between two types of situations *S* and *S'*, denoted by *S* => *S'*, which is read as '*S* involves *S'*,' and is interpreted as 'actual situations of type *S* involve there being actual situations of type *S'*.'[18] The relation that holds between two types of situations can be a causal relation from any of the two directions, or a conventional relation. (Barwise & Perry 1983: 101; Barwise 1989a: 52). However, there are also regularities which are not of a causal or conventional nature (Barwise & Seligman 1997: 17).

Regularity is a pre-theoretic notion that comes from observations. While

[16] The principle of relevance is also seen as governing this kind of communication, guiding the worshippers to the intended meaning of the divinity.
[17] In some sense, therefore, meaning can be classified into a finite number of types, demonstrating a kind of finiteness along with that discussed in the compositionality of natural language.
[18] In fact, as we shall see in Chapter 3 when the concept of infomorphism is discussed, regularity does not only involve types, it also involves tokens. But for the moment, it is enough to take it as involving only types.

situation is regarded as a primitive, regularity is to be modeled and formalized by an abstract theory, namely the channel theory (Barwise & Seligman 1994, 1997). We are not going to review this theory until Chapter 3. In this section, we shall review three related features of regularity: reliability, fallibility, and background conditions.

According to Barwise & Seligman (1994), it is the nature of regularities that they are both *reliable* and yet *fallible*. To reconcile these two seemingly contradictory properties, they drew our attention to *background conditions* (in some contexts known as 'experimental' conditions) that go hand in hand with a regularity. They observed that the background conditions associated with a regularity must be fulfilled for successful information flow. In this section, we shall give some preliminary examples to illustrate this important observation. Detailed discussion on background conditions and its linguistic implication will be offered in Chapter 6 when the pragmatics of conditionals is discussed.

Example K

Mathematical statements were once considered as absolute truths, something that correctly describe the reality and cannot be false or fallible in any circumstances. However, such an absolute view has been increasingly challenged by philosophers of mathematics (e.g. Kichter 1984, Lakatos 1978), mathematics educators (e.g. Ernest 1998, Hersh 1999) and working mathematicians (e.g. Kline 1972). For example, it has been more and more evident that some mathematical assertions were found to depend on the fulfillment of certain presupposed conditions, conditions that are concerned with a particular conception of the world. Thus, the assertion: (A) ‘Angle sum of a triangle is 180 degrees’ is a ‘truth’ only with the assumption of the Fifth Postulate in Euclidean geometry. This postulate reflects a particular conception of space when the notion of infinity is involved. If such a background condition (i.e. the Fifth Postulate) is not assumed to hold, as in the case of non-Euclidean geometry, assertion (A) is false, that is, the angle sum of a triangle may either be smaller or greater than 180 degrees. With the awareness of this background condition, a geometric theorem like (A) degenerates from an absolute truth to a mere regularity, capable of being fallible when the precondition is not holding, though reliable enough in most practical applications, e.g. building bridges (but not that useful in atomic physics and cosmology).

Example L

Scientific assertions about the nature or the physical world, sometimes called the laws of nature, invariably depend on the fulfillment of background conditions, conditions usually referred to in this context as experimental conditions. The assertion is true that two free falling bodies under gravity will reach the ground at the same time from the same height, but only on condition that there is no resistance upon falling. Thus, the observation that a feather takes a longer time to reach the ground than a stone from the same height does not constitute a counterexample to that assertion, because the assertion is stated with an experimental condition specifying the absence of air resistance, which is clearly violated in the stone-feather free fall experiment.

Example M

The convention that a green traffic light and a red one taking turns to signal moving and stopping one's car respectively is a regularity. It is the 'semantics' of traffic light. This conventional regularity is extremely reliable; otherwise, the society would have to incur a big cost from traffic congestions or even accidents. Reliability of traffic lights comes from at least two sources. On the one hand, given that a traffic light is an electrical device, the regularity provided by the laws of electricity guarantees part of the reliability of the light.[19] On the other hand, the commitment of implementing the convention also affects its reliability. While electricity laws may not fail, the police might choose to replace the traffic light with a policeman in case of traffic accidents. With the traffic flow at the hands of a policeman, the conventional regularity of the traffic light (if still on) breaks down and becomes fallible (e.g. a green light now does not signal moving).

[19] Actually, there are countless preconditions; for example, the wires inside the light should be connected properly.

6. Communication with the Use of Declarative Sentences

6.1 Direct vs Indirect Evidence of the Speaker's Intended Message

When a speaker wants to communicate a message to an audience, providing direct evidence of that message to her seems to be the most effective way whenever possible. Suppose Peter wants to communicate the message to Mary that John has broken his leg, which is now bleeding. This is really easy; all Peter needs is to show John's wounded leg to Mary. In terms of relevance theory, Peter is providing direct evidence of his message. In terms of situation theory, he is presenting the actual situation of John's broken leg; he 'describes' that situation by directly showing it to an audience.

When showing direct evidence of the speaker's intended message is not possible, providing indirect evidence also works. Suppose John suffers from a broken leg from the inside, with no visible wound on the surface. Showing his leg this time does not help much, since Mary is not able to see through his skin. However, he can get an X-ray photo of his leg and show it to Mary. The photo serves as a piece of indirect evidence of his message. Although the X-ray photo is not direct evidence of his broken leg, it is close enough given the technology governing the relationship between an object and its X-ray photo (Barwise & Perry 1983: 16-17). The photo gives a true description of the situation of John's leg, though no more true than the actual situation itself.

6.2 Using Language as Providing Indirect Evidence of Speaker's Message

Language provides a way for a speaker to convey his message when direct evidence of his message cannot for various reasons be provided (Sperber & Wilson 1986/95: 22). Suppose X-ray technology had not been invented, or for whatever reasons he could not get an X-ray scanning. Peter can still convey his message to Mary that John has broken his leg by saying (9a), i.e. by uttering these words '*John's* - *leg* - *was* - *broken*.' In terms of situation theory, the situation in which these words (i.e. sentence 9b) are uttered serves as indirect evidence for the situation of John's leg; Peter is using the sentence to describe John's leg situation.

9a. Peter: John's leg was broken

b. Sentence: *John's leg was broken*

According to the regularity model, the notions of situations, types of situations and regularities are enough to explain how the communication of speaker message is possible with the use of a declarative sentence (e.g. Barwise 1984). The story is like this. Within the English speech communities, sentence (9b) carries with it a regularity ($U \Rightarrow D$) relating two types of situations, namely the type U of utterance situations in which (9b) is uttered and the type D of described situations in which John's leg is broken. Since Peter utters (9b), it is an utterance situation of type *U*. This utterance situation will carry the information (due to *U* => *D*) that the described situation is of type *D*, which implies that the described situation is one in which John's leg is broken. It is the regularity carried by sentence (9b) that makes the flow of Peter's message to his audience possible.

When the sentence uttered involves indexicals (e.g. pronouns), the regularity model still works. Consider the sentence *He broke it*. Utterances of this sentence share a common type *U*, namely the type of situations in which the sentence *He broke it* is uttered. On the other hand, all situations in which a male *M* broke something *X* share a common type *D*, namely the type in which a male broke something. Furthermore, the English language guarantees that there is a regularity holding between type *U* and type *D*. Now, suppose that Mary asks Peter who broke John's leg in (10a), and Peter replies with (10b), with 'he' intending Jack and 'it' intending John's leg. The utterance situation of Peter's reply carries the information (due to the regularity *U* => *D*) that the described situation is of type *D*, namely a situation in which a male *M* broke something *X*. Since Peter intends 'he' as Jack and 'it' as John's leg, *M* gets instantiated as Jack and *X* as John's leg. In other words, the described situation must be that Jack broke John's leg.

10a. Mary: Who broke John's leg?

b. Peter: He broke it

In brief, Peter's communication with Mary in (9) and (10) is adequately explained with the regularity model.

7. Summary and Conclusion

There are three distinct but related questions concerning the nature communication: How communication is possible? What is communicated? How to recover the communicated message? We have argued with the claims of situation theory that it is the presence of regularities between types of situations that makes communication possible. They allow the speaker's message (a kind of information) to flow to the hearer, and the communicated message is a situation being of a certain type. In this way, situation theory has provided answers to the first two questions.

This regularity view of meaning (i.e. the relation theory of meaning) and its implications for communication are not shared by modern pragmatics, and are therefore unique to situation theory. An added advantage of this situation-theoretic view is that it provides a possible way to formalize the process of explicit communication. This shall be the subject matter of Chapter 4.

For the third question of how the communicated message is recovered, we shall demonstrate in the next chapter that the regularity model also works, but we need the help of the notion of relevance and the relevance-theoretic comprehension procedure before we can offer a satisfactory answer. We shall study this in the next chapter.

Chapter 2

Remodeling the Concept of Explicature from a Situation-Theoretic Perspective

EXPLICATURE IS A concept of meaning proposed by the relevance theory. It is the best hypothesis of the explicitly intended meaning (content) of a speaker's utterance in a particular communicative occasion. The hypothesis is derived by the hearer in an inferential process, namely the explicating process, with the guidance of relevance. In this chapter, we shall bring the concept of explicature to fit the situation theoretic regularity model. Specifically, we shall argue that our regularity model also works with the communication of explicit speaker meaning. We will show how regularities allow contextual information to flow to the hearer for his identification of an utterance's explicature. In this way, we are able to answer the third question in Chapter 1: How is the communicated message recovered?

The recovery of the speaker's message, whether explicit or implicit, is ultimately the job of the hearer. Situation theory has in principle explained how regularities allow the speaker's message to flow to the hearer. However, we regard the explanation as incomplete because it does not address how the recovery is possible when the semantic value of a sentence underdetermines the intended message conveyed by the use of that sentence. For example, how does the hearer identify what the linguistic expression ‘he’ is referring to, or what the ellipsis part in ‘I haven’t’ is, in a concrete exchange? So, our work in this chapter can be seen as complementary to the situation-theoretic view of communication.

We shall first review the relation theory of meaning in situation theory and other conceptions of meaning in modern pragmatics. Next, we review the phenomenon of underdeterminacy and its possible causes. After that we look critically at the notion of explicit meaning and pin down a workable domain for explicature. Then, we shall discuss how the hearer arrives at the explicature of an utterance in the explicating process. More specifically, we shall argue that the guidance of relevance can be built into an Input-Context-Conclusion regularity on which the derivation of explicature is based. The contribution of contextual information to the identification of explicature is possible in virtue of such a regularity, because it allows those information to flow to the hearer for the comprehension of explicit meaning.

1. Various Understandings of ‘Meaning’

‘What is meaning’ is surely a philosophical question or enquiry, but that some sounds or marks are *meaningful* is clearly an objective phenomenon or observation. There may be many versions of what meaning is supposed to be, but there seems to be only one sense for a stream of sounds or a string of marks to be meaningful. According to Barwise & Perry (1983: 1), they are meaningful in virtue of the objective fact that they ‘can be used to convey information’ about the outer world or our inner mind. This consideration opened up a completely new perspective for the concept of *meaning*. The idea is that meaning should be studied within a general theory of information flow. One the one hand, a word or a sentence is meaningful not so much because it possesses a ‘meaning’ as because it can be used to convey information, things we will not dismiss as nonsense. On the other hand, a word or a sentence may be said to possess or carry a thing called ‘meaning’ in virtue of the fact that this meaning allows speakers to convey information (ibid: 37). From this information perspective, situation theory then asked two questions:

(i) In virtue of what can a linguistic expression be used to convey information (i.e. what is the nature or essence of a meaning)?

(ii) What information does it thereby convey (i.e. what meaningful content is conveyed through the use of a linguistic expression, which carries with it a meaning)?

Situation theory provides very clear answers to these two questions in general (i.e. not restricted to natural language expressions):

(i) It is the systematic relations, namely regularities, holding between types of situations that allow the conveyance of information. (So, a meaning is a regularity)

(ii) The information conveyed by a particular situation *s* is another situation *s'* being of a certain type *T*. (So, the content carried by *s* is the claim that *s'* is of type *T*)

Situation theory calls the conventional regularity associated with a declarative sentence the *meaning* of the sentence, and calls the information conveyed in an occasion of use of the sentence the *content* of that use, and whatever the speaker is intended to convey the *author meaning* (Barwise 1986c). Such a view of meaning is called the *relation theory of meaning*, that is, meanings are not something in the world but 'relations of something' in the world.

Within the situation-theoretic framework, we may regard the type of situations described by a declarative sentence via its associated conventional regularity as the 'semantic value' of the sentence. Thus, the semantic value of the sentence *John is talking with her* is the type of situations in which John is talking with a female, who is referred to by 'her' and is to be identified by the hearer according to actual context. These notions of the semantic value of a sentence, content and author meaning correspond respectively to 'sentence meaning', explicit speaker meaning and full speaker (utterance) meaning in relevance theory (Figure 2-1). Although the correspondence is a neat one, it is by no means a matter of terminology. Thus, the meaning structure of situation theory comes from the regularities that support information flow, whereas relevance theory presupposes some semantic encodings for words specified by a grammar.

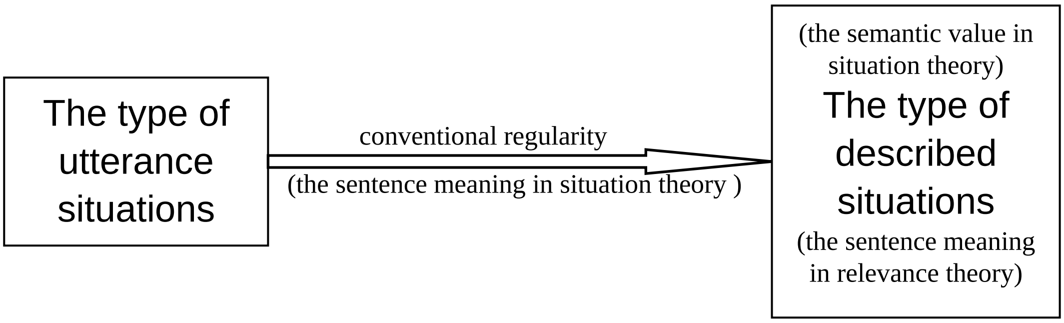

Figure 2-1

The situation-theoretic view of sentence meaning can dispel some puzzles about the notion of meaning in linguistics and philosophy of language. Here we give two instances. First, it is sometimes said that it is misleading to think of a sentence as ‘having a meaning’ (e.g. Hofmann 1993: 9). We are cautioned that a sentence gets its meaning only when a context of use is specified, and that since it can be used in many contexts, it is ‘pointless’ to say that it has a meaning. However, such a conception of meaning is actually what modern pragmatics refers to as speaker meaning. Situation theory argues that sentences like (1) and (2) do have *fixed* meanings independent of the context of use (Barwise 1986c, 1989), since these sentences can be and have been used to convey information under many different contexts, and are therefore meaningful linguistic expressions. If a sentence is meaningful, it is legitimate for it to have a 'meaning,' a thing that is responsible for its being meaningful.

1. *I am a philosopher*

2. *I need you*

A second puzzle concerns the role of truth conditions of sentences. The meaning of a sentence is frequently identified with its truth condition. One conception of truth conditions is through the T-sentences introduced in Davidson (1967). A T-sentence is of the form '*S* is true if and only if *p*' where p is the truth condition of the sentence S. For example, since we have T-sentence (3a), the truth condition of the sentence *Snow is white*, and hence the meaning, is 'snow is white.' Although T-sentence as a characterization of sentence meaning has its own advantage (e.g. enabling to model compositionality of language), this concept is not without problem. For example, since we have the T-sentence (3b), the sentence meaning of *Snow is white* will also be 'snow is white and 2 plus 5 equals 7.' But this is of course counter-intuitive.

3a. *Snow is white* if and only if snow is white

b. *Snow is white* if and only if snow is white and 2 plus 5 equals 7

Another conception of the truth condition of a sentence is that it is the condition under which the sentence can be used to make a true statement. But what is such a condition? It seems that there is no concrete description of what such a condition is in the literature. It is our view that situation theory can offer one. Consider sentence (4a) *Joe is eating*. What is its truth condition? Is it not a situation in which Joe is eating that will make 'Joe is eating' a true statement? In other words, the truth condition of (4a) is exactly the type of situations in which Joe is eating. Any situation of this type will make 'Joe is eating' a true statement. As a result, from a situation-theoretic point of view, the concept of truth condition is just the type of described situations referred to by a sentence. Moreover, this seems to be the correct way to construe truth conditions. Indeed, consider sentence (4b). Apparently, (4a) and (4b) are both true or both false under any condition, and so it seems that they have the same meaning. However, this is in fact not the case as long as we admit that situations are *limited*, *partial* parts of the reality, as opposed to the *whole* world. (4a) refers to all situations in which Joe is eating, whereas (4b) refers to those situations in which Joe is eating and Sarah is sleeping *plus* those situations in which Joe is eating and Sarah is not sleeping. Since the collection referred to in (4a) contains many situations in which Sarah is *not* present (due to partiality of situation), so it is not the same as the collection referred to in (4b). Thus, situation theory reflects the semantic difference between (4a) and (4b) through the consideration of situations (Barwise & Perry 1983:

25-26).

4a. *Joe is eating*.

b. *Joe is eating and Sarah is sleeping or Sarah isn't sleeping*.

The upshot is that: on the situation-theoretic account, the truth condition of a sentence is *not* the sentence's meaning but merely its semantic value (i.e. the type of situations referred to).

2. Linguistic Underdeterminacy

An interaction between the use of a sentence or linguistic expression with the embedding context leads to an important phenomenon in pragmatics, that of the semantic value of a sentence underdetermining the speaker meaning conveyed by the use of that sentence, or simply linguistic *underdeterminacy*. Since the discussion in Grice (1975), the phenomenon has triggered a number of interesting issues, which have been discussed actively in Bach (1994), Blakemore (1992), Carston (1988, 2002), Horn (1984), Jiang (2005), Levinson (1983, 2000a), Recanati (1989, 1993), Sperber & Wilson (1986/95), among many others. Although controversies concerning particular issues still remain, it has become generally agreed that underdeterminacy almost invariably exists. We now survey some major cases of this phenomenon.

2.1 Underdeterminacy Involving the Conveyance of Implicit Meaning

Underdeterminacy can be phrased roughly as the phenomenon of 'more is communicated than the literal meaning,' however one construes the notion of literal meaning. A prominent case is what Grice (1975) called a conversational implicature. To quote one of his famous examples, when the speaker chose to say (5a) instead of (5b), she not only communicated to her audience the literal meaning of (5a), but also the intended implicit meaning that Miss X had sung very poorly, which was presumably something that she did not take the risk of saying openly. This is certainly a case of literal meaning underdetermining speaker meaning, because the literal meaning alone of (5a) does not contain the message 'Miss X had sung very poorly.' Other familiar cases of underdeterminacy arising from conversational implicatures are figurative uses of language like metaphors and ironies[20]. Thus, by flouting the first maxim of Quality 'Do not say what you believe to be false,' (6a) can speaker mean ironically 'X is a bad friend' and (6b) can mean metaphorically 'You are my pride and joy.' Thus, the literal meanings in (6a) and (6b) underdetermine (in fact are completely different from) their speaker meanings.

5a. Miss X produced a series of sounds that corresponded closely with the score of 'Home Sweet Home'

[20] Note that in relevance theory, irony is analyzed as higher-level explicature, not implicature.

b. Miss X sang ‘Home Sweet Home’

6a. X is a fine friend

b. You are the cream in my coffee

2.2 Underdeterminacy Involving the Conveyance of Explicit Meaning

The semantic value of a sentence used (or roughly the literally meaning) said may also underdetermine the speaker meaning at the explicit level. Roughly, explicit meanings or contents are that part of the intended meanings ‘said’ or ‘stated’ by the speakers. It is generally accepted that referents assigned to indexicals (or other singular noun phrases like *the man*, *Clinton*, etc) and word senses after disambiguation are parts of the explicit contents of utterances. Thus, the literal meaning of utterance (7) obviously underdetermines the explicit speaker meaning, since whom ‘He’ refers to is not known, ‘saw’ may be an action or a tool, ‘her duck’ might mean a female’s duck (an animal) or the action of pulling down one’s head.

7. He saw her duck

Within the relevance-theoretic framework, Carston (1988) first drew our attention to cases in which explicit speaker meanings might be underdetermined subtly by literal meaning (or in relevance-theoretic usage ‘sentence meaning’). This immediately raised the controversial issue of what qualifies as explicit. Consider utterance (8a), which is usually taken to mean (8b):

8a. John took out the key *and* opened the door

b. John took out the key *and then* opened the door

But did the speaker mean (8b) explicitly? All accounts agree that *and* is only a logical connective conjoining two events, but they diverge on where the extra temporal meaning should go. Relevance theory argues that the temporal connotation of *and* should be counted as part of the explicit content of (8a), while Grice (1975), Bach (1994), and Levinson (2000a) regarded it as implicitly conveyed. Therefore, on the relevance-theoretic account, (8a)'s 'sentence meaning' even underdetermines its explicit speaker meaning. We shall discuss in more detail the explicit/implicit demarcation in the next section.

2.3 Cases of Explicit Meaning Underdeterminacy

On the relevance-theoretic account of Carston (2004), cases in which underdeterminacy occurs at the explicit level can be grouped into four categories. Jiang (2005) has surveyed from the relevance theory literature a list of (putative) examples as follows:

Structural ambiguity

Utterances that can be assigned more than one syntactic structure:

9. He was writing advertisements on the train

According to Jiang, there are two readings for (9) due to two possible syntactic structures: (i) the prepositional phrase *on the train* qualifies the predicate verb *write*; (ii) the prepositional phrase qualifies the subject *He*. For (i), (9) may mean that he, standing on the platform, was writing advertisements onto the train, while for (ii), it may mean that he, being on the train, was writing advertisements, say, with a notebook computer. So, the ambiguity in meaning stems from the possible assignment of two distinct syntactic structures to the utterance.

Indexicality or quasi-indexicality

The sentence meaning is semantically incomplete due to the presence of indexicals or quasi-indexicals:

10. She put it there

(Mary put the book on the table.)

11. Jasmine tea is better [than what?]

(Jasmine tea is better than lemon tea.)

12. It's hot enough [for what?]

(It's hot enough for a bath.)

Ad hoc use of lexical items

Words are not used in accordance with their usual lexical meaning:

13. A *tired* tapas is worse than anything

(A tapas that is not freshly prepared enough is worse than anything)

14. The beef steak is too *old*

(The beef steak is overdone.)

Free constituents (three subcategories)

A. Uninformative Statements

The literal meaning is a trivial truth or an obvious falsity, so that the utterance does not seem to convey any useful information:

15. It'll take time for your knee to heal

(It'll take quite a long time for your knee to heal.)

16. He's a person with a brain

(He's a person with a good brain.)

17. Emily has a temperature

(Emily has an above normal temperature.)

B. Hidden information

Extra information is hided in some lexical items, like the logical connectives *and*, *if*:

18. Jack and Jill went up the hill

(Jack and Jill went up the hill together.)

19. Sue got a Ph.D. and became a lecturer

(Sue got a Ph.D. and then became a lecturer.)

20. I'll give you £10 if you mow the lawn

(I'll give you £10 if and only if you mow the lawn.)

C. Subsentential utterances

Sentence fragments or even words are used to convey speaker meaning:

21. Water

(Give me water / I want some water / Get me some water / I want to buy some water / …)

22. A torch A torch

(Get a torch / Use a torch / You need a torch / …)

To sum up, the implication of underdeterminacy is that hearers cannot arrive at the full speaker meanings by merely attending to the conventional senses of the sentences or expressions uttered, and for some (and possibly all) cases underdeterminacy even occurs at the level of explicit meaning. As far as explicit meaning is concerned, therefore, hearers have to identify the explicit speaker meanings through inferences. This leads to the concepts of explicating process and explicature.

2.4 Possible Causes of Underdeterminacy

Sociocultural Reasons

It is uncontroversial that sociocultural factors, like politeness, are one source for underdeterminacy. Modern pragmatics and sociolinguistics literatures have demonstrated that social and cultural factors frequently motivate the communication of conversational implicatures. Politeness consideration that triggers indirect speech acts, like 'I'm feeling cold,' is another example.

Argument from Design

Levinson (2000a) argued that it is the 'design flaws' of our speech articulation apparatus that trigger underdeterminacy. Drawing on evidence from phonetics and psycholinguistic researches on speech production and comprehension, he concluded that there is a mismatch between actual speech articulation rate and speech comprehension rate. The mismatch is caused by the observation that 'human speech encoding is relatively very slow: the actual process of phonetic articulation is a bottleneck in a system that can otherwise run about four times faster.'(6) The consequence is that the use of inference will make communication 'gain speed', thereby making it more efficient, so that inference becomes 'cheap' and articulation 'expensive' (28-29). It seems that this is a reasonable observation. After all, humans are economical animals. In the communication of explicit contents, letting inference do part of the articulation job can save some speech production cost, gaining efficiency.[21] If there is so to speak a division of labour between inference and speech production, underdeterminacy seems unavoidable.

Efficiency of Language

Situation theory offers another perspective for the efficiency of language use that triggers underdeterminacy. The observation is that the same expressions of a language can be used again and again by different people in different occasions to convey different contents (Barwise & Perry 1983: 5, 32). For example, if Jacks says to Rose, 'I need you,' then the utterance means 'Jack needs Rose.' If in another occasion Mary says to Peter, 'I need you,' the utterance now means 'Mary needs Peter.' In both cases, the contents are different but the sentence *I need you* used is one and the same with a fixed sentence meaning. Hence, a linguistic expression can be recycled by users to convey different information. It is in this sense that situation theory says language is efficient. With such a conception of efficiency, underdeterminacy *is* also unavoidable.

3. Explicit Meaning and Explicature

3.1 Explicit Meaning

What is explicit meaning, anyway? According to relevance theory, an 'explicitly

[21] There is more cost-benefit evidence from Zipf (1949) and Horn (1984, 1989).

communicated content (or explicature)' is a 'proposition recovered by a combination of decoding and inference' (Wilson & Sperber 2004)[22]; the explicit meaning of an utterance is the 'proposition explicitly expressed' and 'communicated' by that utterance (Carston 1988). By 'communicated', it is meant 'intentionally communicated.' We think that it is not immediately clear from these elaborations which part of the speaker meaning is explicit. But at least two points are uncontroversial:

(i) Explicit speaker meaning of an utterance is a determinate proposition;

(ii) It is intended by the speaker.

From (i) and (ii), it is easy to see that referents and senses assigned to indexicals and ambiguous words are parts of the explicit speaker contents. If John says 'He saw her duck,' then he must be intending a person for 'He' and senses for 'saw', 'her' and 'duck', all of which taken together will form a determinate proposition. For the case of structural ambiguity, the speaker is also intending a definite proposition, which is the explicit content of the utterance concerned.

For quasi-indexicals, they represent a kind of semantic incompleteness. Examples like (11) and (12) above cannot be conveying complete propositions; one cannot specify the types of situations being described without completing them as, say,

[22] Note that explicitly communicated content is what the speaker intended to convey explicitly, while explicature is a hypothesis of this content constructed by the hearer. So, there is a conflation of the two by Wilson and Sperber in this particular quotation.

‘better than lemon tea’ and ‘enough for a bath.’ The lexical items *-er* and *enough* invite the hearer to identified the complete propositions explicitly intended. The case of subsentential utterances can be analyzed along the same line of semantic incompleteness; there must be some propositions explicitly intended in such subsentential utterances. For *ad hoc* use of lexical items, we can also treat it as a kind of word sense ambiguity. The explicitly intended sense of an *ad hoc* concept contributes to the proposition explicitly intended by the speaker.

The case of uninformative statements seems to be more subtle. Some utterances appear literally uninformative, if only they are obviously true or false. Thus, when the mobile phone service provider Orange Co. Ltd. was inaugurated in Britain by the Hong Kong tycoon Mr. Li Ka-shing a few years ago, Li and the British Prime Minister Tony Blair, who is in the ceremony, had the following exchange in (23). What Blair had conveyed was a complete proposition, which is a trivial truth. But this did not in the least make the proposition uninformative. The question is what content was explicitly intended by Blair.

23a. Li: I hope it (Orange) works

b. Blair: I'm sure something will happen

One approach is to propose that the explicit proposition intended by an uninformative statement contains a *free adjunct* from elaboration (Yuen 2002). The adjunct can be a member of a scale to be inferred by the hearer for an informative proposition. For utterances like (16) and (17), ‘a brain’ can be a/an <bad, normal, good, very good or excellent> brain; ‘a temperature’ can be a <very low, low, high, very high> temperature, or can be a temperature <far below, at, above, far above> normal level. Intuitively, the explicit contents intended by these speakers should have been ‘He is a person with a good brain’ and ‘Emily has a temperature above normal level,’ which supposedly they would not deny. Blair’s explicit content must have been ‘I’m sure that something *unusual* will happen,’ which is an assertion supposedly he would not deny. However, Jiang (2005) notes that free adjuncts from elaboration may be too free, and suggests that the case of uninformative statements could be analyzed as understatements or loose talks.

To sum up, the explicit content of an utterance must be that part of the speaker meaning that is intended by the speaker and is a complete proposition. In the case of the presence of semantic incompleteness, the hearer has to use inference to supply the omitted elements to get a complete proposition, which is seen to be a hypothesis of the explicit content. Semantic incompleteness may associate with indexicals or quasi-indexicals, lexical or structural ambiguities, domains of quantification and subsentential utterances.

3.2 Explicature and the Problem of 'And'

The case of *and* in the hidden information category is much more controversial. Consider utterance (18) 'Jack and Jill went up the hill.' On the relevance-theoretic account, the 'explicature' is 'Jack and Jill went up the hill together.' But Bach (1994, 2000) argued that the togetherness of the two events conjoined by *and* is only implicit, and so strictly speaking may not be the explicit content of the utterance, anymore than 'Jack and his sister Jill get married together' is the explicit content of utterance 'Jack and his sister Jill get married.' Bach called this kind of meaning an *impliciture* as opposed to explicit content and implicature. For Grice (1975) and Levinson (2000a), it is analyzed as an implicature arising from the observance of pragmatic maxims that come from without the linguistic system.

Let us call the relevance-theoretic position on the pragmatic analysis of *and* the explicature analysis. Carston (1988, 2002) gave some arguments for the explicature analysis of *and*. The gist is to invoke the assumption that explicature and implicature must not overlap in content. This assumption is known as the *principle of functional independence*, the idea of which is that 'explicature and implicature should play independent roles in the mental life of the hearer' (2002: 189). Carston claims that to analyze the extralinguistic sense of *and* as part of the implicit content would violate this principle. To see this, if 'Jack and Jill went up the hill together' is to be an implicature of (18), the logical conjoin of the two events 'Jack went up the hill' and 'Jill went up the hill' will have to be the explicature. Then, this implicature would 'entail' the explicature. The consequence is that the explicature would play no role in the hearer's mind as premises for later pragmatic inferences for further contextual implications. And if it has no such a role to play, (Carston asked) what would be the possible function of such an explicature? Hence, the extralinguistic sense of *and* must not be analyzed as implicit.

For more evidence, Carston quoted several famous examples from various sources to argue further against an implicature analysis of *and*:

24. If the old king died of a heart attack *and* a republic was declared Sam will be happy, but if a republic was declared *and* the old king died of a heart attack Sam will be unhappy. (If A & B then Q, but if B & A, then not Q)
25. He didn't steal some money *and* go to the bank; he went to the bank *and* stole some money. (Not A & B; B & A)
26. It's better to meet the love of your life *and* get married than to get married *and* meet the love o your life. (Its better to A & B than B & A)

If the temporal connotation of *and* in these utterances is analyzed as part of the implicit meaning, then the explicit meaning of (24) and (25) will be contradictory, and that of (26) will be nonsensical. Hence, Carston argued that the temporal connotation of *and* in these utterances should be analyzed as explicit.

Nevertheless, the explicature analysis of *and* seems to face some difficulties. Specifically, we think that it is not a correct way to make the principle of functional independence serve as a demarcation for implicit and explicit contents. This is because it is the *intention* of the speaker that determines something as explicit and implicit. If an assertion is openly denied but covertly admitted by a speaker as intended, it is in no way part of the explicit content. In view of this, the explicature analysis of *and* seems to be problematic in some cases. Consider the utterance (27a):

27a. Mr. Jones has been insulted and he's going to resign

b. Mr. Jones has been insulted and *as a result* he's going to resign.

It is controversial to claim that the speaker explicitly meant that Mr. Jones has been insulted and *as a result* he's going to resign. This is because (i) the speaker might openly deny that this is what he explicitly meant (i.e. (27b) is not overtly intended); (ii) the speaker might not know whether Mr. Jones' being insulted is the cause of his resignation; he might want to know, and in that case he was merely stating the two events in such an order as to trigger information from his audience; (iii) or that the speaker is quite sure that Mr. Jones' being insulted was the cause, but just want to let the hearer infer it to avoid putting words in his own mouth (i.e. (27b) will be covertly intended), and in that case the causal connection must not be taken as explicit.

The explicature analysis of *and* might be defended by invoking the notion of *defeasibility*. On the relevance-theoretic account, an explicature is just a hypothesis made by the hearer about the explicitly intended speaker meaning, though an inference to the best explanation. And if it is just a hypothesis, it might nevertheless go wrong. Explicature as a derivational or an inferential concept is, therefore, defeasible. Hence, on the relevance-theoretic view, if the explicature gets the intended explicit content wrong, this is natural because defeasibility *is* a property of explicature.

Nevertheless, we believe that it is the notion of defeasibility that seems to deal a hard blow to the explicature analysis of *and*. Although explicature as an inferential hypothesis is defeasible by the hearer, the explicitness/implicitness of the speaker's intention cannot be canceled by the hearer. Something that is intended as an implicature by the speaker can in no way be canceled; and if it is canceled, it is the speaker who does it, not the hearer. Consider the following example. Suppose someone says:

28. John loves her

and the hearer interprets it as 'John loves Mary' when in fact the speaker actually intended 'John loves Rose.' Although the hearer has got the referent wrong, she is nevertheless correct at the explicit/implicit level, because letting his audience know that John has a loved object (referred to by ‘her’) is indeed the explicit intention of the speaker. In this case, it is legitimate to call the hearer’s interpretation ‘John loves Mary’ an explicature (although the interpretation is a wrong one). But the analysis of *and* is a completely different picture, as already noted by Bach. In (27), if the causal connection is indeed intended implicitly by the speaker, then the alleged explicature will be defeasible/wrong at the explicit/implicit level. And if an explicature is defeasible at this level, this will make an explicature analysis very inadequate, because it is the level of explicitness/implicitness that lies at the heart of language use. The explicature analysis will make a wrong prediction in every conceivable implicitly intended use of *and*; every such case will falsify the explicature analysis.

3.3 Summary: A Workable Domain for Explicature

In summary, we have argued that for a workable domain of explicature, it is necessary to restrict our consideration to semantic incompleteness caused by indexicals, word sense ambiguities, domains of quantifications and subsentential utterances. Since syntactic incompleteness entails semantic incompleteness, syntactically incomplete utterances like (29b) surely admit an explicature analysis and may admit an explicature ‘A has eaten dinner.’ However, beyond the level of semantic completeness, an explicature analysis might not be justified, and is even hard to defend in some cases (like that of *and*).

29a. Q: Do you want to join us for dinner?

b. A: No thanks; I've eaten

4. The Explicating Process

Situation-theoretic regularity model is essentially a speaker-oriented theory of communication: it studies what it is that a speaker uses a sentence to convey information. However, language use typically involves both the speaker and the hearer; the speaker states and the hearer comprehends. In contrast, what relevance theory distinguishes itself from other pragmatic theories is its shift of attention to the hearer side. It focuses on the comprehension of utterances and defines pragmatics as the study of how the hearer bridges the gap between encoded meaning of sentences (i.e. the semantic value) and speaker meaning (Wilson 2004).

4.1 A Role for the Hearer: From Statement to Comprehension

There is some evidence for an active role of the hearer to play in a communication process. A first observation comes from the referential use of definite descriptions and pronouns. Consider an exchange at the end of a lesson in (30). John's classmate still understood what John has said in (30a) even though she knew that John has got wrong with the title of the teacher, who is in fact (say) a senior lecturer, not a professor. When his classmate replied with (30b), John understood him perfectly, though this time it is his classmate that has got wrong; their teacher is actually a woman! This is a phenomenon that has to be explained by an adequate theory of communication.

30a. John: The Professor has just announced that delayed assignments will not be marked

b. Classmate: All right; he is really not as nice as we thought

Another frequently observed phenomenon is the slips of the tongue (Sperber & Wilson 1986/95, Wilson 2004, Blakemore 1992). A speaker might make a slip of the tongue as in (31a), when in fact what he wants to convey is (31b). According to relevance theory, if the hearer knows that there are no penguins in Trafalgar Square, she has two ways to conceive of the speaker: either he is irrational or he is rational. Having assumed that the speaker is rational, together with the fact that *penguin* is phonologically related to *pigeon*, and that many people like feeding pigeons in Trafalgar Square, she would take (31b) as the best interpretation of the utterance.

31a. I like to feed the penguins in Trafalgar Square

b. I like to feed the pigeons in Trafalgar Square

These two phenomena demonstrate enough that although sentence’s encoded meaning can underdetermine speaker meaning in an unusual way, communication can still proceed unimpeded. We therefore need to explain how the hearer works out or infers the speaker meaning.

4.2 Explicating: From Logical Form to Explicature

From a hearer perspective, relevance theory defines *explicating* as an inferential comprehension process in which the hearer starts processing from the encoded meaning of a sentence uttered for the best hypothesis of the explicit speaker content of the utterance. The encoded meaning, according to relevance theory, is known as the 'logical form' of the utterance; the hypothesis is the explicature. Due to underdeterminacy, the logical form is typically incomplete. The hearer has to use her inferential ability to *enrich* or *develop* the logical form into a determinate, complete propositional form (i.e. a semantic representation of the proposition explicitly expressed), which is regarded as a hypothesis about the explicit speaker meaning.

With regard to the definition of the concept of explicature, two representatives are found in the literature, with an additional definition for the notion of development of a logical form:

> **Explicitness**
>
> An assumption communicated by an utterance *U* is explicit iff it is a development of a logical form encoded by *U*. (Sperber & Wilson 1986/95)

Explicature

> An ostensively communicated assumption which is inferentially developed from one of the incomplete conceptual representations (logical forms) encoded by the utterance. (Carston 2002)

Development

> The notion of development of a logical form is meant to cover the various pragmatic processes needed to flesh out the encoded sentence meaning into a hypothesis about the speaker's explicit meaning. (Wilson 2004)

As an example, consider the utterance (11) 'She put it there.' The logical form can be represented as

PUT (*X*, *Y*, *l*),

where PUT represents the predicate *put* with *X* (the referent of *She*) playing the role of agent, *Y* (the referent of *it*) the role of patient and *l* (the referent of *there*) the location of *Y*. This logical form as a semantic representation of the sentence meaning is incomplete; it does not determine a definite proposition. Now the hearer has to inferentially develop this logical form into a complete propositional form as a semantic representation for the proposition explicitly expressed. With his cognitive ability, the hearer may, to his best effort, infer that *She* is referring to, say, Mary; *it* referring to Peter's book; and *there* referring to the table. Thus after development, the enriched logical form becomes

PUT (Mary, Peter's book, the table).

So, the explicature, which is hypothesized as the proposition explicitly expressed by the speaker, has been explicated as 'Mary put Peter's book on the table.'

4.3 The Status of Development or Enrichment

There have been some objections to the fleshing out strategy for the recovery of the explicit speaker content. Thus, situation theory held that such a strategy by which a context dependent sentence is replaced by less context dependent one is 'wrongheaded' and 'unworkable' (Barwise 1986a). It claimed that the strategy conflates sentences with statements, meanings with contents; what a sentence provides is the type of the described situations, whereas what a statement provides is a specific proposition that a certain situation is of a certain type. Levinson (2000b: 293), among others, seems to object to the strategy on the grounds that 'the more you say, the more you implicate that something untoward is intended,' so that 'in principle it is not possible to express exactly the thought corresponding to what you say.' Thus according to Levinson, saying (32a) is not equal to saying (32b), because (32b) will implicate 'All of my book might well have been missing,' which may not be intended.

32a. Some of the books I own are missing

b. Some but not all of the books I own are missing

However, we believe that these two objections are built completely on a speaker-oriented perspective. From a hearer perspective to which relevance theory is committed, explicature is derived by the hearer as a *proposition* expressed by the fleshed out or enriched sentence, not the sentence itself (a reply to situation theory). On the other hand, relevance theory does not claim that the speaker might as well have said (32b); rather, it just claims that the proposition expressed by the fleshed out (32b) might well be the explicitly intended content (a reply to Levinson).

4.4 Logical Form and Proposition

According to relevance theory (Sperber & Wilson 1986/95: 72), logical forms are well-formed formulae responsible for the logical properties of conceptual representations, making these representations capable of implying or contradicting one another and of undergoing deductive rules. And propositional forms are logical forms that are semantically complete, hence capable of being true or false. On this account, propositions are represented by propositional forms.

However, situation theory largely ignores the status of logical forms, which are the main tools of a Davidsonian type of truth-conditional semantics. On the one hand, according to Barwise (1989: 4), model-theoretic semantics, on which situation theory was based, treats valid entailments as valid in virtue of contents, not of forms. On the other hand, situation theory has its own conception of a proposition, namely the claim that *s* is of type σ. For example, suppose that someone says 'John loves Mary.' The speaker is describing (or stating the existence of) a specific situation *s*. This *s* must be of certain type σ in order that it qualifies to be so stated within the speech community concerned. Hence, what the speaker is claiming is just that *s* is of type σ. But what is this type? It must be the type in which John loves Mary (one possible scenario may be that they are kissing), which arises from a classification or individuation scheme by humans. Cats or rats or other animals may have their own schemes of classification.

In situation theory, a proposition '*s* is of type σ' is formally represented as

$$s \models \sigma,$$

which is read as 'the situation *s* supports the type σ.' While situation *s* is taken as a primitive not to be modeled by anything, a type of situations, which is a realistic entity, is to be modeled by an *infon* (Barwise 1986d, 1988a; Cooper 1988, 1991; Devlin 1990), which is understood in the present study as a formal construct. An infon is sometimes referred to as a *fact* or a *state of affairs* in the literature on situation theory. But due to the heavy philosophical connotations of these two terms on the one hand, and the possible confusion to which they might give rise between realistic phenomena and formal constructs on the other, we shall stick to the term 'infon', a new term created during the later development of situation theory. An infon is represented as

<<*R*, *l*, *a*, *b*, …; 1>>

if individuals *a*, *b*, … stand in relation *R* at the space-time location *l*. It is written as

<<*R*, *l*, *a*, *b*, …; 0>>

if *a*, *b*, … do not stand in relation *R* at *l*. A relation is also a primitive in situation theory. The argument *l* can be optionally filled (Barwise 1986d). As illustrations, the type of situations in which John loves Mary can be represented as

<<*LOVE*, *J*, *M*; 1>>

where *J* = John and *M* = Mary; the type in which John does not love Mary is

<<*LOVE*, *J*, *M*; 0>>.

The proposition ‘John loves Mary’ is the claim that the situation *s* (e.g. the field of vision that the speaker is seeing) is of type <<*LOVE*, *J*, *M*; 1>>. This proposition is represented as

s |= <<*LOVE*, *J*, *M*; 1>>.

The proposition that John does not loves Mary is represented as

s |= <<*LOVE*, *J*, *M*; 0>>.

In the present study, we decide to follow the situation-theoretic view of proposition. However, we do not see how a ‘logical form’ understood in relevance theory differs significantly from an infon, as far as formalization is concerned. As suggested by Cooper (1988), things can be treated axiomatically. On this view, a logical form or an infon or anything is only a methodological device, not an ontological concept. So long as it fits our purpose of investigation, we are happy to play with it, in the same way as playing with 'numbers' happily without worrying too much about their metaphysical status. We find it methodologically worthwhile to stay with the situation-theoretic conception of proposition, but also remain comfortable to live with logical forms.

5. Bringing Explicature to Fit the Regularity Model of Communication

5.1 Relevance as a Guide for Inferential Comprehension

What guides the process of inferential communication in general, and the explicating process in particular? There must be some powerful guidance (e.g. a hint, a heuristic, or a rule) for the hearer to complete the inferential process, and quickly. Otherwise, inference might go on indefinitely without an end, which is counterintuitive given that utterance comprehension is spontaneous. It is reasonable, therefore, to assume that some mechanism is guiding and constraining the process of inferential comprehension. Inspired by Grice (1975), relevance theory proposes one:

The Central Tenet of Relevance Theory

> The expectations of relevance raised by an utterance are precise and predictable enough to guide the hearer towards the speaker's meaning. (Wilson & Sperber 2004)

We shall list two important observations by relevance theory that are most useful to our present study, then give some examples to illustrate how the intuitive notion of relevance actually guides utterance comprehension.

Relevance theory has made the following two important observations (Wilson 2004, Wilson & Sperber 2004):

(I) Human intentions and behaviors under contexts are non-arbitrary;

(II) Derivation of explicature depends on:

(i) seeing the intended relevance of an utterance; and

(ii) the ability to construct contextual assumptions.

We shall focus on (I) in this section and discuss (II) in the next. As regard (I), it is based on the psychological researches on *mind-reading* or the *theory of mind* (e.g. Baron-Cohen 1995; Happe 1993), which claims that human beings are intentional animals and are capable of attributing intentions to others. To illustrate, suppose that John takes out a key as he walks towards his front door (an example from Wilson 2004, Ch.1). You will immediately assume that he intends to unlock the door. This intention would best explain his behavior given our daily experience; this package of intention, context and behavior is regular enough to justify the assumption (Figure 2-2). Although it is logically possible that John might intend to do other things with the key, say, making a scratch on the door or pressing the doorbell button, it is the hypothesis that he intends to unlock the door that best explains his behavior. His behavior becomes *relevant* enough to others if the observer is aware of such a regular package of intention, context and behavior.

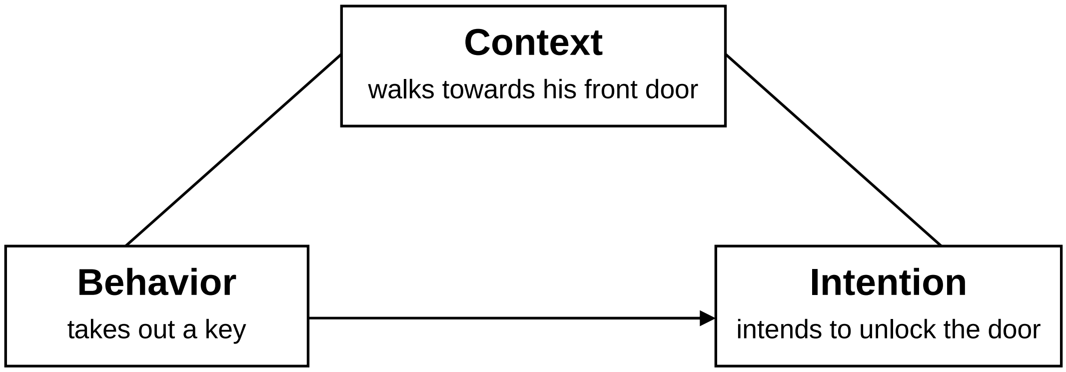

Figure 2-2

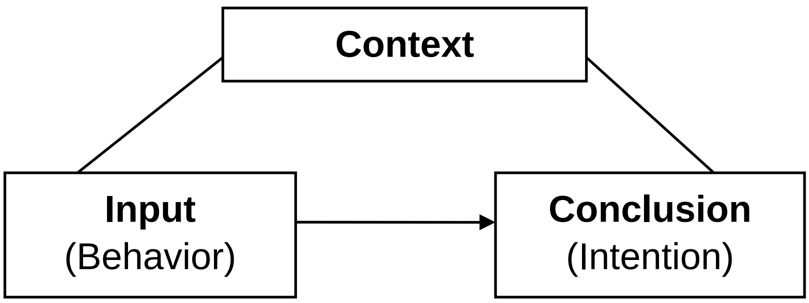

Figure 2-3

An important consequence of (I) is that there are *regularities* of Input-Context-Conclusion packages, where behaviors serve as inputs for processing, against a context, and intentions are the conclusions (Figure 2-3). We play with the garage example in Grice (1975) to illustrate this idea:

33a. A: ?

b. B: There is a garage round the corner.

34a. Petrol is available there.

b. The Museum is in Third Street.

c. The garage is a terrorist target!

B's input is utterance (33b). This input may pair up with suitable contexts to form regular Input-Context-Conclusion packages with conclusions (34a, b, c). If the context is a previous utterance of A, then the following three contexts may serve to form such packages:

Input (Behavior)	**Context**	Conclusion (Intention)
35a. B: There is a garage round the corner.	A: I am out of petrol	Petrol is available there.
35b. B: There is a garage round the corner.	A: The Museum is either in Third Street or round the corner.	The Museum is in Third Street.
35c. B: There is a garage round the corner.	A: Car bombs are said to be near here.	The garage is a terrorist target!

These packages are said to be regular because in any occasion, no matter who A and B are and where and when the conversation takes place, combinations of such inputs, contexts and conclusions will *normally* go through. Such regularities may come from many sources, including:

(i) pure deduction (e.g. Input = *p*, Context = *If p then q*, Conclusion = *q*),

(ii) some schema (e.g. Input = 'He has 3 children,' Context = PEOPLE ARE TRUTHFUL, Conclusion = 'He has exactly 3 children'), or

(iii) abductions (e.g. Input = 'The garage is round the corner', Context = 'Car bombs are near here' + other contextual clues, Conclusion = 'The garage has car bombs').

Abduction is a kind of defeasible reasoning frequently described as 'the inference to the best explanation.' It was introduced by Charles Peirce in the mid-19th century. The reasoning scheme is like this:

$$\frac{\begin{array}{l} P \rightarrow Q \\ Q \end{array}}{P}$$

For example, it is known that when it rains, the ground is wet. Now it is observed that the ground has been wet. So, according to abductive reasoning, it has rained before. That it has rained is a plausible explanation consistent with the premises 'Rain → Wet' and 'the ground is wet.'

5.2 Identification of Explicature through Input-Context-Conclusion Regularities

Exploiting regularities to communicate and identify implicit meaning

An implication for communication is this: if we are attuned to these Input-Context-Conclusion regularities, we can exploit them to convey implicit meaning. The idea is to let the hearer 'solve' for the conclusion based on a chosen context and the speaker's input utterance. In the above illustration, suppose that A said 'Car bombs are said to be near here' and B replied 'There is a garage round the corner.' B's reply will appear very relevant to A if A is attuned to the regularity represented by package (35c). A will therefore conclude that what B intended to convey is that the garage is the terrorist target.

Exploiting regularities to communicate and identify explicit meaning

Another implication for communication is the derivation of explicature, as stated in (II) above. Again, the idea is to let the hearer solve, this time, for the input given the conclusion and a chosen context. If the hearer can see the intended relevance of an utterance, she somehow has an idea of what the conclusion is like. If she can construct a context to arrive at a regular Input-Context-Conclusion package so that the input utterance is relevant enough, then she can just take the solved input as the explicature;

after all, this is the best she can do as far as recovering the explicit speaker content is concerned. To illustrate, consider the exchange:

36a. Alan: Would John like to have dinner with us tonight?

b. Lisa: He's eaten

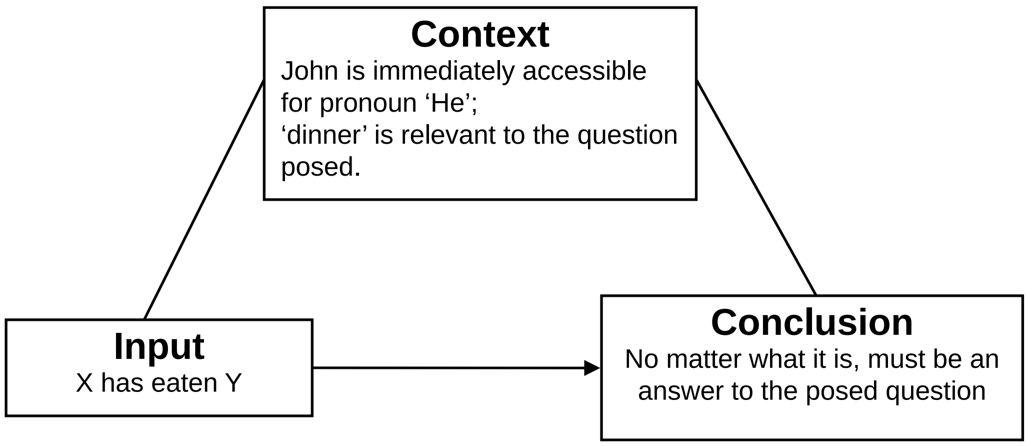

Figure 2-4

Given that utterance (36b) is intended to provide an answer to the question posed, and that (i) John is immediately accessible for the pronoun *He*, (ii) the word *dinner* is relevant to the question posed, and (iii) 'John has eaten dinner' is relevant enough as an answer to the posed question, the best hypothesis for the explicit meaning of (36b) is therefore 'John has eaten dinner.'

We have argued that the expectation of relevance will guide the hearer towards a relevant enough Input-Context-Conclusion regularity for the identification of both the explicit and the implicit speaker meaning. This is guaranteed on the one hand by a relevance-theoretic assumption about human cognition:

Cognitive Principle of Relevance

Human cognition tends to be geared to the maximization of relevance. (Sperber & Wilson 1986/95)

And on the other hand, relevance theory proposes a *comprehension procedure* in which the hearer stops processing at a point where her expectation of relevance is satisfied:

Relevance-theoretic Comprehension Procedure

(i) Follow a path of least effort in looking for cognitive effects. Consider interpretations (disambiguations, reference assignments, supply of contextual assumptions, derivation of implications, etc.) in order of accessibility.

(ii) Stop when your expectation of relevance is satisfied (or abandoned).

(Wilson & Sperber 2004)

We shall explain the technical terms 'effort' and 'cognitive effects' stated in the procedure immediately. Given that the principle of least effort is widely applicable, and that utterance comprehension is spontaneous, it is reasonable to assume that the hearer will stop searching for other packages of implicit and explicit meanings once her expectation of relevance is satisfied by a particular package.

5.3 The Notion of Relevance

We shall first give a very brief review of the technical notion of relevance proposed in relevance theory. Then we will present our own view of this notion.

According to relevance theory, a stimulus or an input *S* is relevant to a cognitive agent if the processing of *S* against a context will give him some 'useful' results, called *cognitive effects*. Cognitive effects are of three types: *S* may (i) make him strengthen some old information, (ii) make him abandon some old information, or (iii) give, via deduction, a contextual implication as new information. The more of the number of cognitive effects *S* yields from processing, the more relevant *S* is. But according to relevance theory, the *processing effort* consumed to derive cognitive effects also matters. *S* (compared with other inputs) is less relevant if it consumes more processing effort to get the same cognitive effects.[23] Thus relevance theory defines 'relevance' to be a cognitive property of an input with respect to an agent such that it is an increasing function of cognitive effects and a decreasing function of processing effort.

It has to be noted that the relevance-theoretic notion of relevance is not widely accepted. For example, Levinson (2000a) objected to processing effort on the grounds that it is 'not empirically measurable (or at least not empirically measured).' Merin

[23] Standard definitions of cognitive effects and processing effort may be found in Sperber & Wilson (1986/95), Wilson and Sperber (2004) or any other relevance theory literatures.

(1997: n. 13) criticized the way that the size of cognitive effects are measured, claiming that it does not meet Carnap's (1950) criteria for the explication of a pre-theoretic notion of relevance. Though, it should also be noted that empirical researches are being done recently to test the validity of such a formulation of relevance in terms of processing effort and cognitive effects (Noveck & Sperber 2004). We will leave the formulation as an open issue.

In fact, it seems that we need not know what relevance is for an adequate theory of pragmatics. It has been observed by mathematicians that we need not know what a 'number' is before we can compare numbers, in the same way that we need not know what 'length' or 'weight' is before we can compare two lengths or two weights (Stewart 1981/95: 127). To compare lengths, it suffices to place the two lengths side by side to determine which is longer or whether they are equal. To compare weights, it suffices to place the two weights on the two sides of a balance. The upshot is that, in the case of relevance, the assumption that the hearer can compare the relevance of two stimuli is sufficient; he need not know what relevance is!

As a result, in the present study we do not follow the relevance-theoretic version of relevance. Our strategy is as follows:

(a) We say that an input or a contextual clue/assumption becomes *relevant* to a cognitive agent if it is part of an Input-Context-Conclusion regularity to which he is attuned. We therefore propose that the notion of relevance is rooted in the notion of regularity.

(b) We agree to the view that it is 'preferable to treat…relevance…in the form of intuitive comparative judgment[s] rather than absolute numerical one[s]' (Wilson & Sperber 2004).

(c) A consequence of (b) is that we can talk about an ordinal, though not a cardinal, measurement of relevance so as to make 'maximization of relevance' intelligible. A relevant input or contextual assumption will therefore attain a certain level or degree of relevance for the purpose of ordering for choice. Relevance in our model becomes a primitive concept.

(d) We think that our discussion of the attunement to the Input-Context-Conclusion regularities by cognitive agents has sufficiently captured the insights of the three kinds of cognitive effects for the purpose of formalization of explicature. (See the justification below)

(e) Given that the principle of least effort is widely acknowledged, we also agree to the notion of processing effort as a mental cost on inference, though we think that it is the regularities and the levels of relevance attained that are at the heart of our formalization work.

Some justification is needed for (d). First, although cognitive effects are of three types, according to relevance theory the type of contextual implications is the most important. This implies that {Input + Contextual assumptions => Conclusion} is the major schema for an input to achieve relevance. Second, we find that some cases of strengthening or abandonment of old information (e.g. beliefs or assumptions) also admit this schema. For abandonment[24], suppose Nixon said 'I am not a crook (*P*),' then this utterance typically achieves relevance by eliminating the belief 'Nixon was a crook (~*P*)' in the hearer's mind. Hence, by choosing ~*P* as a contextual assumption, the Input-Context-Conclusion package (*P*, ~*P*, *P* is contradiction) would be relevant enough to the hearer.

For the case of strengthening, consider the exchange (37). A classic analysis is that the Input (37b) may achieve relevance to Peter by adding the Context 'Charles is a cheat' on top of the explicature 'Mary doesn't speak to cheats' to yield deductively the Conclusion 'Mary doesn't speak to Charles' (Figure 2-5).

37a. Peter: Do you ever speak to Charles?

b. Mary: I don't speak to cheats[25]

[24] This point came from an online discussion by Wilson in 2004.
[25] Another example from the online discussion by Wilson mentioned in the previous footnote.

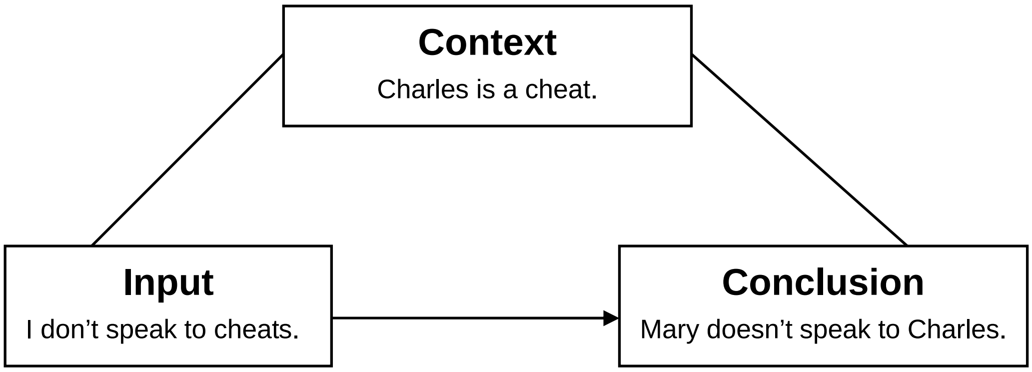

Figure 2-5

However, although the contextual assumption 'Charles is a cheat' might strengthen Peter's old belief that Charles is a cheat, say, Wilson did not count it as a cognitive effect of strengthening from the utterance (37b), and in general said that relevance theory did not treat implicated contextual assumptions as intended cognitive effects of the base-level explicature of an utterance, and hence wondered how strengthening might give rise to implicatures.[26] That is, Wilson worried how a belief strengthening might be a contextual implication from *pure deduction* in order that it qualifies to be an implicature.

Nevertheless, we think that whether 'Charles is a cheat' is a premise or a conclusion depends very much on what Mary is intending. She might have been intending to take her opportunity to convey implicitly the message that 'Charles is a cheat' more than to take it as her turn to answer Peter's question. If this is the case, the

[26] Wilson did not explain in the online discussion why an implicated premise, though may achieve relevance in its own right (in this case by strengthening Peter's belief), is not a cognitive effect of the base-level explicature.

following abductive inference in which the Context is the added contextual assumption ‘Mary doesn’t speak to Charles’ and the Conclusion is ‘Charles is a cheat’ seems to be quite robust (Figure 2-6); such a package will make the Input relevant enough.

Input: Cheat (X) → Mary doesn’t speak to X (i.e. Mary doesn’t speak to cheats)

Context: Mary doesn’t speak to Charles

Conclusion: Cheat (Charles) (i.e. Charles is a cheat)

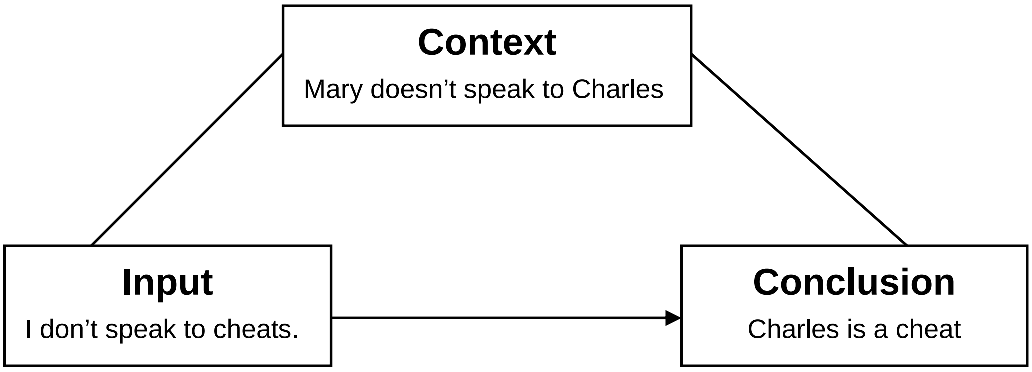

Figure 2-6

In brief, given that abductive frameworks are also popular (e.g. Hobbs 1993, 2004; Jiang 2002), if we do not insist on employing deduction as the main framework for non-demonstrative reasoning, our regularity approach, which allows for abductive packages, seems good enough to accommodate all the three types of cognitive effects.

6. Conclusion

We have made several points in this chapter: (i) We have identified a workable domain for the concept of explicature. We have argued that the basis for this concept is the semantic incompleteness of the sentence or expression used in an utterance. Beyond this basis, explicature as a notion for the hypothesis of explicit speaker meaning (content) is found to be problematic. (ii) We have also defended the explicating or so-called ‘fleshing out’ strategy that is employed to derive the explicature of an utterance, and have argued that the shift of perspective from speaker to hearer leads naturally and necessarily to this strategy. (iii) Based on the insights of relevance theory, we have shown that Input-Context-Conclusion regularities can be exploited for the communication of both explicit and implicit meaning. In particular, such regularities allow contextual information to flow to the hearer for his identification of the explicature. We believe that our regularity model has distilled most of the essential features of the relevance-theoretic framework of communication necessary for the formalization of the explicating process and explicature.

Chapter 3

The Channel Model

ONE OF THE main goals of the present study is to adapt a formalism developed in Barwise & Seligman (1994, 1997) to one for the explicating process and explicature. The formalism is known as the *channel* model, and is built upon two central concepts: *classification* and *infomorphism*. This chapter reviews the basic concepts of classification, infomorphism and the channel model. The next chapter will offer a channel-theoretic model for the explicating process and explicature.

1. Classifications

According to Barwise & Seligman (1994: 340), classifications involve particulars being classified into *types*: 'a classification is a way of lumping particular things together into types.' The particular things being classified are usually described as instances, particulars, or *tokens*. The types are used to classify them (into types, of course). Types and tokens make up a classification. For example, marbles can be classified into different marble types: green marbles, red marbles, orange marbles, etc.

These marble types together with the marble tokens (i.e. the individual marbles) form a classification for marbles. A basic observation of situation theory is that situations, which are limited parts of reality, are being classified by the 'facts' (or 'states of affairs', infons[27]) that happen in them. Thus, a situation can be classified as, say, belonging to a type in which John kicks the ball; another one can be classified as belonging to the type in which Mary doesn't run away, etc.

Situation theory does not assume that there is a 'universal' classification for things (ibid. 341). It assumes that things can be classified in numerous ways. Thus marbles need not be classified by color alone. They can also be classified by size or weight or some other properties. In other words, a particular marble can be made to belong to various types: it can be a member of the GREEN type and simultaneously belong to the type of BIG-SIZE and that of LESS-THAN-10gram. Similarly, a situation can be classified into different types by different 'facts'.

We believe that the relatively uncontroversial assumptions that a situation can be classified into a type and that classification can be done in more than one way provide a useful way for thinking about language phenomena. We shall demonstrate this with two examples below.

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[27] See Chapter 2, Section 5.

1.1 Classification Applied to Discourse Studies

We observe that the concept of classification is working in discourse studies of news texts. According to Bell (1991: 147), journalists ‘do not write articles’ but only ‘stories’. He observed that ‘a story has structure, direction, point, viewpoint,’ elements that ‘an article may lack.’ Within the tradition of critical discourse analysis, Fowler (1991: 1-2) also claimed that the ‘“content” of newspapers is not facts about the world;’ it is ‘socially constructed’ and is therefore only ‘ideas’ or ‘beliefs’. To him, ‘language is not neutral,’ but is a ‘highly constructive mediator.’ What these authors have been claiming is that the same incident, event or situation can be described, talked about or focused on in different ways. In terms of situation theory, a given situation is neutrally out there, but the type to which the situation belongs is ‘constructed’, depending on how the situation is classified by we humans.

Zeng (1999) gave a further interesting observation during a discussion of news texts translating. He analyzed the leads of news stories produced by international news agencies from an *information structure* perspective, and has found that messages in the lead are presented within an information structure. The structure must contain a piece of new information as the foreground news, together with other messages as background information. More importantly, Zeng observed that there are frequently other new information contained in the background, called the ‘background news,’ so that the foreground ‘main news’ and the background news are simultaneously structured within the lead sentence. He regarded this as a fact that a newly occurred event to be reported in a news story can be approached from many different angles. With regard to the translating into Chinese of an English lead, Zeng then advised that translators be allowed to make shifts between foreground and background news in order to accommodate linguistic differences between Chinese and English. For instance (Zeng 1999: 37), consider the lead (1a) of a news story:

1a. SEOUL – A child was killed and 40 people hurt when an express train derailed near a Seoul railway station and collided with a freight train yesterday.

b. (漢城電) – 一列高速列車昨天於漢城一火車站附近發生出軌意外，列車與一貨車相撞，造成一名小童死亡，四十人受傷。

c. A child was killed and 40 people hurt

d. an express train derailed

e. an express train collided with a freight train

According to Zeng, (1c) ‘A child was killed and 40 people hurt’ was treated as the main news in (1a), while (1d) ‘an express train derailed’ and (1e) ‘an express train collided with a freight train’ were pushed to the background. But it should be noted that (1d) and (1e) were also new information, as typically reflected from the use of indefinite articles *a* and *an*. When translating (1a) into Chinese as (1b), the translation shifted the background news (1d) to the foreground as the main news, and reframed (1e) and (1c) as background information. Such a shift was pursued because, as Zeng said, causes and effects in Chinese reporting of accident or calamity are invariably presented in the lead in their natural order of occurrences rather than in the reverse order (Zeng 1999: 52).

We can frame Zeng's findings in terms of classification. In (1a), the original English lead classified the accident with the fact (1c) as a situation in which a child was killed and 40 people were hurt. But in (1b), the same accident was classified by the fact (1d) as a situation in which an express train derailed. An implication for translation theory from Zeng is that there exists a situation-theoretic basis for the notion of translation equivalence: a necessary (and sometimes also sufficient) condition for the source sentence to be translation equivalent to the target sentence is that they have to classify exactly the same situation. Thus, given that (1a) and (1b) classified exactly the same situation, it is justified (or at least plausible) to treat them as translation equivalent.

1.2 Classification Applied to Lexical Semantics

We want to show that the concept of classification can also shed light on lexical semantics. It is commonly claimed in the studies of English-Chinese translation that English words are ‘polysemous’ while Chinese words are not (at least relatively so). We shall challenge this from a classification perspective. Consider the examples in (2) that involve the English verb *develop*. It is said that *develop* has numerous meanings, which is reflected in the Chinese translations in (2b) of the verb phrases in (2a) (Zeng 1999: 20). However, several authoritative dictionaries quoted in (3) seem to show that *develop* possesses only one (core) meaning: to unfold (or to grow).

2a. Develop a weapon	2b. 研制一項武器
Develop a habit	養成一種習慣
Develop a symptom	出現一個病徵
Develop a disease	患了一種疾病
Develop a market	開發一個市場
Develop a relationship	建立一種關係

3a. *Oxford English Dictionary*, (2nd ed., 1989):

To unfold, unroll (anything folded or rolled up) (the first definition)

b. *Merriam-Webster's Online Dictionary*:

To make visible or manifest; to make active or promote the growth of; to cause to unfold gradually (selected definitions)

c. *Collin’s COBUILD* (2003)

When something *develops*, it grows or changes over a period of time and usually becomes more advanced, complete, or severe. (The first definition)

d. *Cambridge Advanced Learner's Dictionary* (2nd ed., 2003):

develop (GROW): to (cause something to) grow or change into a more advanced, larger or stronger form (single definition)

In terms of classification, we therefore say that the situations described in (2a) are actually classified into a single type by a single fact: all are situations in which something (a thing or an event) unfolds or grows, and so belong to the same type of situations. Now, when the English verb phrases in (2a) are translated into Chinese in (2b), each situation is classified differently by the Chinese speech community. Thus, the situation in which a weapon is developed becomes a situation in which a weapon is '*yan zhi*' (studied and produced); the situation in which a habit is developed becomes a situation in which a habit is '*yang cheng*' (nurtured and stabilized); etc. Although the situations in (2a) are classified differently in Chinese, the translation are usually deemed as 'good', 'correct' or 'functionally equivalent' to the source-texts. From a situation theoretic perspective, they are good or attain equivalence because the source and the respective target texts classify exactly the same situations.

Conversely, it is unjustified in the same way for the English speech community to conclude that Chinese words or morphemes are polysemous just because they admit different English translations. Consider the things listed in (4a) (Chen 2005: 50). All Chinese know that there is a single meaning for the morpheme 濃 (*nong*), meaning 'thick'.[28] These things are all classified by the Chinese as things with the property *nong*. But when translated into English, they are classified differently. Tea is now classified according to the intensity of taste; fog is classified with the sense of weight or thrust perceived by humans; smoke is classified with relative quantity with respect to volume; shadow is classified with darkness. And when these classifications for things are different, the classifications for situations in which these things are present are, accordingly, also different.[29] Again, the translations in (4b) are regarded as equivalent because the things that the English adjectives classify are exactly the same as those classified by the Chinese morpheme *nong*.

4a.	4b.
濃茶	strong tea
濃墨	thick ink
濃霧	heavy fog
濃烟	dense smoke
濃眉	thick eyebrows

[28] From the classical dictionary *Shuo Wen Jie Zi*.
[29] According to situation theory, the meaning of a common noun, say, *cookie* is a conventional regularity systematically linking the utterance situations containing the utterance of the word *cookie* and the external situations in which there exists a cookie (Barwise & Perry 1983: 13).

濃蔭 dark shadow

According to Barwise & Seligman (1997), classification as a pre-theoretic notion can be modeled with set theory. Before introducing its formal definition, we shall review another concept, infomorphism, that models the notion of regularity.

2. Infomorphism

According to the channel model, the concept of an infomorphism is used to model the notion of regularity and its support of information flow. A channel is defined to be a system of infomorphisms. This section gives an informal review of the more basic concept of infomorphism.

2.1 Infomorphism as a Model of Regularity

An informal definition for infomorphism is given in Barwise & Seligman (1994: 342):

> **Infomorphism (informal definition)**
>
> A link between two classifications along which information flows.[30]

Roughly, an infomorphism can be understood as capturing how a token of one classification carries the information about another token of a second classification. Barwise & Seligman (1994: 342) gave an example of a *Temperature Infomorphism*

[30] Initially, this is an informal definition for 'channel' instead of 'infomorphism'. Later in Barwise & Seligman (1997), they re-named it as 'infomorphism', and reserved the term 'channel' for a network of infomorphisms.

that describes how a hospital thermometer conveys the information of the body temperature of a patient. If we think in linguistic terms, their model actually describes how we understand the ‘utterances’ of a thermometer.

Hospital thermometers can be used to measure the body temperature of patients. The height of the mercury column inside a thermometer is used to indicate the temperature of a patient. That height is the ‘sentence’ uttered by the thermometer. The Temperature Infomorphism involves two classifications: in the *Thermometer Classification*, a token is a thermometer instance *t* (a concrete object) at a particular time after use, classified by the height of its mercury column (a number, in cm); on the other hand, in the *Patient Classification* a token is a particular patient *p* (a human) classified by his/her body temperature (a number, in ^{o}F).

To understand how the Temperature Infomorphism supports the flow of information, consider a nurse using a thermometer to take the temperature of a patient. Suppose the thermometer token *t* indicates a mercury column of height 4.5cm. The observation is that:

5. The nurse immediately gets hold of the information that the body temperature of the patient token *p* is $99^{o}F$.

How does the Temperature Infomorphism model (or describe, explain) this observation? According to Barwise & Seligman (1994), the piece of information which the token *t* (which is the physical thermometer in that particular occasion) of the Thermometer Classification has conveyed about the token *p* (which is the patient) of the Patient Classification is 'token *p* is being of type 99 (^{o}F).' How this information got conveyed? The story goes like this:

(i) First, the thermodynamic properties of mercury guarantee a systematic link between the height of the mercury column and the temperature of the patient, thereby establishing a *regular relation at the type level* between the two classifications.

(ii) Second, every time the nurse pulls out the thermometer from the patient's mouth, she has made each patient connected to a specific thermometer, thereby establishing a *connection at the token level* between the two classifications.

(iii)Third, the nurse makes the following inference. Given that

(a) *p* is connected to *t* (by (ii)),

(b) *t* is of type 4.5 with the Thermometer Classification, and

(c) type 4.5 is systematically linked to type 99 (by (i)),

she can then infer, due to the Patient Classification, that *p* is of type 99. (Figure 3-1)

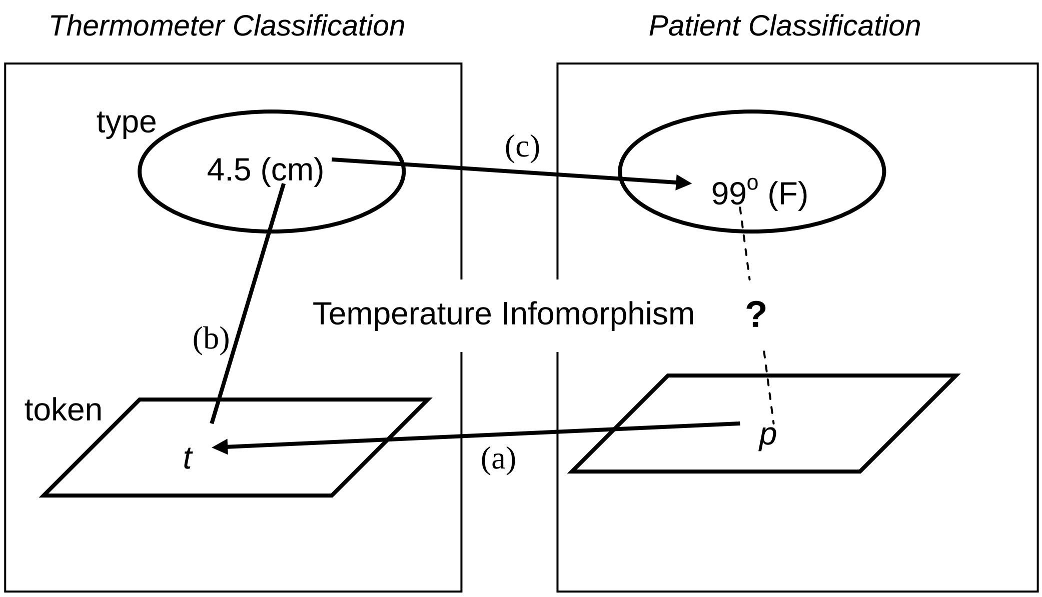

Figure 3-1

Thus, together with the infomorphism condition to be discussed in Section 3, the Temperature Infomorphism has modeled, and in some sense explained, the observation (5). The situation-theoretic model of infomorphism has captured on the one hand how information flows from a thermometer reading of 4.5cm to the body temperature of $99^{o}F$ of the patient, and on the other hand it explicates the reasoning behind the nurse from the premise of a 4.5cm mercury column to the conclusion of patient temperature being $99^{o}F$. In linguistic terms, the model describes how the nurse understood the utterance of the thermometer.

2.2 Misinformation

The model of infomorphism helps delineate three ways in which information flow could be unsuccessful, thereby conveying *misinformation*. According to Barwise & Seligman (1994: 343-4), although the Temperature Infomorphism supports the flow of information, it only does that *normally*. Two broad cases are identified that will make information flow unsuccessful. They correspond to the failures at type level (c), and those at token level (a). For (c) to hold, background conditions for the systematic link between types must be fulfilled. However, unfulfillment may occur, say, from a manufacturing flaw in the thermometer used, or that the nurse does not shake the thermometer properly before using it, or that the patient does not place it in the mouth long enough, etc. In these cases the mercury column reading might not reflect the true body temperature of the patient concerned. On the other hand, failure for (a) to hold means that there are mismatches for *p* and *t*. Thus, the nurse may read the wrong thermometer for a specific patient, or she may attribute a specific thermometer reading to a wrong patient.

It is interesting to note that the model predicts that level (b) might possibly be a source of misinformation, and if this is really the case one may wonder how it arises. We shall show that, when we view translation as a special kind of information flow, the process of translating between two languages confirms this prediction. Our idea is that if the source-text is miscomprehended by the translator, or if he cannot express accurately with the target language, the translation into the target-text is bound to be unfaithful, causing misinformation. This idea is trivial enough. What is not trivial is to formulate it in terms of infomorphism, which we shall show immediately below.

We describe translating in terms of the infomorphism model as follows. Suppose the source-text is the Chinese word 濃茶 (*nong cha*). Since the translator is attuned to the conventional regularity of this word, he gets hold of the situation *s* described, namely, one in which strong tea is present, and is being of type 濃茶. This situation *s*, for an English speaker, is classified as *strong tea* (i.e. *s* is being of this type). Now, information flow within the translation process is like this:

(i) '濃茶' is the type for situation *s*,

(ii) *s* is connected to a situation *u*, which is the utterance/writing situation produced by the translator, and

(iii) *u* is being of type *strong tea*;

hence, the English expression *strong tea* should correspond to the Chinese word 濃茶 (Figure 3-2). The translator will therefore take *strong tea* as the proper translation for the Chinese word.

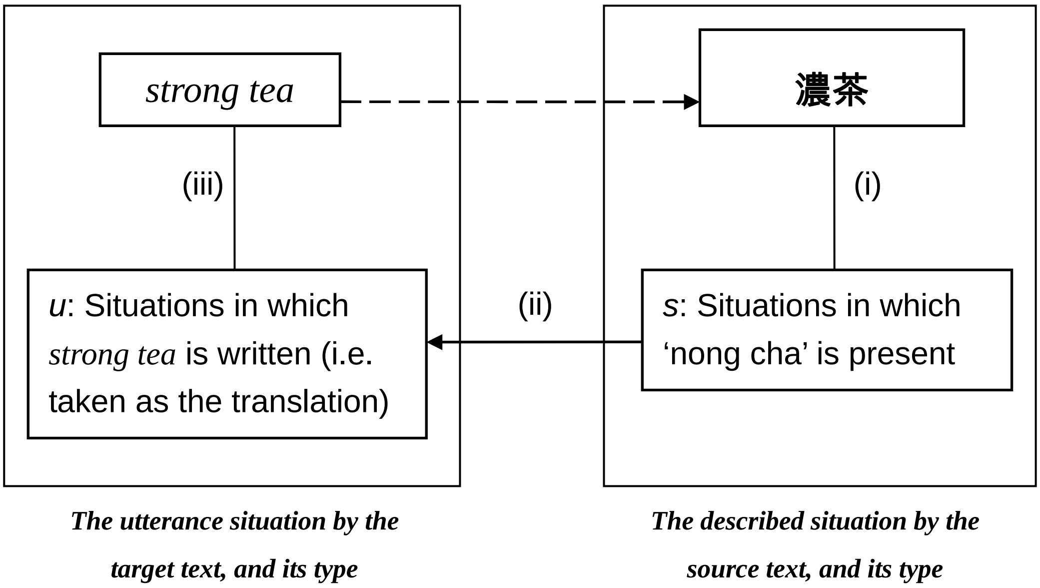

Figure 3-2

With this model, misinformation occurs if the translator gets wrong with either (i) or (iii). If he gets (i) wrong, say, miscomprehending 濃茶 as meaning thick soup (most probably he is a non-Chinese translator), then *s* and accordingly *u* will be situations in which thick soup is present. Although (iii) gets correct, the translation will be *thick soup*, which is wrong. If the translator gets (i) right but wrong with (iii) (probably he is a Chinese translator who only practices word-for-word translation), say, classifying *u* as being of type *thick tea*, then the translation will be *thick tea*, which is again wrong. In brief, the model of infomorphism has made a prediction which is confirmed in the process of translation.

2.3 Features of Regularity Revisited

The concept of infomorphism sharpens our understanding of the nature of regularity:[31]

(i) First, regularity that supports information flow from one classification to another is both *reliable* and *fallible* (Barwise & Seligman 1994: 334). The link between thermometer readings and body temperature of patients is not a necessity but only a regularity; it is reliable enough, but may sometimes be fallible. The satisfaction of background conditions at the type level and the connections at the token level are both responsible for successful information flow.

(ii) Second, as a consequence of the first, regularity does not only involve types, but, crucially, also involves tokens. This is because, as far as information flow is concerned, it is the tokens (e.g. situations) that carry or convey information (ibid, 1994: 339-41; 1997: 27).

(iii) Third, given that regularity is capable of being fallible, the inference drawn by an agent who is attuned to a regularity is a kind of defeasible inference, and so cannot be adequately described alone by deduction, which is non-defeasible inference.

[31] This is an example illustrating that a theoretical model of a notion or phenomenon frequently has positive feedbacks on the understanding of the notion or phenomenon itself.

3. Some Formal Definitions

An elegant formalism for the pre-theoretic notion of regularity is constructed in Barwise & Seligman (1997), where formal definitions for classification and infomorphism, among other concepts, are given. This section reviews the definitions of these two concepts. The formalization of the relation theory of meaning is given in the Appendix.

Definition of Classification

A classification $\boldsymbol{A}$ is a triple $(A, T, |=_{\boldsymbol{A}})$ where

(i) A is a set of objects to be classified, called the **tokens** of $\boldsymbol{A}$;

(ii) T is a set of objects, called the **types** of $\boldsymbol{A}$, to be used to classify the tokens; and

(iii) $|=_{\boldsymbol{A}}$ is a binary relation between elements of A and T; if $a \ |=_{\boldsymbol{A}}\ t$ where $a \in A$ and $t \in T$, then a is said to be of type t in $\boldsymbol{A}$.

$\boldsymbol{A}$ is written as (A, T) if no confusion is likely.[32] The notation tok ($\boldsymbol{A}$) is sometimes used to denote the set of tokens of $\boldsymbol{A}$, while typ ($\boldsymbol{A}$) to denote the set of types of $\boldsymbol{A}$. For the Thermometer Classification $\boldsymbol{T}$ in the thermometer example above, tok ($\boldsymbol{T}$) is the set of all thermometer instances at particular times after use; typ ($\boldsymbol{T}$) is a

[32] In this chapter, A, B, C usually stand for the set of tokens, with a, b, c as their elements; T, V, W usually stand for the set of types, with t, v, w as their elements.

set of real numbers. A token $t \in$ tok (***T***) is binary-related to a type $r \in$ typ (***T***), written as $t \models_{\boldsymbol{T}} r$, if the height of the mercury column in t is r. ***T*** is then written as (tok (***T***), typ (***T***), $\models_{\boldsymbol{T}}$).

Definition of Infomorphism

Given two classifications $\boldsymbol{A} = (A, T, \models_{\boldsymbol{A}})$ and $\boldsymbol{B} = (B, V, \models_{\boldsymbol{B}})$, an infomorphism $f : \boldsymbol{A} \rightarrow \boldsymbol{B}$ is defined to be a pair of functions $f = (f^{>}, f^{<})$, where $f^{>}: T \rightarrow V$ is at the type level and called the *up-function,* and $f^{<}: \boldsymbol{B} \rightarrow \boldsymbol{A}$ is at the token level and called the *down-function*, such that for any token $b \in B$ and type $t \in T$ we have

(*) $\quad f^{<}(b) \models_{\boldsymbol{A}} t \quad$ if and only if $\quad b \models_{\boldsymbol{B}} f^{>}(t)$.

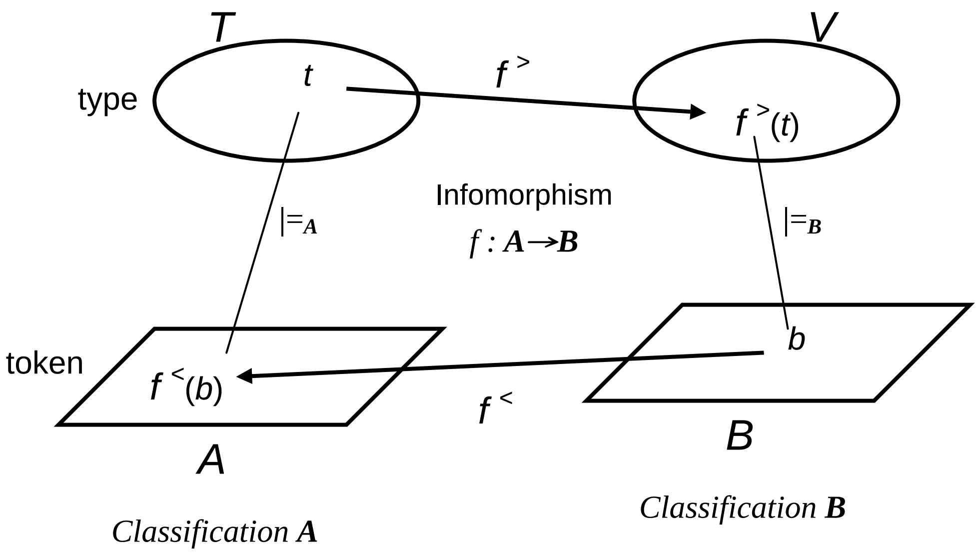

Figure 3-3

In the present study, (*) is called the *infomorphism condition*. The infomorphism condition has characterized and formalized the 'fundamental property of regularity.' The concept of infomorphism is used to model a regularity between two classifications, regularity that 'provides a way of moving information back and forth between them' (Barwise & Seligman 1997: 72), thereby allowing a cognitive agent to make inferences from one classification to the other. If the possibility of moving information back and forth is taken as the fundamental property of a regularity, then it is now captured by the infomorphism condition (*).To see this, we elaborate on the exposition in Barwise & Seligman (1997). Given $f^{<}(b) \models_{\boldsymbol{A}} t$, we have

(i) b is related to $f^{<}(b)$ (via the down-function),

(ii) $f^{<}(b)$ is of type t (given), and

(iii) type t is related to type $f^{>}(t)$ (via the up-function).

Then, if information flow is successful, one can infer from (i), (ii) and (iii) that b is of type $f^{>}(t)$. This is captured by the only-if part of the condition (*), i.e.

$$f^{<}(b) \models_{\boldsymbol{A}} t \quad \Rightarrow \quad b \models_{\boldsymbol{B}} f^{>}(t). \text{ (See Figure 3.3.)}$$

On the other hand, given $b \models_{\boldsymbol{B}} f^{>}(t)$, we have

(iv) $f^{<}(b) \in A$ to which b corresponds (via the down-function),

(v) b is of type $f^{>}(t)$ (given),

(vi) $f^{>}(t)$ to which t corresponds (via the up-function).

Hence, if information flow is successful, one can infer that $f^{<}(b)$ is of type t through (iv), (v) and (vi). This is captured by the if-part of (*), i.e.

$$f^{<}(b) \models_{A} t \quad <= \quad b \models_{B} f^{>}(t).$$

For simplicity, the superscripts $^{<}$ and $^{>}$ of the up- and down-functions $f^{>}$ and $f^{<}$, along with the subscripts $_{A}$ and $_{B}$ of the binary relations $\models_{A}$ and $\models_{B}$, are usually omitted if no confusion arises. Thus, (*) can be written simply as

$$f(b) \models t \quad \Leftrightarrow \quad b \models f(t).$$

With this form, we can regard (*) as stating roughly that an infomorphism *preserves* classification relation when the functor f is moved from the left of |= to the right of |=, and vice versa.

4. Information Channels

According to Barwise & Seligman (1997: 25), the channel model is a formalism designed to provide an understanding of '[h]ow…information about some components of a system carries information about other components of the system.' It can be viewed as a model that describes formally how a cognitive agent performs inference to extract information about a component of a system based on the information of some other components.

Our idea is to see the channel model as providing a way to formalize how a hearer interprets an utterance in communication. In particular, the concept of explicature can be formally described with this model, since the task of the hearer is regarded as performing inference to a hypothesis about the explicit content of an utterance based on the information from a chosen context. This section reviews the basic elements of the channel model. The formalization of the explicating process and explicature will be discussed in the next chapter.

The essence of the channel model is a surprisingly simple idea. This idea states that information can flow from some components to other components within a distributed system in virtue of their being linked to a *core* (Barwise & Seligman 1997: 35). We construct a simple example to illustrate this. Suppose John and Mary both set the time of their watches according to the Tower Clock of PolyU. Then, information can immediately flow back and forth between John's watch and Mary's watch within the system: [***John'sWatch***, ***Mary'sWatch***, ***TowerClock***]. Thus, when John looks at his watch showing, say, 4 p.m., he can infer that the time shown on Mary's watch must also be 4 p.m. It is the connections of John's and Mary's watches to the Tower Clock, the core of the system, that make the inference possible. What is not trivial is to describe all of these in formal terms.

Definition of Channel

A channel *Ch* is an indexed family of infomorphisms $\{f_i : \boldsymbol{A_i} \to \boldsymbol{C}\}$ with a common co-domain classification ***C***, called the ***core*** of *Ch* (Barwise & Seligman 1997: 34, 76).

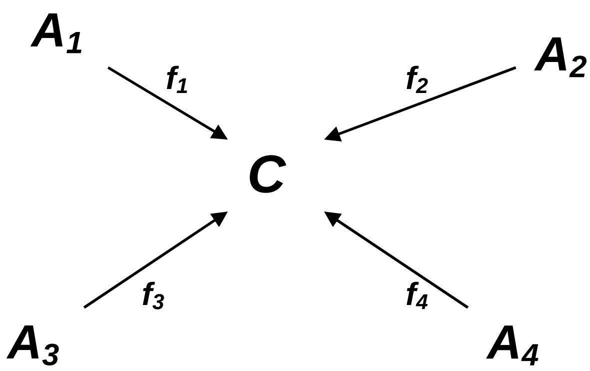

Figure 3-4

Barwise & Seligman (1997) illustrated how the information flow within a flashlight can be described by the channel model. A flashlight as a system can be decomposed into a number of components, depending on the purpose of the modeling. It can be decomposed into two components: the bulb and the switch, or into four components by adding the battery and the case (Figure 3-5). These components are then modeled by classifications. For the bulb component, the bulb tokens b_r at time r are classified into three types {LIT, UNLIT, LIVE} in a commonsensical way: $b_r \models_{\boldsymbol{B}}$ LIT if the bulb is lit at time r; similarly for other types. For the switch component, the switch tokens s_r at time r, they are classified into two types {ON, OFF}, with $s_r \models_{\boldsymbol{S}}$

ON if the switch is on at time *r*; similarly for OFF. The flashlight itself is regarded as the core of the system with its own classification ***F***.

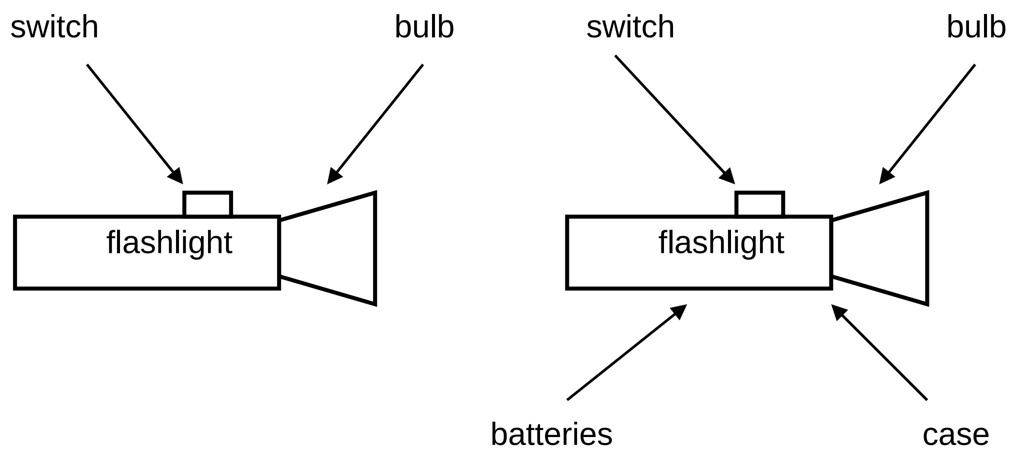

Figure 3-5

For a normally functioning flashlight, information can flow from one component to another component. Thus, the switch being on carries the information that the bulb is lit. The regular relations at type level (mostly electrical and mechanical) and the connections at the token level ensure that the position of the switch is systematically related to the flashing of the bulb. Hence, if the switch is on, one can infer that the bulb is lit. It will be shown below how this flow of information is described by the model. Before doing this, one more concept is needed: constraint.

According to Barwise & Seligman (1997), for a particular classification that models a component of a system or the whole system itself, there are entailment-like relationships among the types that hold for all tokens of the classification. For example, in the case of the flashlight, there is a sort of entailment-like relationship between the type LIT and the type LIVE that holds for all bulb tokens, namely that whenever the bulb is lit it is live. These entailment-like relationships among the types of a classification are called constraints. The set of all those relationships is called a 'theory' of that classification (Barwise & Seligman 1997: 29).

Definition of Constraint

(i) Let ***A*** be a classification and Γ, Δ be two sets of types of ***A***. The pair (Γ, Δ) is called a *sequent* of ***A***.

(ii) A token *a* is said to *satisfy* the sequent (Γ, Δ) provided that if *a* is of type *t* for all $t \in \Gamma$ then *a* is also of some type $v \in \Delta$, i.e. ($a \models_{A} t$ for all $t \in \Gamma$) => ($a \models_{A} v$ for some $v \in \Delta$).

(iii) If all tokens of ***A*** satisfy the sequent (Γ, Δ), Γ is said to *entail* Δ in ***A***, written as $\Gamma \vdash_{A} \Delta$. The sequent is then called a *constraint* supported by the classification ***A***. (Barwise & Seligman 1997: 29).

For the flashlight system, the classification ***B*** used to model the bulb supports the constraints {LIT} $\vdash_{B}$ {LIVE} and {LIT, UNLIT} $\vdash_{B}$ ϕ (the empty set). The latter constraint means that the types LIT and UNLIT are incompatible.

Barwise & Seligman (1997) conceived how information flow is achieved with their very simple idea: the token *c* of the core ***C*** of the channel is thought to 'connect' various tokens of the components. It is this simple fact, which is at the token level, together with the presence of regular relations at the type level that permits information flow and inference. Thus, given the regular relations that hold between the types of various component classifications (modeling the bulb and the switch) and those of the core classification (modeling the whole flashlight), one can make inference from the bulb at time *r* to the switch at time *r* or vice versa, in virtue of the fact that the bulb at *r* is connected to the switch at *r* via their being connected to a single flashlight at *r*.

A channel-theoretic description of the information flow within the flashlight is given in Barwise & Seligman (1997: 36). Let $f : \boldsymbol{B} \rightarrow \boldsymbol{F}$ be the infomorphism representing the whole-part relation between the flashlight and the bulb, and $g : \boldsymbol{S} \rightarrow \boldsymbol{F}$ be the infomorphism between the flashlight and the switch (Figure 3-6). The channel $\{f, g\}$ is a binary channel with ***F*** as the core. The infomorphisms *f* and *g* are defined as follows. For the down-function of *f* at the token level[33], the flashlight at time *r* is mapped to the bulb at time *r*, i.e. $b_r = f(f_r)$. This is because the bulb is connected to the flashlight, so that the flashlight token at *r* corresponds to the bulb token at *r*. Similarly, for *g* at the token level, the flashlight token at *r* corresponds to the switch token at *r*,

[33] For simplicity, we omit the superscripts $^<$ and $^>$ of the up- and down-functions.

i.e. $s_r = g(f_r)$.

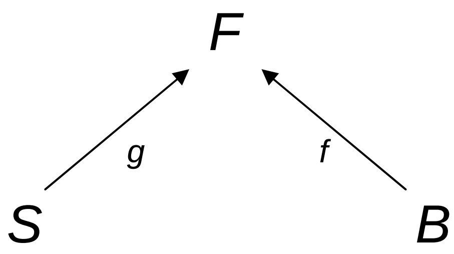

Figure 3-6

For the present purpose, there is no need to explicitly specify the types of the classification ***F*** for the flashlight and hence the up-functions of *f* and *g*. Identifying what the types of ***F*** are is the job of the physical scientists. What is aimed at here is to describe formally how information flows from the switch to the bulb when the flashlight is functioning normally. So, all one needs is to observe that *g*(ON) and *f*(LIT) are two types of ***F*** and to assume that ***F*** supports the following constraint for the normal functioning of the flashlight:

$$g(\mathrm{ON}) \vdash_{\boldsymbol{F}} f(\mathrm{LIT}).$$

The constraint means that $f_r \models_{\boldsymbol{F}} g(\mathrm{ON}) \Rightarrow f_r \models_{\boldsymbol{F}} f(\mathrm{LIT})$ for all f_r, i.e. for all flashlight tokens at any time *r*. The model can now reflect the fact that 'the information that s_r is on carries the information that b_r is lit.' We elaborate the steps in Barwise & Seligman (1997). Since *f* and *g* are infomorphisms, we have

$$f(f_r) \models_{\boldsymbol{B}} \mathrm{LIT} \quad \Leftrightarrow \quad f_r \models_{\boldsymbol{F}} f(\mathrm{LIT}) \quad \text{and}$$

$$g(f_r) \models_{\boldsymbol{S}} \mathrm{ON} \quad \Leftrightarrow \quad f_r \models_{\boldsymbol{F}} g(\mathrm{ON}).$$

Now,

s_r is on

=> $s_r = g(f_r) \models_{\boldsymbol{S}} \mathsf{ON}$

=> $f_r \models_{\boldsymbol{F}} g(\mathsf{ON})$ (since g is an infomorphism)

=> $f_r \models_{\boldsymbol{F}} f(\mathsf{LIT})$ (since $g(\mathsf{ON}) \vdash_{\boldsymbol{F}} f(\mathsf{LIT})$ is a constraint)

=> $f(f_r) \models_{\boldsymbol{B}} \mathsf{LIT}$ (since f is an infomorphism)

=> $b_r = f(f_r) \models_{\boldsymbol{B}} \mathsf{LIT}$

=> b_r is lit

What has been shown is this: the channel model has sufficiently described how the inference from 's_r is on' to 'b_r is lit' is possible.

Appendix

The Formalization of the Relation Theory of Meaning

The relation theory of meaning has yet to be rigorously formalized in the literature. With the concept of infomorphism, we are now in a position to formalize the flow of information achieved by the use of simple declarative sentences. Recall that according to situation theory, a declarative sentence is a conventional regular relation holding between the utterance situations and the described situations. To avoid being too abstract, consider a concrete example before generalization. Suppose out there is a particular situation in which John has eaten dinner. What is it that the speaker can use the sentence (σ) *John has eaten dinner* to inform a hearer that this is a situation in which John has eaten dinner? The story goes like this. When the speaker utters the sentence σ, the described situation s_σ got connected to this utterance situation u_σ. Now, u_σ is of a particular type, namely the type U_σ of situations in which the sentence σ is uttered. And, this type U_σ is regularly related to the type D_σ of situations in which John has eaten dinner. Hence, the hearer can infer from the utterance situation u_σ that the described situation s_σ, which is connected to u_σ, must be of type D_σ, that is, s_σ must be a situation in which John has eaten dinner. It is the connections at both the type and the token levels and the classification relations between types and tokens that provide a structure for the speaker to convey his information; and it is the above series of reasoning performed by the hearer that makes him recover the speaker's message. The story can be represented in Figure 3-7:

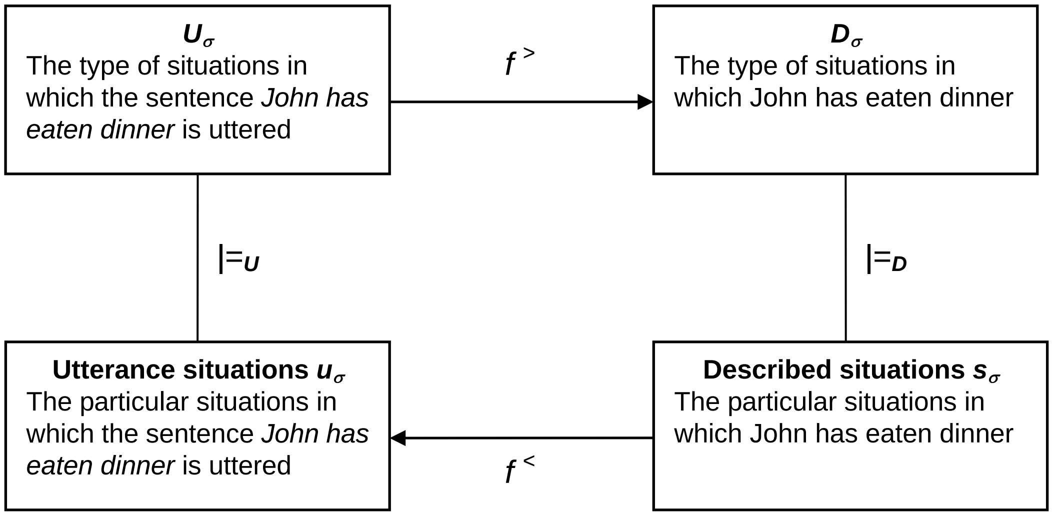

Figure 3-7

We can now formalize the above story with the help of infomorphism:

(i) Define $\boldsymbol{U}$ = (tok ($\boldsymbol{U}$), typ ($\boldsymbol{U}$), $|=_{\boldsymbol{U}}$), the *Utterance Classification*, where tok ($\boldsymbol{U}$) is the set of all utterance situations u_σ in which the sentence σ is uttered, typ ($\boldsymbol{U}$) is the set of all types U_σ of utterance situations in which σ is uttered, and that u_σ is of type U_σ, i.e. $u_\sigma |=_{\boldsymbol{U}} U_\sigma$.

(ii) Similarly, define $\boldsymbol{D}$ = (tok ($\boldsymbol{D}$), typ ($\boldsymbol{D}$), $|=_{\boldsymbol{D}}$), the *Description Classification*, where tok ($\boldsymbol{D}$) is the set of all described situations s_σ described by sentence σ, and typ ($\boldsymbol{D}$) is the set of all types U_σ of described situations described by σ, and that s_σ is of type D_σ, i.e. $s_\sigma |=_{\boldsymbol{D}} D_\sigma$.

Note that the elements of tok ($\boldsymbol{D}$) are situations 'described by a sentence σ', not 'bare' situations. In other words, even though $s_{\sigma 1}$ and $s_{\sigma 2}$ may correspond to the same 'bare' situation, they are regarded as distinct described situations as long as σ_1 and σ_2 are different. This does not contradict the fact that a bare situation can be classified differently with different sentences, because a described situation is more than a bare situation. A described situation already relates to the descriptive intention of the speaker, whereas a bare situation is nothing more than a limited ontological entity. Thus, a cup of tasty coffee with poison can be described as 'a cup of tasty coffee' or 'a cup of poisonous coffee,' but a person who hears the first description may drink it while another who hears the second will definitely not. The consequences of this is that $s_{\sigma 1} = s_{\sigma 2}$ will imply $\sigma_1 = \sigma_2$, and that $D_{\sigma 1} = D_{\sigma 2}$ will imply $\sigma_1 = \sigma_2$.

(iii) Define a function $f : \boldsymbol{U} \rightarrow \boldsymbol{D}$ from the Utterance Classification to the Description Classification in terms of a pair of functions $f = (f^{>}, f^{<})$ as follows:

up-function at the type level: $f^{>}$: typ ($\boldsymbol{U}$)→ typ ($\boldsymbol{D}$), where $f^{>}(U_\sigma) = D_\sigma$;

down-function at the token level: $f^{<}$: tok ($\boldsymbol{D}$)→ tok ($\boldsymbol{U}$), where $f^{<}(s_\sigma) = u_\sigma$.[34]

This definition of f, as we are about to show, guarantees that f is an infomorphism. To see this, we need to check the infomorphism condition

$$(**) \qquad f^{<}(s_\sigma) \models_{\boldsymbol{U}} U_\sigma \quad \Leftrightarrow \quad s_\sigma \models_{\boldsymbol{D}} f^{>}(U_\sigma).$$

[34] That $f^{>}$ is a well-defined function is trivial. That $f^{<}$ is well-defined follows immediately from (ii) above: $s_{\sigma 1} = s_{\sigma 2} \Rightarrow \sigma_1 = \sigma_2 \Rightarrow f^{<}(s_{\sigma 1}) = f^{<}(s_{\sigma 2})$.

In fact, by the definition of the up-function, U_σ is related to D_σ through $f^{>}(U_\sigma) = D_\sigma$; by the definition of the Description Classification, we have $s_\sigma \models_{\boldsymbol{D}} D_\sigma$. These two imply $s_\sigma \models_{\boldsymbol{D}} f^{>}(U_\sigma)$. Hence, given any s_σ such that $f^{<}(s_\sigma) \models_{\boldsymbol{U}} U_\sigma$, we arrive at the right hand side of (**). Conversely, by the definition of the down-function, s_σ is connected to u_σ through $u_\sigma = f^{<}(s_\sigma)$; and by the definition of the Utterance Classification, we have $u_\sigma \models_{\boldsymbol{U}} U_\sigma$. These two imply $f^{<}(s_\sigma) \models_{\boldsymbol{U}} U_\sigma$. Hence, given any s_σ such that $s_\sigma \models_{\boldsymbol{D}} f^{>}(U_\sigma)$, we have the left hand side of (**). This completes the proof that the infomorphism condition (**) is satisfied.

The above three, (i), (ii) and (iii), constitute a formal characterization of the relation theory of meaning. It models the process in which a declarative sentence is used by a speaker to convey information.

Chapter 4

A Formal Characterization of Explicature

THE AIM OF this chapter is to offer a formal modeling of the explicating process which, we believe, is adequate enough to support a formal definition for the concept of explicature. We regard this as our original contribution to formal pragmatics. We shall first discuss the motivations for such a formal treatment. Then, after presenting the underlying idea of our modeling, we will focus on two simple verbal exchanges for which specific channels will be constructed to describe their explicating processes. It will be shown that the channel model is able to give an adequate description of the processes. Based on this adequacy, we propose a formal definition for the concept of explicature.

1. Motivations for a Formal Characterization of Explicature

1.1 General Motivation

There are two motivations for a formal study of explicature in the present work. One is general and the other specific. For the general motivation, the history of science demonstrates enough that formalization is an important, and even critical, step for the growth of a scientific theory or discipline. It is preferable to list notable examples rather than present philosophical arguments to justify the claim. First order logic is a paradigm of the formalization of human reasoning; Montague grammar is another for the formalization of natural language semantics. Since then, both theories have become the foundation of a major portion of semantics, leading to fruitful theoretical and practical applications within and without linguistics.

There have been numerous examples in which formalization made a discipline grow by leaps. We present two examples here. Quantum mechanics is an uncontroversial case. According to Odifreddi (2000), quantum mechanics was first modeled by two completely different formalisms, one using infinite matrices and the other wave functions, out of ‘purely heuristic motivations.’ It was the idea of the mathematician David Hilbert that the two models could be unified by an axiomatic formulation. His assistant von Neumann, who in his later years invented the computer, realized the axiomatization with the use of function analysis, a branch of mathematics where a function is regarded as a ‘point’ in an infinite dimensional space called the Hilbert space. In his *Mathematical Foundation of Quantum Mechanics* (1932), von Neumann treated the states of a quantum system as points in a Hilbert space, and quantities like position and velocity as functions (or called operators) on the Hilbert space. Quantum mechanics has then become the study of functions on Hilbert spaces.

Another case in which the growth of a discipline owed much to its formalization is probability theory. Again, according to Odifreddi, the notion of probability, along with its applications in natural and social sciences, had been mature in early 1800's due to numerous efforts dated back as early as 1500's, involving mathematicians like Pascal, Fermat, Bernoulli, Bayes, Gauss, and Laplace. It had been intuitively defined as the ratio between the favorable and the possible outcomes of an event. However, 'an abstract definition of it was still missing' (Odifreddi: 119). It is Kolmogorov who finally came to an axiomatization in 1931 with the following three axioms: (i) for any event A, the probability $p(A)$ is a number between 0 and 1; (ii) p(empty set) = 0 and p(set of all possible events) = 1; (iii) $p(A_1 + A_2 + A_3 + \ldots) = p(A_1) + p(A_2) + p(A_3) + \ldots$ for mutually non-overlapping events $A_1, A_2, A_3, \ldots$.

1.2 Specific Motivation

A more specific motivation for a formal study of explicature is directed at the proposed definitions for this concept in the current literature. It is observed that the proposed definitions for explicature are either too minimal or not precise enough to bring out its nature (Jiang 2005). Recall that there are two representative definitions for explicature:

> An assumption communicated by an utterance *U* is explicit iff it is a development of a logical form encoded by *U*. … [A]n explicitly communicated assumption [is called] an explicature. (Sperber & Wilson 1986/95)

> Explicature: An ostensively communicated assumption which is inferentially developed from one of the incomplete conceptual representations (logical forms) encoded by the utterance. (Carston 2002)

The two definitions merely tell us that an explicature is derived from the explicating process, in which the underdetermined logical form of an utterance got enriched or fleshed out to a determinate, complete proposition.[35] The weakness of such formulations, we think, is that the notion of relevance is hidden, which is unfortunate since it is this notion that distinguishes the relevance theoretic view of explicitness from those of other scholars. Such a consideration calls for a definition, and a formal one if possible, that can reflect the notion of relevance and its guidance during the explicating process.

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[35] See Chapter 2, Section 5.

2. Modeling the Explicating Process: Our Underlying Idea

Recall our discussion of the identification of explicature in Chapter 2. If the hearer can see the intended relevance of an utterance, she will have an idea of what the conclusion is like, and so by constructing a context to arrive at an Input-Context-Conclusion regularity that makes the input relevant enough, she is entitled to take that input as the explicature. This is the regularity version of the relevance-theoretic comprehension procedure, a story to which we commit ourselves in the present study.

The goal in this chapter is to use the channel model to describe the above story as much as possible. Our main idea is to conceive the intended relevance of an utterance (Conclusion) as giving rise to the core that connects the explicature (Input) and various constructed contexts (Context). Relevance will be treated as an ordinal measure or index that classifies the described situations into different types.

To illustrate our idea, consider the following example that will be discussed again formally in Section 3. Suppose someone walks into a university lecture conducted in Li Ka-shing Building (LKS) and says (1a). A hearer in the lecture has to identify the explicature of (1a) by assigning a suitable referent to the noun phrase *the* *building*. The explicature is most likely (1b).[36]

1a. Ladies and gentlemen, the building is on fire

b. LKS Building is on fire

Our approach will describe the explicating process as follows in Figure 4-1 to 4-3.

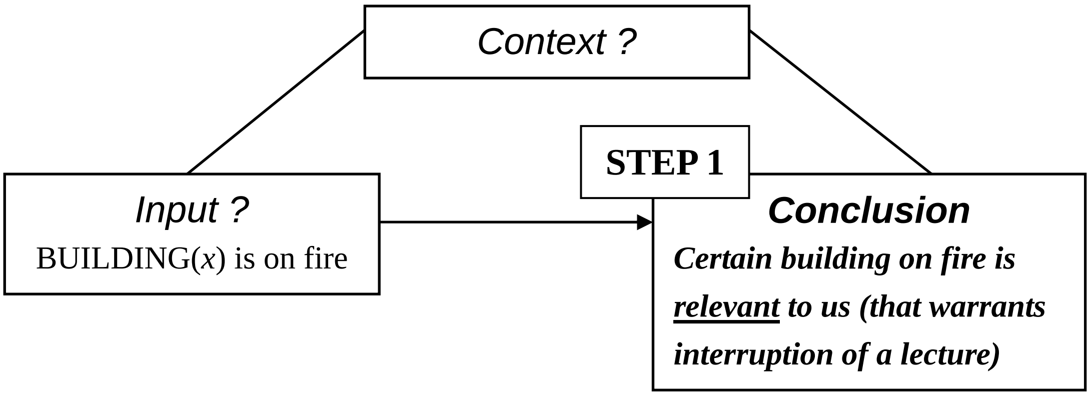

Figure 4-1

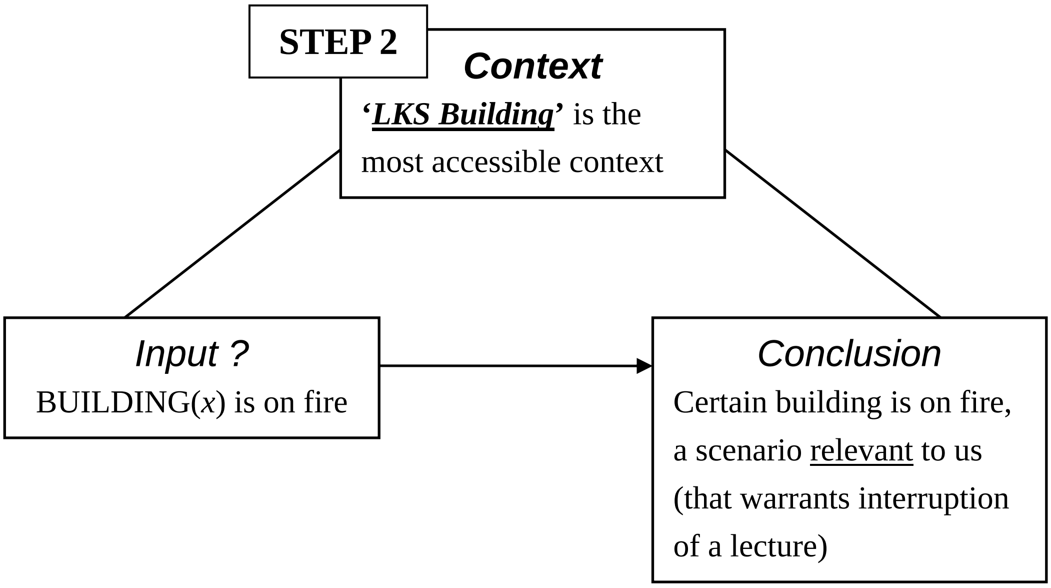

Figure 4-2

[36] An example adapted from Wilson (2004)

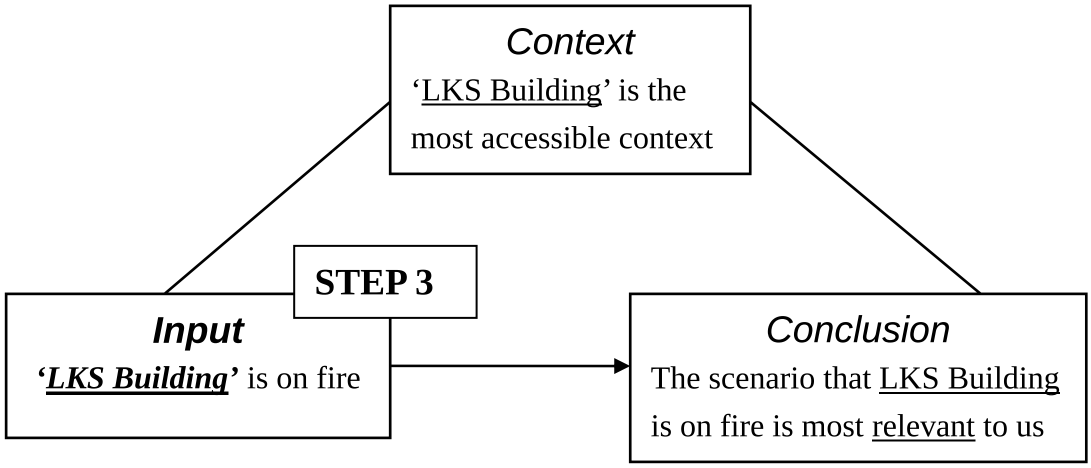

Figure 4-3

The search for relevance by the hearer (Step 1) triggers the most accessible context, which is 'LKS Building' (Step 2), under which the enriched input 'LKS Building is on fire' (Step 3) will give a relevant enough conclusion that makes the hearer regard it as the explicature. In other words, under the guidance of relevance, information about a context (e.g. accessibility of a referent) carries the information about the explicature. It is this *information link* that the hearer exploits in the comprehension of explicit speaker meaning. An adequate modeling of the explicating process needs to reflect such an information link.

We now offer an informal discussion of the modeling. To model the Input-Context-Conclusion regularity with the channel model, thereby describing the explicating process, we need to specify the classifications of the components and the core of the channel on the one hand, and the infomorphisms between each component and the core on the other. First, observe that the collection of all described situations, situations in which ‘the building’ is on fire, can be classified into two different types, forming a classification that corresponds to the Input component in our Input-Context-Conclusion regularity. One type collects all those situations in which the fire occurs in LKS Building. Call this type ***B***. The other type groups all those situations in which the fire occurs in other buildings. Call this type ***O***. (Figure 4-4)

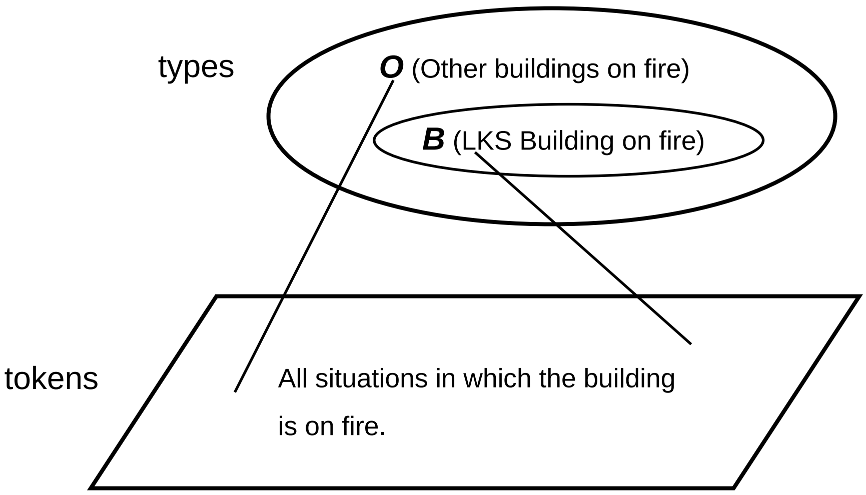

Figure 4-4

Second, the described situations can also be classified into two other types, those relevant to the hearer as type ***REV***, and those irrelevant as type ***IRR***[37], forming another classification that corresponds to the Conclusion component in the Input-Context-Conclusion regularity. Call it the Core Classification, which is to act as the core of our channel.

[37] We may also set REV as 1 and IRR as 0, but has to bear in mind that these are only ordinal measures to give an ordering scale, not themselves cardinal measures.

For the infomorphism from the Input Classification to the Core Classification, define the up-function $f_o^{>}$ as mapping type ***B*** to type ***REV*** and mapping type ***O*** to type ***IRR*.** This is because situations in which LKS Building is on fire are the relevant ones to the hearers, while others are irrelevant. So, it is necessary for the definition of the up-function to reflect this fact. The down-function $f_o^{<}$ is naturally defined to be the identity function.

It is clearly absurd that the noun phrase *the building* will invariably be connected to LKS Building (the one in which the lecture is conducted) by the hearer. For if the accessibility of LKS Building is very low, it would not be interpreted as the intended referent of *the building*. Hence, accessibility of a referent plays a crucial role in utterance comprehension. This gives rise to a third classification, the Context Classification that corresponds to the Context component. It has two types: the accessible ***ACC*** and the inaccessible ***INA***, where ***ACC*** groups those situations in which LKS Building is on fire and ***INA*** groups those others in which other buildings is on fire. For the infomorphism between the Context Classification and the Core Classification, define the up-function $f_1^{>}$ as mapping ***ACC*** to ***REV*** and ***INA*** to ***IRR***. This is because the accessible referent LKS Building is relevant while the inaccessible referents 'other buildings' are irrelevant. The down-function $f_1^{<}$ is again defined naturally to be the identity function.

The Core Classification can now be seen as a link between the Context and the Input, allowing contextual information (in this case the accessibility of a referent) to contribute to the identification of the explicature (in this case, crucially, the intended referent of a noun phrase). The binary channel $\{f_o , f_1\}$ is shown graphically in Figure 4-5 (only the type levels are shown).

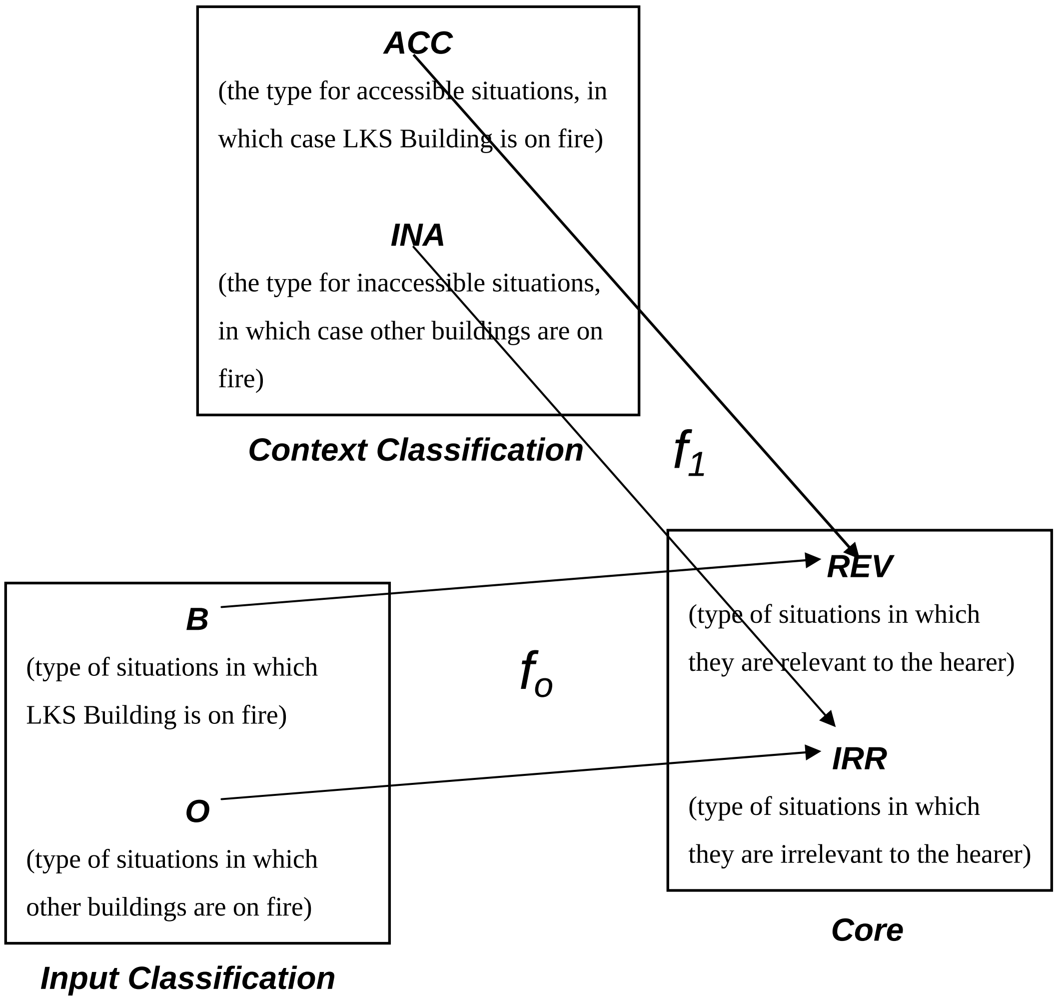

Figure 4-5

3. A Simple Formal Model

A theory of explicature and the accompanying process of explicating are to be discussed under the following setting. A speaker S produces an utterance *u* to the hearer H. The type of situations associated with *u* is represented as an *infon* <<*R*, *l*, *x*, *y*, …; 1>>, whose unknown arguments (some or all of *l, x, y,* …) are to be saturated or filled in via pragmatic inference by the hearer. The process of saturation may involve some or all of the following: reference assignment, word sense disambiguation, recovery of ellipsis parts, restriction of quantifier domain, etc. When a saturated infon arrived at under the guidance of relevance is deemed relevant enough, it will be taken as the explicature, which indicates that the intended, described situation is of this type (of course, to the best inference of the hearer). Thus, if the explicature of ‘He’s eaten’ is ‘John has eaten dinner,’ then the intended situation described by this utterance is a situation of the type ‘John has eaten dinner,’ i.e., a situation in which John has eaten dinner. The regularity that underlies the explicating process is to be modeled by a channel that involves three components:

(a) the **Input Classification** $\boldsymbol{A_o}$, in which the explicature is to be identified;

(b) the **Context Classifications** $\boldsymbol{A_1}$, $\boldsymbol{A_2}$, … that correspond to the context; and

(c) the **Core Classification** ***C*** that corresponds to the guidance of relevance.

Input Classification A_o

(i) The tokens of A_o are all situations that can be described by the utterance *u*. For example, the utterance ‘He’s eaten’ can describe many situations:

situations in which John has eaten dinner;

situations in which Jack has eaten a cake;

situations in which Peter has eaten dinner in this evening; etc.

So, all these situations are tokens of A_o concerned.

(ii) The types of A_o are infons that are supported by the situations in tok(A_o). In the case of the utterance ‘He’s eaten,’ the types include:

<<*EAT, John, dinner*; 1>>,

<<*EAT, Jack, a cake*; 1>>,

<<*EAT, this evening, Peter, dinner*; 1>>, etc.

These types are all members of typ(A_o) concerned.

(iii) The classification relation is naturally the support relation ‘$|=_{A_o}$’ between situation tokens and their corresponding infons.

Contextual Classifications $A_1, A_2, \ldots$

(i) The sets of tokens of each classification $A_1, A_2, \ldots$ are the same as that of A_o, i.e., tok(A_o) = tok(A_1) = tok(A_2) = ….

(ii) For reference assignment and word sense disambiguation, we may use ***ACC*** (accessible) and ***INA*** (inaccessible) as types. For other free enrichments, the types may be ***ANS*** (question answered) and ***UNA*** (question unanswered), or some other kinds of types deemed suitable in a case by case basis.

(iii) The classification relations will be the commonsensical relations between the types and the situation tokens.

Core Classification *C*

(i) The set of tokens of ***C*** is the same as tok($\boldsymbol{A_o}$).

(ii) The situation tokens of ***C*** will be classified by levels of relevance, which are defined to be the values between 0 to 1, where a level of 0 means 'irrelevant' and a level of 1 means '100 percent relevant'. In simple cases like example (1) above, we only need two types: ***REV*** (relevant) and ***IRR*** (irrelevant).

(iii) The classification relation comes from the natural relations between situation tokens and their corresponding relevance levels.

We are now in a position to use the channel model to describe explicating processes. Two examples will be analyzed in detail.

Example A

[Someone walks into a university lecture conducted in LKS Building and says]

1. The building is on fire.

We shall present a formal modeling with the channel model on how the explicating process proceeds and leads to the identification of the explicature. First, define the classifications as follows.

(a) The Input Classification $\boldsymbol{A_o}$:

(i) $s \in \text{tok}(\boldsymbol{A_o})$ if s is a situation in which ‘the building’ is on fire;

(ii) typ($\boldsymbol{A_o}$) is the set {$\boldsymbol{B}$, $\boldsymbol{O}$}, where $\boldsymbol{B}$ = <<*ON_FIRE*, *LKS Building*; 1>> and $\boldsymbol{O}$ collects all those situations in which the fire occurs in other buildings.

(iii) $s \models_{A_o} \boldsymbol{B}$ iff s is a situation in which LKS Building is on fire; $s \models_{A_o} \boldsymbol{O}$ iff s belongs to all other situation tokens.

(b) The Contextual Classification $\boldsymbol{A_1}$:

(i) tok($\boldsymbol{A_1}$) = tok($\boldsymbol{A_o}$);

(ii) typ($\boldsymbol{A_1}$) is the set {$\boldsymbol{ACC}$, $\boldsymbol{INA}$};

(iii) If $s \in \text{tok}(\boldsymbol{A_1})$ is a situation in which the fire occurs in LKS Building, it is accessible to the hearers, and so is classified as type $\boldsymbol{ACC}$, i.e. $s \models_{A_1} \boldsymbol{ACC}$. On the other hand, if s is a situation in which the fire occurs in other buildings, it is not accessible to the hearers, and so is classified as type ***INA***, i.e. $s \models_{A1}$ ***INA***.

(c) The Core Classification ***C***:

(i) tok(***C***) = tok($\boldsymbol{A_o}$);

(ii) typ(***C***) is the set {***REV***, ***IRR***};

(iii) If $s \in$ tok(***C***) is a situation in which the fire occurs in LKS Building, it is a relevant situation to the hearers, and so is classified as type ***REV***, i.e. $s \models_C$ ***REV***. On the other hand, if *s* is a situation in which the fire occurs in other buildings, it is not relevant to the hearers, and so is classified as type ***IRR***, i.e. $s \models_C$ ***IRR***.

(d) The infomorphisms:

We shall specify infomorphism f_o from $\boldsymbol{A_o}$ to ***C*** and f_1 from $\boldsymbol{A_1}$ to ***C***, so that information from the Contextual Classification $\boldsymbol{A_1}$ can flow to the Input Classification $\boldsymbol{A_o}$ with the linkage provided by the Core Classification ***C*** (Fig 4-6). This will model the intuitive explicating process via the Input-Context-Conclusion regularity, which has been discussed at the beginning of section 2.

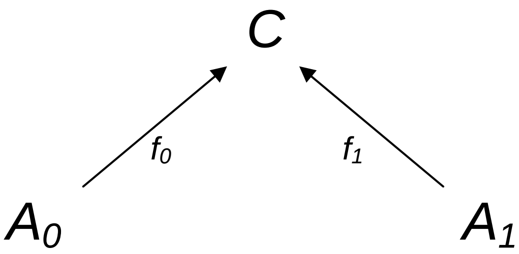

Figure 4-6

We define $f_o : \boldsymbol{A_o} \rightarrow \boldsymbol{C}$ as follows:

(i) For the tokens, we take the down-function as the identity function, i.e. $f_o^{<}(s) = s$.

(ii) For the types, it is natural to define $f_o^{>}(\boldsymbol{B}) = \boldsymbol{REV}$ and $f_o^{>}(\boldsymbol{O}) = \boldsymbol{IRR}$.

To check that f_o is in fact an infomorphism, we need to show that

$$f_o^{<}(s) \models_{\boldsymbol{Ao}} t \;\Leftrightarrow\; s \models_{\boldsymbol{C}} f_o^{>}(t).$$

Suppose token $s \in \text{tok}(\boldsymbol{C})$ and $f_o^{<}(s) \models_{\boldsymbol{Ao}} t$. Then $s \models_{\boldsymbol{Ao}} t$, since $f_o^{<}$ is the identity function. If t is the type $\boldsymbol{B}$, we have $s \models_{\boldsymbol{Ao}} \boldsymbol{B}$, and so s is a situation in which LKS Building is on fire, and hence is a relevant situation. So, $s \models_{\boldsymbol{C}} \boldsymbol{REV} = f_o^{>}(\boldsymbol{B})$. Similarly, if t is the type $\boldsymbol{O}$, s will be not a situation in which LKS Building is on fire, and so is an irrelevant situation, so $s \models_{\boldsymbol{C}} \boldsymbol{IRR} = f_o^{>}(\boldsymbol{O})$. In both cases, we have $f_o^{<}(s) \models_{\boldsymbol{Ao}} t \Rightarrow s \models_{\boldsymbol{C}} f_o^{>}(t)$. This proves the '=>' part.

Conversely, suppose $s \in \text{tok}(\boldsymbol{C})$ and $s \models_{\boldsymbol{C}} f_o^{>}(t)$. If t is $\boldsymbol{B}$, then $f_o^{>}(t) = \boldsymbol{REV}$, so that we have $s \models_{\boldsymbol{C}} \boldsymbol{REV}$. This means that s is a relevant situation, so s is of type $\boldsymbol{B}$ in $\boldsymbol{A_o}$, ie, $s \models_{\boldsymbol{Ao}} \boldsymbol{B}$, implying $f_o^{<}(s) \models_{\boldsymbol{Ao}} \boldsymbol{B}$, since $f_o^{<}$ is the identity function. Similarly, If t is $\boldsymbol{O}$, then $f_o^{>}(t)$ = ***IRR***, so we have $s \models_{C}$ ***IRR***. This means that s is an irrelevant situation, and so s is of type ***O*** in $\boldsymbol{A_o}$, ie, $s \models_{A_o}$ ***O***, implying $f_o^{<}(s) \models_{A_o}$ ***O***. In both cases, we have $s \models_{C} f_o^{>}(t) \Rightarrow f_o^{<}(s) \models_{A_o} t$. This proves the '<=' part. Hence, f_o is an infomorphism.

Similarly, define $f_1 : \boldsymbol{A_1} \rightarrow \boldsymbol{C}$ as follows:

(i) For the tokens, take the down-function as the identity function $f_1^{<}(s) = s$.

(ii) For the types, define $f_1^{>}$(***ACC***) = ***REV*** , $f_1^{>}$(***INA***) = ***IRR***.

It can be similarly checked that f_1 is an infomorphism.

An interesting consequence from this simple model is (*) below. What (*) says is that contextual information contributes to the identification of the explicature. In this simple example, accessibility of a referent totally determines what the explicature is. In the more complicated Example B to be discussed below, other factors also helps determine the explicature.

> (*) A situation that is accessible by the hearer is also a situation in which LKS Building is on fire (i.e. it is also a situation of the type corresponding to the explicature 'LKS Building is on fire').

To see how (*) is derived, observe that the Core Classification ***C*** supports the following constraint:

$$f_1^{>}(\boldsymbol{ACC}) \vdash_{\boldsymbol{C}} f_o^{>}(\boldsymbol{B}).$$

This is because $f_1^{>}(\boldsymbol{ACC}) = \boldsymbol{REV} = f_o^{>}(\boldsymbol{B})$, and so the constraint is just $\boldsymbol{REV} \vdash_{\boldsymbol{C}} \boldsymbol{REV}$, which is of course true. Now,

$$s \models_{A1} \boldsymbol{ACC}$$

$$\Rightarrow \quad f_1^{<}(s) \models_{A1} \boldsymbol{ACC} \qquad \text{(since } f_1^{<} \text{ is identity function)}$$

$$\Rightarrow \quad s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{ACC}) \qquad \text{(since } f_1 \text{ is infomorphism)}$$

$$\Rightarrow \quad s \models_{\boldsymbol{C}} f_o^{>}(\boldsymbol{B}) \qquad \text{(since } f_1^{>}(\boldsymbol{ACC}) \vdash_{\boldsymbol{C}} f_o^{>}(\boldsymbol{B}) \text{ is a constraint in } \boldsymbol{C}\text{)}$$

$$\Rightarrow \quad f_o^{<}(s) \models_{Ao} \boldsymbol{B} \qquad \text{(since } f_o \text{ is infomorphism)}$$

$$\Rightarrow \quad s \models_{Ao} \boldsymbol{B} \qquad \text{(since } f_o^{<} \text{ is identity function),}$$

which is (*). In brief, our channel model has adequately described the explicating process by reflecting this information link that leads to the identification of the explicature.

We can also imagine a scenario in which the hearer cannot figure out the explicature, leading to a communication failure. Suppose that Peter is a student listening to the lecture, who has been reported that Shaw Building on the other side of the university campus was found to contain tons of inflammable material stored by terrorists. It can be imagined that Shaw Building might become the most accessible context to Peter, and so become relevant to him. On the other hand, LKS Building will also be relevant to Peter because he is a participant in the lecture and a fire on LKS means an immediate threat to his life. Intuitively, Peter will have problem in interpreting the utterance ‘The building is on fire’ if the strength of relevance from the two sources are equal, in which case he will not know whether the utterance means ‘Shaw Building is on fire’ or ‘LKS Building is on fire.’ Our simple model does capture this case of communication failure by revising the definition (b) above of the Contextual Classification to (b’) to reflect Peter’s circumstances:

(b’) The Contextual Classification $\boldsymbol{A_1}$:

(i) tok($\boldsymbol{A_1}$) = tok($\boldsymbol{A_o}$);

(ii) typ($\boldsymbol{A_1}$) is the set {***ACC***, ***INA***};

(iii) If $s \in$ tok($\boldsymbol{A_1}$) is a situation in which the fire occurs in Shaw Building, it is accessible to Peter, and so is classified as type ***ACC***, i.e. $s \models_{A1}$ ***ACC***. On the other hand, if s is a situation in which the fire occurs in LKS Building or other buildings, it is not accessible to Peter, and so is classified as type ***INA***, i.e. $s \models_{A1}$ ***INA***.

The possibilities of relations between the types are shown in Figure 4-7:

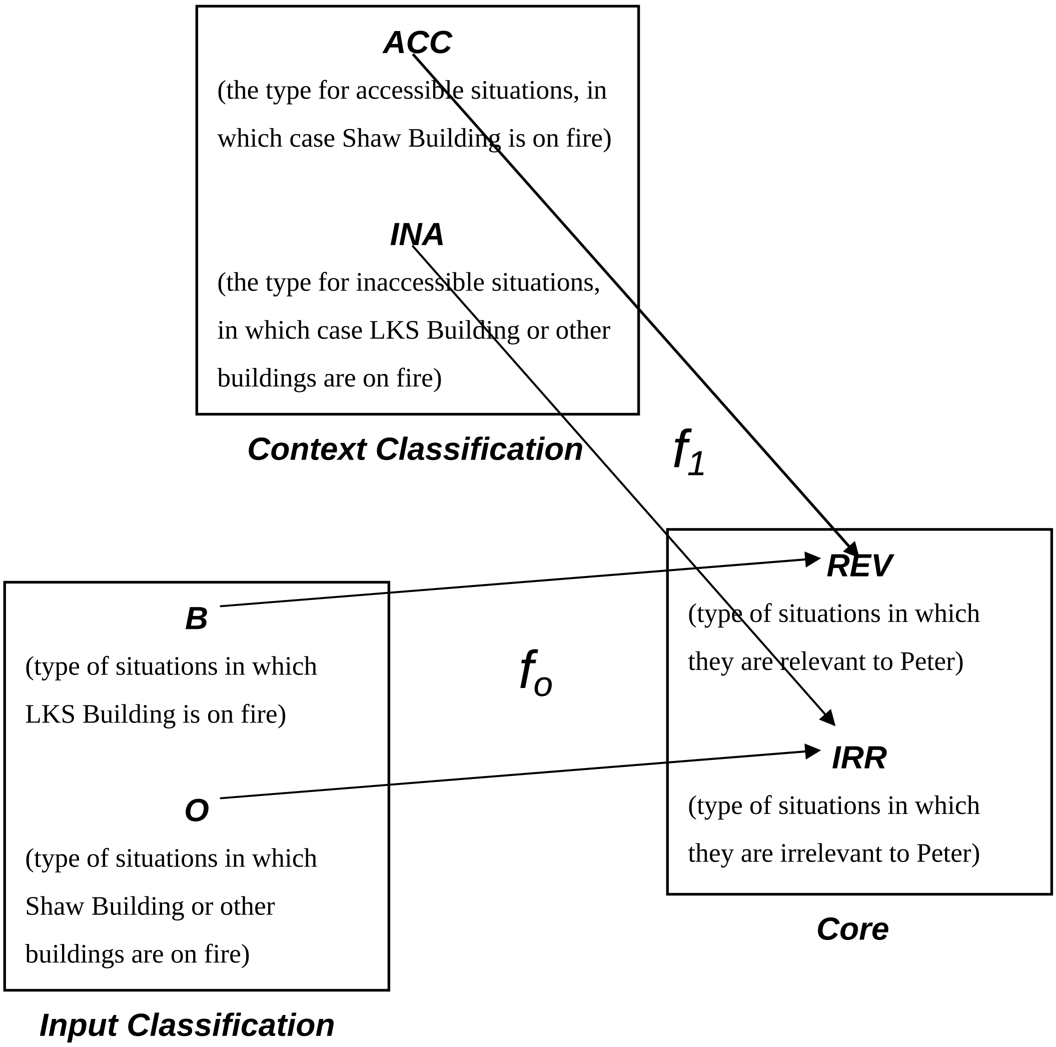

Figure 4-7

Intuitively, as can be seen from Figure 4-7, although the supposed explicature is 'LKS Building is on fire' (***B*** mapped to ***REV***), it is not supported by the contextual information. This is because LKS Building is the least accessible and will therefore be the least relevant (***INA*** mapped to ***IRR***) while Shaw Building is the most accessible and hence most relevant (***ACC*** mapped to ***REV***). To explain technically this intuition that Peter faces a communication failure, just note that it can be easily proved that the definition of the Core Classification in (c) above will fail to make f_1 an infomorphism, since the infomorphism condition will not be satisfied. On the other hand, if we define the Core Classification as (c') below, then this time f_o will fail to be an infomorphism.[38]

(c') The Core Classification ***C***:

(i) tok(***C***) = tok($\boldsymbol{A_o}$);

(ii) typ(***C***) is the set {***REV***, ***IRR***};

(iii) If $s \in$ tok(***C***) is a situation in which the fire occurs in Shaw Building, it is a relevant situation to Peter, and so is classified as type ***REV***, i.e. $s \models_{\boldsymbol{C}}$ ***REV***. On the other hand, if s is a situation in which the fire occurs in LKS Building or other buildings, it is not relevant to Peter, and so is classified as type ***IRR***, i.e. $s \models_{\boldsymbol{C}}$ ***IRR***.

In brief, the informational dilemma in the case of Peter can be technically reflected within the channel model.

[38] The infomorphism condition is $f_1^{<}(s) \models_{\boldsymbol{A_1}} t \Leftrightarrow s \models_{\boldsymbol{C}} f_1^{>}(t)$. But note that $(f_1^{<}(s) \models_{\boldsymbol{A_1}}$ ***ACC***$)$ => $(s \models_{\boldsymbol{A_1}}$ ***ACC***$)$ => (s is Shaw Building) => $(s \models_{\boldsymbol{C}}$ ***IRR***$)$ => $(s \models_{\boldsymbol{C}} f_1^{>}($***INA***$))$, hence the left to right implication of the infomorphism condition is not satisfied for the type ***ACC*** of $\boldsymbol{A_1}$. So, f_1 is not an infomorphism with (c) as the Core Classification. That f_o is not an infomorphism with (c') as the Core can be shown similarly.

Example B

Consider a slightly more complicated example:[39]

2a. Alan: Would John like to have dinner with us?

b. Lisa: He's eaten.

Apparently, the utterance 'He's eaten' can mean many things: John has eaten dinner; Jack has eaten a cake; Peter has eaten dinner in this evening; … . However, the hearer, Alan, will only find 'John has eaten dinner' relevant, because such an enriched input will provide an answer to his question, thus satisfying his expectation of relevance. In this case, relevance guides the hearer to assign a suitable referent to the pronoun *He* and to recover the ellipsis term 'dinner'. The explicating process involves filling in *two* unknown arguments *X* and *Y* in the underdetermined infon <<*EAT*, *X*, *Y*; 1>> of Lisa's utterance. We shall model the explicating process with the following channel.

(a) The Input Classification $\boldsymbol{A_o}$:

(i) The tokens are all situations in which 'he has eaten.'

(ii) The tokens can be classified into four types: {***JD***, ***J***, ***D***, ***O***}:

JD = <<*EAT*, *John*, *dinner*; 1>> collects those situations in which John has eaten dinner;

J = <<*EAT*, *John*, *Y*; 1>> collects those situations in which John has eaten;

[39] Adapted from Wilson 2004, Lecture 7

D = <<*EAT*, *X*, *dinner*; 1>> collects those in which he has eaten dinner;

O = collects situations other than those collected by ***JD***, ***J***, and ***D***.

(iii) Classification relation is naturally the relation between situation tokens and their respective types. (Figure 4-8)

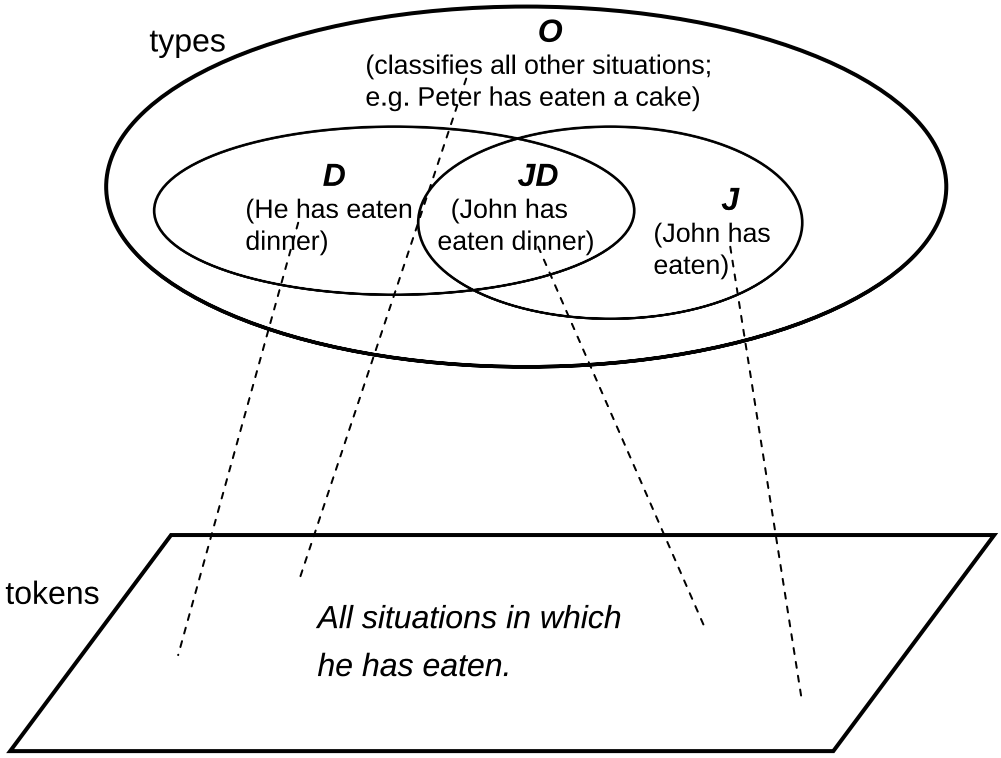

Figure 4-8

Note that $\boldsymbol{A_o}$ supports constraints (C1), (C2) and (C3):

(C1) $\{\boldsymbol{JD}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{J}\}$, because if *s* is a situation in which John has eaten dinner, then *s* is also a situation in which John has eaten;

(C2) $\{\boldsymbol{JD}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{D}\}$, because if *s* is a situation in which John has eaten dinner, then *s* is also a situation in which he (some male) has eaten;

(C3) $\{\boldsymbol{JD}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{J}, \boldsymbol{D}\}$, because if *s* is a situation in which John has eaten dinner, then *s* is either a situation in which John has eaten or a situation in which he has eaten.

We may wonder if $\boldsymbol{A_o}$ also supports (C4) as a constraint:

(C4) $\{\boldsymbol{J}, \boldsymbol{D}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{JD}\}$.

In fact, we have to make an assumption before (C4) becomes a constraint. For if *s* is a situation in which John has eaten and at the same time a situation in which he (some male) has eaten dinner, then it might happen that *w* is a situation in which, say, John has eaten 'a chocolate' and 'Peter' has eaten dinner. In that case *w* will not be a situation in which John has eaten dinner. This circumstance can be represented in Figure 4-9a. We therefore need to assume that each situation token in tok($\boldsymbol{A_o}$) is sufficiently limited to exclude such a circumstance. Equivalently, we need to make the assumption that the situations classified by ***JD*** *exhaust* all the situations classified by both ***J*** and ***D***. This is represented in Figure 4-9b. This also vindicates the claim of situation theory that a situation is only a limited part of reality.

Note that the above four constraints arise solely from the Input Classification itself; contextual information and the consideration of relevance have not entered into the picture. Moreover, it is the constraint (C4) that is crucial and will be used later.

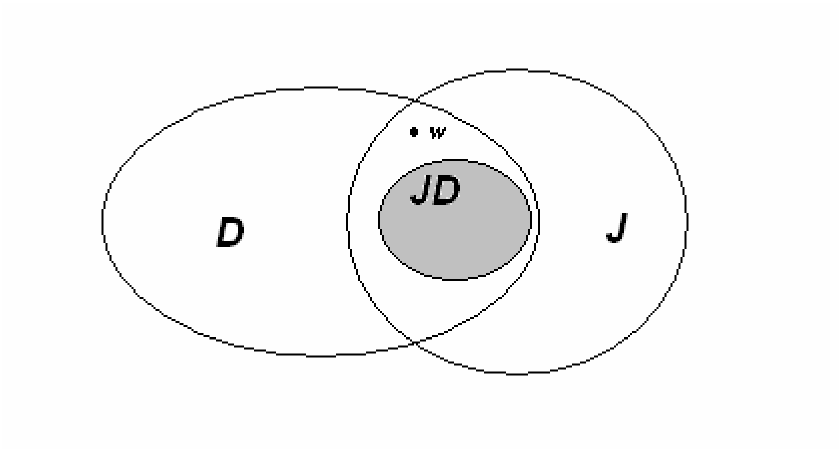

Figure 4-9a

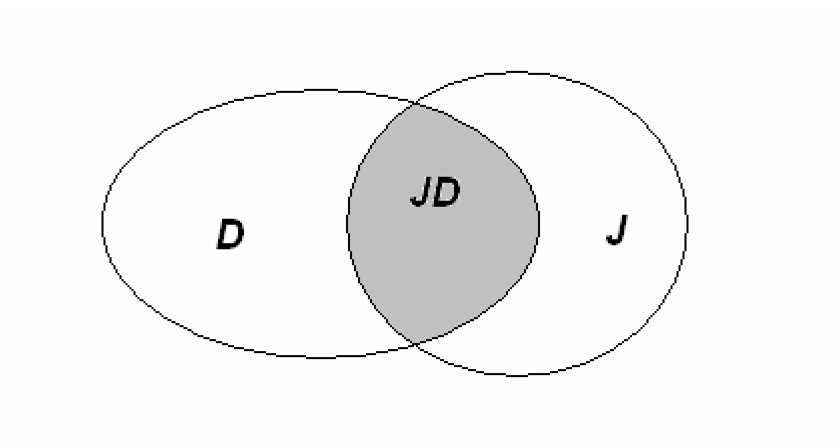

Figure 4-9b

(b) There are two contextual factors that affect the identification of explicature; they correspond to two classifications for contextual information.

Context Classification $\boldsymbol{A_1}$: (Accessibility of referents for the pronoun *He*)

(i) The set of token tok($\boldsymbol{A_1}$) = tok($\boldsymbol{A_o}$).

(ii) The types and their classification relations with the tokens are as follows:

typ($\boldsymbol{A_1}$) = {***ACC***, ***INA***}, where

$s \models_{A1}$ ***ACC*** if *s* is a situation in which John has eaten;

$s \models_{A_1}$ ***INA*** if otherwise.

Contextual Classification $\boldsymbol{A_2}$: (Relevance of the omitted object of the verb *EAT*, which concerns whether Lisa's utterance constitutes an answer to the question posed by Alan)

(i) The set of token tok($\boldsymbol{A_2}$) = tok($\boldsymbol{A_o}$).

(ii) typ($\boldsymbol{A_2}$) = {***ANS***, ***UNA***}, where ***ANS*** collects situations serving as a direct answer to the question posed by Alan, and ***UNA*** collects all other situations; thus,

$s \models_{A_2}$ ***ANS*** if *s* is a situation in which he has eaten supper;

$s \models_{A_2}$ ***UNA*** if otherwise.

(c) The Core Classification ***C***:

(i) Again, the set of token tok(***C***) = tok($\boldsymbol{A_o}$).

(ii) Types and classification relation:

$s \models_C r_4$ if $s \models_{A_o}$ ***JD***

$s \models_C r_3$ if $s \models_{A_o}$ ***J***

$s \models_C r_2$ if $s \models_{A_o}$ ***D***

$s \models_C r_1$ if $s \models_{A_o}$ ***O***

$s \models_C r_3$ if $s \models_{A_1}$ ***ACC***

$s \models_{C} r_1$ if $s \models_{A1}$ ***INA***

$s \models_{C} r_2$ if $s \models_{A2}$ ***ANS***

$s \models_{C} r_1$ if $s \models_{A2}$ ***UNA***,

where $0 = r_1 < r_2 < r_3 < r_4 \leqq 1$ are relevance levels serving as types of ***C***. Here, we assume that the relevance level (r_3) achieved by situations involving the accessible, intended referent of the pronoun *He* is higher than that (r_2) involving the ellipsis object of the verb *EAT*. But it is easily seen from the derivation below that the model still works if $r_3 < r_2$.

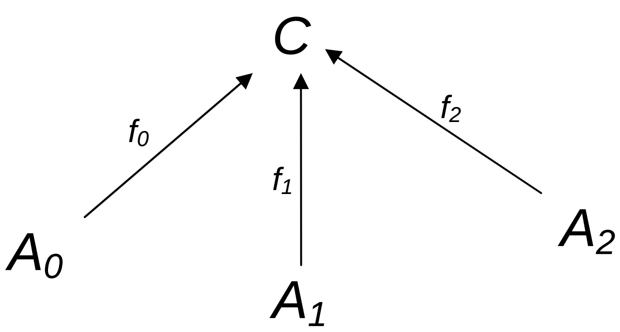

Figure 4-10

We need to define infomorphisms from each component classification to the core (Figure 4-10). First, for the Input Classification, define f_o: $\boldsymbol{A_o} \rightarrow \boldsymbol{C}$ as follows:

(i) for the tokens, take $f_o^{<}$ as the identity function;

(ii) for the types, define $f_o^{>}$(***JD***) = r_4,

$f_o^{>}(\boldsymbol{J}) = r_3$,

$f_o^{>}(\boldsymbol{D}) = r_2$,

$f_o^{>}(\boldsymbol{O}) = r_1$.

It is so defined for obvious reasons. It can be easily checked that f_o (and also f_1, f_2 below) is in fact an infomorphism. The routine checking is placed in the appendix of this chapter.

Next, define $f_1 : \boldsymbol{A_1} \to \boldsymbol{C}$ as follows:

(i) for the tokens, define $f_1^{<}$ as the identity function;

(ii) for the types, define $f_1^{>}(\boldsymbol{ACC}) = r_3$,

$f_1^{>}(\boldsymbol{INA}) = r_1$.

Then, define $f_2 : \boldsymbol{A_2} \to \boldsymbol{C}$ as follows:

(i) for the tokens, define $f_2^{<}$ as the identity function;

(ii) for the types, define $f_2^{>}(\boldsymbol{ANS}) = r_2$,

$f_2^{>}(\boldsymbol{UNA}) = r_1$.

One of the advantages of the channel model is that it offers a technical way to collapse all the context classifications and their respective infomorphisms to the core into a *single* classification and infomorphism, so that the whole communicative process can still be represented by exactly three components corresponding to Input, Context and Conclusion. The trick is to take their sum classification ($\boldsymbol{A_1} + \boldsymbol{A_2} + \ldots$) and their sum infomorphism. For the sum of two classifications, we have the following definition (Barwise & Seligman, 1997: 33, 81).

Definition of Sum of Classifications

Given classifications $\boldsymbol{A}$ (A, T, $\models_{\boldsymbol{A}}$) and $\boldsymbol{B}$ (B, V, $\models_{\boldsymbol{B}}$) the sum $\boldsymbol{A} + \boldsymbol{B}$ is the classification defined as follows:

(a) the set of tokens is the Cartesian product $A \times B$;

(b) the set of types is the disjoint union of T and V; specifically, they are ordered pairs of the form (i, x) where $i = 0$ and $x \in T$, or $i = 1$ and $x \in V$.

(c) the classification relation $\models_{\boldsymbol{A}+\boldsymbol{B}}$ is defined by

$$(a, b) \models_{\boldsymbol{A}+\boldsymbol{B}} (0, t) \quad \text{if} \quad a \models_{\boldsymbol{A}} t\ ,$$

$$(a, b) \models_{\boldsymbol{A}+\boldsymbol{B}} (1, v) \quad \text{if} \quad b \models_{\boldsymbol{B}} v\ .$$

Intuitively, the definition just tells us that the tokens of the sum $\boldsymbol{A} + \boldsymbol{B}$ are the ordered pairs of the tokens of $\boldsymbol{A}$ and $\boldsymbol{B}$, while the types are those of $\boldsymbol{A}$ and $\boldsymbol{B}$ taken together. The sum of classifications can also be generalized to an arbitrary number of classifications $\boldsymbol{A_i}$'s (Barwise & Seligman, 1997: 83).

Specifically, in Example B, the sum $\boldsymbol{A_1} + \boldsymbol{A_2}$ is defined as follows:

(i) tokens are of the form (s_1, s_2), where $s_1 \in$ tok (***A_1***) and $s_2 \in$ tok (***A_2***) ;

(ii) totally four types: (1, ***ACC***), (1, ***INA***), and (2, ***ANS***) and (2, ***UNA***);

(iii) the classification relation is

$$(s_1, s_2) \models_{\boldsymbol{A1 + A2}} (1, \boldsymbol{ACC}) \quad \text{if} \quad s_1 \models_{\boldsymbol{A1}} \boldsymbol{ACC}$$

$$(s_1, s_2) \models_{\boldsymbol{A1 + A2}} (1, \boldsymbol{INA}) \quad \text{if} \quad s_1 \models_{\boldsymbol{A1}} \boldsymbol{INA}$$

$$(s_1, s_2) \models_{\boldsymbol{A1 + A2}} (2, \boldsymbol{ANS}) \quad \text{if} \quad s_2 \models_{\boldsymbol{A2}} \boldsymbol{ANS}$$

$$(s_1, s_2) \models_{\boldsymbol{A1 + A2}} (2, \boldsymbol{UNA}) \quad \text{if} \quad s_2 \models_{\boldsymbol{A2}} \boldsymbol{UNA}$$

For the infomorphism from ***A_1*** + ***A_2*** to the core ***C***, it is known that there is a unique infomorphism $h = f_1 + f_2$ such that the diagram in Figure 4-11 commutes, where n_1 and n_2 are natural infomorphisms (B&S: Definition 5.3 and Proposition 5.4, p. 82). So, $h = f_1 + f_2$ is defined as follows:

Type level:

$$h^{>}(1, \boldsymbol{ACC}) = (f_1 + f_2)^{>}(1, \boldsymbol{ACC}) = f_1^{>}(\boldsymbol{ACC}) = r_3$$

$$h^{>}(1, \boldsymbol{INA}) = (f_1 + f_2)^{>}(1, \boldsymbol{INA}) = f_1^{>}(\boldsymbol{INA}) = r_1$$

$$h^{>}(2, \boldsymbol{ANS}) = (f_1 + f_2)^{>}(2, \boldsymbol{ANS}) = f_2^{>}(\boldsymbol{ANS}) = r_2$$

$$h^{>}(2, \boldsymbol{UNA}) = (f_1 + f_2)^{>}(2, \boldsymbol{UNA}) = f_2^{>}(\boldsymbol{UNA}) = r_1$$

Token level:

$$h^{<}(s_1, s_2) = (f_1 + f_2)^{<}(s_1, s_2) = (f_1^{<}(s_1), f_2^{<}(s_1)) = (s_1, s_2)$$

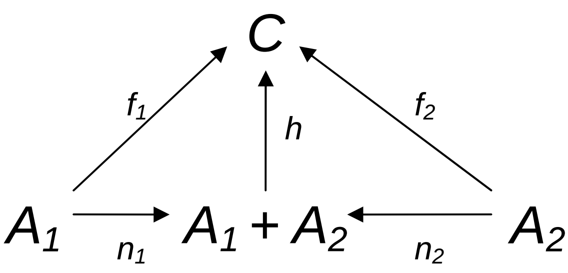

Figure 4-11

After the summation of the two Context Classifications, it leads to a binary channel as shown in Figure 4-12.

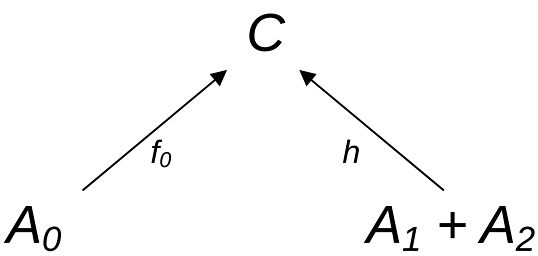

Figure 4-12

Our crucial question is: Does the core ***C*** support (1), or equivantly (2), as a constraint?

(1) $\{h^{>}(1, \boldsymbol{ACC}),\quad h^{>}(2, \boldsymbol{ANS})\} \vdash_{\boldsymbol{C}} \{f_o^{>}(\boldsymbol{JD})\}$

(2) $\{r_3,\quad r_2\} \vdash_{\boldsymbol{C}} \{r_4\}$

To answer this, note that $\{\boldsymbol{J}, \boldsymbol{D}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{JD}\}$ is a constraint in $\boldsymbol{A_o}$, and since f_o: $\boldsymbol{A_o} \rightarrow \boldsymbol{C}$ is an infomorphism with $f_o^{<}$ as the identity function, so by Lemma 12.17 of Barwise & Seligman (1997),

$$\{f_o^{>}(\boldsymbol{J}),\quad f_o^{>}(\boldsymbol{D})\} \vdash_{\boldsymbol{C}} \{f_o^{>}(\boldsymbol{JD})\}$$

is also a constraint in ***C***, and it is just (2), and hence (1) (see the Appendix for a proof). Therefore, (1) is also a constraint.

Now, for any $s \in \boldsymbol{C}$

$s \models_{\boldsymbol{A1}} \boldsymbol{ACC}$ and $s \models_{\boldsymbol{A2}} \boldsymbol{ANS}$

=> $f_1^{<}(s) \models_{\boldsymbol{A1}} \boldsymbol{ACC}$ and $f_2^{<}(s) \models_{\boldsymbol{A2}} \boldsymbol{ANS}$ (since $f_1^{<}$ and $f_2^{<}$ are identity function)

=> $s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{ACC})$ and $s \models_{\boldsymbol{C}} f_2^{>}(\boldsymbol{ANS})$ (since f_1 and f_2 are infomorphisms)

=> $s \models_{\boldsymbol{C}} h^{>}(1, \boldsymbol{ACC})$ and $s \models_{\boldsymbol{C}} h^{>}(2, \boldsymbol{ANS})$ (by definition of $h^{>}$)

=> $s \models_{\boldsymbol{C}} f_o^{>}(\boldsymbol{JD})$ (since (1) is a constraint)

=> $f_o^{<}(s) \models_{\boldsymbol{Ao}} \boldsymbol{JD}$ (since f_o is infomorphism)

=> $s \models_{\boldsymbol{Ao}} \boldsymbol{JD}$ (since $f_o^{<}$ is identity function)

What we have shown is the following:

> If *s* is a situation in which it is accessible by the hearer and serves as an answer to the speaker's question, then *s* is also a situation that supports the explicature of the utterance, i.e. a situation of the type 'John has eaten dinner.'

Again, our channel model has successfully described the fact that contextual information, like the accessibility of a referent and the plausibility of an input's answering a question, contributes to the identification of the explicature under the guidance of relevance.

4. A Formal Definition for Explicature

Apart from providing a formal description of the pragmatic process in the comprehension of explicit speaker meaning, the channel model also offers a way to formulate a definition for the concept of explicature. Consider Example B first. Observe that typ(***C***) is the set $\{0 = r_1 < r_2 < r_3 < r_4 \leqq 1\}$, which is a subset of the closed interval [0, 1]. So, the up-function $f_o^{>}$ is actually a real-valued function from typ($\boldsymbol{A_o}$) to [0, 1]. The domain typ($\boldsymbol{A_o}$), which is a set of infons, forms a lattice structure.[40] The explicature is the inverse image $f_o^{>-1}(r_4)$ = ***JD*** = <<*EAT*, *John*, *dinner*; 1>>, i.e. ‘John has eaten dinner.’ Note that r_4 should be seen as a result of the hearer’s search for relevance, or in mathematical terms, a result of the maximization of relevance in utterance comprehension. Hence, $r_4 = \underset{\sigma \in \mathrm{typ}(Ao)}{\mathrm{MAX}} f_o^{>}(\sigma)$, i.e. the maximum value attained by the up-function $f_o^{>}$. It is now easy to see that

$$\text{Explicature} = f_o^{>-1}(r_4) = f_o^{>-1}[\underset{\sigma \in \mathrm{typ}(Ao)}{\mathrm{MAX}} f_o^{>}(\sigma)].$$

Generalizing this equality, if the up-function from the Input Classification to the Core is f: $\boldsymbol{G} \rightarrow [0, 1]$, then we can define the explicature of an utterance as

$$\text{Explicature} = f^{-1}[\underset{\sigma \in G}{\mathrm{MAX}} f(\sigma)].$$

[40] A lattice G is a non-empty ordered set such that the join $x \vee y$ and the meet $x \wedge y$ of any $x, y \in G$ exist (Davey & Priestley 2002).

To paraphrase, this definition states that:

> The explicature of an utterance is the infon that attains maximum relevance within the Input-Context-Core Channel underpinned by the cognitive regularity that resides in verbal communication.

This definition, we believe, has largely reflected the intuition provided by relevance theory about the concept of explicature.

5. Conclusion

It has been demonstrated in this chapter that the concept of an information channel developed in Barwise & Seligman (1997) offers a plausible formalism to model the verbal comprehension process. Specifically, the channel model provides a formal description of pragmatic inference to the explicature of an utterance. It has described how information from a chosen context contributes and leads to the identification of the explicature under the guidance of relevance. On this basis, a formal definition for explicature has been proposed.

Appendix

1. Example B (Checking that f_o , f_1 and f_2 are infomorphisms)

(a) To check that f_o is in fact an infomorphism, we have to show that

$$f_o^{<}(s) \models_{A_o} t \;\Leftrightarrow\; s \models_{C} f_o^{>}(t).$$

Suppose token $s \in \mathrm{tok}(\boldsymbol{C})$ and $f_o^{<}(s) \models_{A_o} t$. Then $s \models_{A_o} t$. If t is the type $\boldsymbol{JD}$, we have $s \models_{A_o} \boldsymbol{JD}$, and so according to the classification relation of $\boldsymbol{C}$, we have $s \models_C r_4$, implying $s \models_C f_o^{>}(\boldsymbol{JD})$.

When t is the type $\boldsymbol{J}$, we have $s \models_{A_o} \boldsymbol{J}$, and so according to the classification relation of $\boldsymbol{C}$, we have $s \models_C r_3$, implying $s \models_C f_o^{>}(\boldsymbol{J})$.

When t is the type $\boldsymbol{D}$, we have $s \models_{A_o} \boldsymbol{D}$, and so according to the classification relation of $\boldsymbol{C}$, we have $s \models_C r_2$, implying $s \models_C f_o^{>}(\boldsymbol{D})$.

When t is the type $\boldsymbol{O}$, we have $s \models_{A_o} \boldsymbol{O}$, and so according to the classification relation of $\boldsymbol{C}$, we have $s \models_C r_1$, implying $s \models_C f_o^{>}(\boldsymbol{O})$.

Hence, we have proved the '=>' part.

Conversely, suppose $s \in \mathrm{tok}(\boldsymbol{C})$ and $s \models_C f_o^{>}(t)$. If t is the type $\boldsymbol{JD}$, we have $s \models_C f_o^{>}(\boldsymbol{JD}) = r_4$. According to the classification relation of $\boldsymbol{C}$, this implies $s \models_{A_o} \boldsymbol{JD} \Rightarrow f_o^{<}(s) \models_{A_o} \boldsymbol{JD}$.

If t is the type $\boldsymbol{J}$, we have $s \models_C f_o^{>}(\boldsymbol{J}) = r_3$. According to the classification relation of $\boldsymbol{C}$, this implies $s \models_{A_o} \boldsymbol{J} \Rightarrow f_o^{<}(s) \models_{A_o} \boldsymbol{J}$. (Of course, with the classification $\boldsymbol{A_1}$, s is also of type ***ACC***.)

If t is the type ***D***, we have $s \models_{\boldsymbol{C}} f_o^{>}(\boldsymbol{D}) = r_2$. According to the classification relation of ***C***, this implies $s \models_{\boldsymbol{Ao}} \boldsymbol{D} \Rightarrow f_o^{<}(s) \models_{\boldsymbol{Ao}} \boldsymbol{D}$.

If t is the type ***O***, we have $s \models_{\boldsymbol{C}} f_o^{>}(\boldsymbol{O}) = r_1$. According to the classification relation of ***C***, this implies $s \models_{\boldsymbol{Ao}} \boldsymbol{O} \Rightarrow f_o^{<}(s) \models_{\boldsymbol{Ao}} \boldsymbol{O}$.

This proves the '<=' part. Therefore f_o is an infomorphism.

(b) To check that f_1 is in fact an infomorphism, we have to show that

$$f_1^{<}(s) \models_{\boldsymbol{A1}} t \;\Leftrightarrow\; s \models_{\boldsymbol{C}} f_1^{>}(t).$$

Suppose token $s \in \text{tok}(\boldsymbol{C})$ and $f_1^{<}(s) \models_{\boldsymbol{A1}} t$. Then $s \models_{\boldsymbol{A1}} t$. If t is the type ***ACC***, we have $s \models_{\boldsymbol{A1}} \boldsymbol{ACC}$, and so according to the classification relation of ***C***, we have $s \models_{\boldsymbol{C}} r_3 \Rightarrow s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{ACC})$.

When t is ***INA***, we have $s \models_{\boldsymbol{A1}} \boldsymbol{INA}$, and so according to the classification relation of ***C***, we have $s \models_{\boldsymbol{C}} r_1 \Rightarrow s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{INA})$. Hence, we have proved the '=>' part.

Conversely, suppose $s \in \text{tok}(\boldsymbol{C})$ and $s \models_{\boldsymbol{C}} f_1^{>}(t)$. If t is the type ***ACC***, we have $s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{ACC}) = r_3$. According to the classification relation of ***C***, this implies $s \models_{\boldsymbol{A1}} \boldsymbol{ACC}$, and so $f_1^{<}(s) \models_{\boldsymbol{A1}} \boldsymbol{ACC}$.

If t is the type ***INA***, we have $s \models_{\boldsymbol{C}} f_1^{>}(\boldsymbol{INA}) = r_1$. According to the classification relation of ***C***, this implies $s \models_{\boldsymbol{A1}} \boldsymbol{INA}$, and so $f_1^{<}(s) \models_{\boldsymbol{A1}} \boldsymbol{INA}$.

This proves the '<=' part. Therefore f_1 is an infomorphism.

(c) Like (b), it can be similarly checked that f_2 is also an infomorphism.

2. Barwise & Seligman (1997): Lemma 12.17 (p. 155)

Let $f : \boldsymbol{A} \rightarrow \boldsymbol{B}$ be an infomorphism, let Γ, Δ be sets of types of $\boldsymbol{A}$, and let $b \in \text{tok}(\boldsymbol{B})$. Then, $f^{<}(b)$ satisfies the sequent (Γ, Δ) in $\boldsymbol{A}$ if and only if b satisfies the sequent $(f^{>}[\Gamma], f^{>}[\Delta])$ in $\boldsymbol{B}$.

(The proof, which is very simple, can be found in the cited book.)

We now use this lemma to show the following claim:

Claim: $\{f_o^{>}(\boldsymbol{J}), f_o^{>}(\boldsymbol{D})\} \vdash_{\boldsymbol{C}} \{f_o^{>}(\boldsymbol{JD})\}$ is a constraint in $\boldsymbol{C}$.

Proof: In fact, since f_o: $\boldsymbol{A_o} \rightarrow \boldsymbol{C}$ is an infomorphism, so for the sequent $(\{\boldsymbol{J}, \boldsymbol{D}\}, \{\boldsymbol{JD}\})$ and a token s in tok($\boldsymbol{C}$), by the lemma we have

(1) $f_o^{<}(s)$ satisfies $(\{\boldsymbol{J}, \boldsymbol{D}\}, \{\boldsymbol{JD}\})$ iff s satisfies $(f_o^{>}\{\boldsymbol{J}, \boldsymbol{D}\}, f_o^{>}\{\boldsymbol{JD}\})$

iff s satisfies $(\{f_o^{>}(\boldsymbol{J}), f_o^{>}(\boldsymbol{D})\}, f_o^{>}\{\boldsymbol{JD}\})$.

Since the down-function $f_o^{<}$ is the identity function, $f_o^{<}(s) = s$. Hence from (1),

(2) s satisfies $(\{\boldsymbol{J}, \boldsymbol{D}\}, \{\boldsymbol{JD}\})$ iff s satisfies $(\{f_o^{>}(\boldsymbol{J}), f_o^{>}(\boldsymbol{D})\}, f_o^{>}\{\boldsymbol{JD}\})$.

But since $\{\boldsymbol{J}, \boldsymbol{D}\} \vdash_{\boldsymbol{A_o}} \{\boldsymbol{JD}\}$ is a constraint in $\boldsymbol{A_o}$, every s in tok($\boldsymbol{C}$) = tok($\boldsymbol{A_o}$) satisfies $(\{\boldsymbol{J}, \boldsymbol{D}\}, \{\boldsymbol{JD}\})$. Hence, by (2) every s satisfies $(\{f_o^{>}(\boldsymbol{J}), f_o^{>}(\boldsymbol{D})\}, f_o^{>}\{\boldsymbol{JD}\})$. This implies that $\{f_o^{>}(\boldsymbol{J}), f_o^{>}(\boldsymbol{D})\} \vdash_{\boldsymbol{C}} \{f_o^{>}(\boldsymbol{JD})\}$ is a constraint in $\boldsymbol{C}$. The claim proved.

Chapter 5

A Regularity Approach to the Semantics of Conditionals

THIS CHAPTER LOOKS at the semantics of conditionals from Barwise's regularity point of view (1986a), and contrast it with truth-conditional theories. Two semantic theories that are based on the consideration of truth conditions will be critically reviewed. We first discuss the material conditional theory of conditionals, its inadequacy and its defense by Grice. We then draw attention to the Fallacy of Identification that Grice and possibly others seem to have committed in their conception of a theory of conditionals. Next we review briefly another truth-conditional semantic theory, the Event theory, which can be seen as a revised version of the material conditional theory. After raising two difficulties of the Event theory, we introduce Barwise's regularity approach and argue for its plausibility in terms of explanatory power for linguistic data and ability to resolve paradoxes stemming from the material conditional theory.

In the present study, whose main goal is to develop a pragmatic analysis of conditionals (in Chapter 6), we will not touch on the more metaphysically oriented possible world framework and the decision-oriented probability approach. Moreover, we will not offer special discussion on counterfactuals. As far as semantics is concerned, we agree with Barwise's (1986a) argument that there is no difference between the semantics of real and counterfactual conditional statements.

1. Introduction

By conditional statements discussed in the present study we mean statements made with the use of a conditional sentence of the form *If P*, (*then*) *Q* or *Q if P*, where *P* and the *Q* are two declarative sentences. The constituent statements P and Q are called respectively the antecedent and the consequent of the conditional statement. It has long been a debate among linguists and philosophers of language on how to characterize the meaning of a conditional sentence or to interpret a conditional statement.

For example, committed to truth conditions as meaning of sentences, the material conditional theory identifies the natural language *if* with the truth-functional connective '→' of the first order logic. On this account, the meaning of a conditional is determined by its truth condition, and its truth values are completely determined by those of the antecedent and the consequent and can be computed by a truth table. The essence of this approach is that a conditional sentence is true whenever the antecedent is false or the consequent is true. Although working well in mathematics and other scientific disciplines, this conception of *if* has long created puzzles and paradoxes in the interpretation of natural language conditionals. In particular, the conception that a conditional sentence with a false antecedent is true is puzzling. The approach is therefore not widely accepted, though some scholars (e.g. Grice 1975, 1989) have tried to defend the material conditional theory from a conversational perspective.

Another truth-conditional approach to the meaning of *if* resorts to the concept of possible world (Stalnaker 1968, Lewis 1973). It is well known that counterfactual statements create a difficulty for the material conditional theory. This is because the antecedent of a counterfactual is false and so, according to the material conditional account, the whole conditional statement is always true, which is clearly unacceptable in many cases. The possible world approach tries to assign truth conditions to counterfactuals in terms of possible worlds. However, apart from the problems arising out of the approach itself, the very concept of possible world is also controversial. The approach is therefore not universally accepted.

Some take a different route to characterize conditional meaning without truth condition (e.g. Adams 1975, Edgington 1986). They claimed that one should interpret a conditional according to its assertibility rather than its truth condition. On this account, whether a conditional is assertible is linked to the conditional probability of the consequent given the antecedent. The probability approach is not widely supported, partly because some find No-Truth-Value talk unacceptable (e.g. Lycan 2001), but also because the approach only deals with real conditionals but not counterfactuals.

More recently, by defending truth conditions as the key to meaning, Lycan (2001) proposed a syntactically motivated semantic theory of conditionals, known as the Event theory. It can be said that this theory is ultimately a revised version of the material conditional theory by considering some contextual factors such as quantifier domain restriction in the 'logical form' of conditionals. The approach can be considered as an advance from previous approaches, since it allows contextual factors to play a role in the interpretation of conditionals. Although he named his theory a semantic theory, Lycan explicitly stated as one of its goal 'to explain some of the ways in which … truth values [of conditionals] depend upon context' (2001: 16).

It is rather surprising to find that there is almost no mention of Barwise (1986a) in the literature on conditionals.[41] In this paper, Barwise proposed that the meaning of conditionals should be studied from an information perspective rather than truth conditions. Unlike the material conditional theory, Barwise urged to take seriously the

[41] The comprehensive bibliographies compiled in Edgington (1995), Sanford (2003) and Bennett (2003) did not mention Barwise (1986a) or any of his other articles.

subject matters described by a conditional. His consideration leads naturally to a situation theoretic approach, where the meaning of a conditional is seen as a regularity between the two types of situations described by the antecedent and the consequent. With this perspective, Barwise introduced the important notion of *background conditions*, which he demonstrated necessary for the interpretation of conditionals.

In the present study, we shall take the cue provided by Barwise and develop a pragmatic analysis of conditional statements. In this chapter, we first study the semantics of conditionals from the regularity perspective. Then in the next chapter, The Pragmatics of Conditionals, we shall explore how the hearer identifies the explicature of a conditional. In these two chapters, we shall show how much the regularity approach and the concept of explicature can shed light on the solution of paradoxes arising from the material conditional theory and the interesting phenomenon of conditional perfection.

2. The Material Conditional Theory and Its Puzzles

In this section, we first give a brief review of the material conditional theory and discuss some of its puzzles. We then look at Grice's defense of this approach, and draw attention to a conflation, namely the conflation of a model with the things being modeled, which we believe is responsible for an unnecessary part of the debate among various approaches to conditionals.

2.1 The Material Conditional Theory

The material conditional theory maintains that the meaning of the natural language conditional marker *if* can be identified with the first order logic connective '$\rightarrow$'. On this account, the meaning of *If P*, (*then*) *Q* is *exactly* the same as that of $P \rightarrow Q$. Therefore, the truth conditions of *If P*, (*then*) *Q* is the same as those of $P \rightarrow Q$, which is truth-functional. A sentence is truth-functional if its truth values are completely determined by those of its constituents. Thus, the truth values of a conditional can be evaluated by the following truth table:

	P	***Q***	***If P, (then) Q*** ($P \rightarrow Q$)
I	T	T	T
II	T	F	F
III	F	T	T
IV	F	F	T

From the truth table, two points are noted concerning the nature of the material conditional theory:

(i) A conditional statement is false when the antecedent is true and the consequent is false (by II);

(ii) A conditional statement is true when the antecedent is false, no matter what the consequent is (by III and IV); or true when the consequent is true no matter what the antecedent is (by I and III).

Thus, on this account, what Marcia said in (1) is true when both the antecedent and the consequent are true, and false when the antecedent is true and the consequent is false. Statement (2a) is also true because both the antecedent and the consequent are true, and (2b) is false because the antecedent is true and the consequent is false. What Jack and Whitehead said in (3) and (4) are also true, since the antecedents are false.

1. Marcia: I will call you on Monday if I get home before 10.00 p.m.[42]

2a. If Beijing is the capital of China, then water freezes at 0°C.

b. If Beijing is the capital of China, then water freezes at 100°C.

3. Jack: If I win the jackpot of today's mark six, I will give all the money to you.

   (It turned out that Jack has got none of the numbers correct.)

4. Whitehead: If Russell changes to study business, he will become a billionaire.

   (It turned out that Russell had not changed to study business and he has never become a billionaire.)

[42] An example from Lycan (2001)

2.2 Initial Puzzles

It is widely said that (II): ‘a conditional statement is false when the antecedent is true and the consequent is false’ is uncontroversial. However, it is not entirely unproblematic. For instance, it is rather odd to say that (2b) is false merely because the antecedent is true and the consequent is false. It is just unimaginable how this conditional statement can be true, true in the sense that it corresponds to an actual state of affairs, and thus it is equally unimaginable how it can be false either. This argument also applies to (2a): it seems odd to say that the whole conditional statement is true just because both the antecedent and the consequent are true, hence also undermining (I).

Further, that what Jack and Whitehead said in (3) and (4) are true is also doubtful. Who, including Jack himself, would dare to guarantee that Jack would keep his promise had he really hit the jackpot and got 50 million dollars? What was the evidence or justification to say that Whitehead’s statement is true?

Apart from problems like those discussed above in getting at the correct truth conditions, the material conditional theory also causes troubles in arguments. To illustrate, consider the following argument represented by classical logic:

5. $P \rightarrow Q$

P

R

R & Q

Argument (5) is a formally valid argument, which means that R & Q is a logical consequence of those premises. However, given the common knowledge that a wet match will not light, the conclusion (6d) is clearly invalid of the following natural language argument (6):

6a. If (P) match M is scratched, (Q) it will light.

b. (P) Match M is scratched.

c. (R) Match M is wet.

d. (R) Match M is wet and (Q) it will light.

Such invalidity shows that there is a discrepancy or gap between the material conditional model and the natural language conditionals.

2.3 Grice's Defense of the Material Conditional Theory

Grice (1975, 1989) proposed a general claim that the seeming divergence between the natural language connective *and*, *or*, *if* and their corresponding truth-functional logical connectives &, V, → is caused by some general principles of conversation. Grice maintained that the meaning of *if* IS '→', that a conditional with a false antecedent or a true consequent is true. The weirdness, if any, of a conditional is not, according to Grice, due to getting wrong with the truth conditions, but arises from the unasseribility implicated from unjustified belief. Thus, if (4) is found to be doubtful, this is not because it is false, but because it is not assertible; the hearer just finds the assertion lacking justification. Consider (7). Suppose the speaker knows very well that Peter is in the bar. Then Grice would say that (7) is unassertible: the speaker is unjustified in putting his utterance this way. A hearer who knows that the speaker knows very well that Peter is in the bar can accuse the speaker of misleading, but not of telling literally false things. As Read (1995) noted, the trick of Grice's defense of the material conditional theory was to distinguish between truth and assertibility.

7. If Peter is not in the bar, then he is in the library.[43]

However, while truth and assertibility are really two distinct things, whether such distinction could be employed for the defence of the material conditional theory is another matter. It is not immediately known how the Gricean line could deal with paradoxes like argument (6) above. Moreover, if we commit ourselves to some version of the correspondence theory of truth, where a statement is true when what it describes corresponds to the facts or states of affairs, it is difficult to see how a natural language statement like (2a) 'If Beijing is the capital of China, then water freezes at

[43] An example adapted from Edgington (1995: 244)

0^oC' can be *true* merely because the consequent is true.

2.4 The Fallacy of Identification

It can be safely said that most scholars find the material conditional theory inadequate as a characterization of the meaning of natural language conditionals (e.g. Adams 1975, 1998; Barwise 1986a; Comrie 1986; Edgington 1995; von Fintel 1998; Lewis 1973; Lycan 2001; Sanford 2003; Stalnaker 1968). They noted that natural language conditionals should in fact be non-truth-functional, or that the antecedent and the consequent should somehow be related, that the material conditional generates unacceptable semantic paradoxes, that one should replace the talk of truth conditions by probability or else retain it but enrich it with concepts like possible world or event. However, we believe that most of the scholars failed to notice a general point of methodology before they launched attacks on or substituted new theories for the material conditional. Once this general point is raised, the controversy concerning the semantic meaning of conditionals will become less intense.

What Grice and possibly others, whatever their stances, seemed to have committed in the debate is what Barwise (1989b) called the *Fallacy of Identification*, 'the failure to distinguish between some mathematical model and the thing it is a model of.' Commenting in this less familiar article on a controversy concerning the concepts of formal proof (within a formal logical system) and informal proof ('the real notion' of proof, like those written by working mathematicians), Barwise noted that it was this fallacy that the debaters had committed, where they had been 'identifying a mathematical model of the domain of proofs with the domain itself.' So, the Fallacy highlighted the distinction between 'a given physical (or other) phenomenon and a mathematical model of that phenomenon,' or between 'this is the way the world is' and 'this is a useful way of thinking of the world.'

In the case of conditionals, we think that the defence of the material conditional theory is a clear sign of committing the Fallacy by identifying a formal construct, namely the logical connective '→', with the informal notion of *if*, not being aware of the fact that the formal sentence $P \rightarrow Q$ is just a mathematical model or a formalization of the natural language sentence *If P,* (*then*) *Q*.

Once the Fallacy has been explicitly brought up, defence of an approach to conditionals that invokes some kind of formalism seems missing the point: after all, it is just a model of a particular natural language phenomenon. Moreover, as long as a model serves some intended purposes, one should learn to live with the inadequacies of or even paradoxes generated by it. A model is not the thing being modeled, and so gap or divergence is unavoidable.

It should be reminded that paradoxes actually abound in pure mathematics, which might sound surprising. Take the example of the concepts of area and volume. What is meant by saying that the area of, say, a flat is $10.69m^2$? Or that the volume of a bowl is $525cm^3$? To our surprise, the concepts of length, area and volume of regions are actually formal constructs, but they are so widely used in daily life that we almost identify such formal models with the real, physical things being modeled, namely, the sizes of lines, surfaces and solids in the physical space. Though the formalization of region size like area or volume is useful, it surprisingly gives rise to at least two paradoxes. The Banach-Tarski Paradox says that a ball can be chopped into a finite number of pieces and then reassembled into two balls of equal volume, so that the volume of a ball can double itself. The Circle-Squaring Paradox says that a plane circular region can be cut up into finitely many pieces and reassembled to form a square of equal area. Both paradoxes, as they are so called, are counter-intuitive. However, as long as the concepts of area and volume as formal models are useful, as they have always been, people just ignore the paradoxes and do not seek to revise the models.

In the case of conditionals, the logical connective '$\rightarrow$' formalizes human conditional reasoning in the way specified in the truth table by distilling just some essential aspects of it. As a model, the formal construct is bound to exhibit discrepancy with the informal notion. But despite this, the success of first order logic is adequately demonstrated in mathematics and other scientific disciplines.[44]

Though, it is not the position held in the present study that exploration of other models of *if* should stop. On the contrary, we should seek models that explore and revise the explicit and implicit assumptions made by the logical connective '→', so that these models fit other purposes. Indeed, models that make use of concepts like possible world, probability, and event are worth their while, only that they would lost the simplicity that the connective '→' lends to the first order logic.

3. The Semantics of Conditionals

A truth-conditional semanticist would hold that the inadequacy of the material conditional theory is its failure to get at the truth conditions for natural language conditionals, and so the strategy is to seek a logical form that can adequately represent the truth conditions. This can be seen as the basic motive of a new semantic theory of conditionals proposed in Lycan (2001), the Event theory. We shall critically review this theory before we look at the regularity approach to conditionals.

[44] Barwise's distinction spelled out in the Fallacy of Identification surely gets the implicit support of Quine (1966): '[The scientist] drops "if – then" in favor of "→" without ever entertaining the mistaken idea that they are synonymous …. He does not care how inadequate his logical notation is as a reflexion of the vernacular, as long as it can be made to serve all the particular needs for which he, in his scientific program, would have otherwise to depend on that part of the vernacular.' (quoted in Sanford 2003: 63)

3.1 The Event Theory

The central idea of the Event theory is that the logical form of a conditional sentence contains a hidden *universal quantifier over events*, whose domain of quantification should be suitably restricted for a proper interpretation of the conditional sentence. According to Lycan (2001: 17-19), the Event theory is a semantic theory that makes 'systematic assignment of truth conditions' to sentences containing *if*.[45] The strategy is as follows. He first paraphrased *If P*, (*then*) *Q* or *Q if P* as meaning 'Q in any event in which P.' Then, he made the hypothesis that its truth condition is

$$\forall\, e\ [\text{In}\ (e, P) \rightarrow \text{In}\ (e, Q)],$$

where '→' is the usual first order logical connective, and the formal symbol In (*e*, *P*) is to mean '*e* in which P.'[46] Next, he suggested that the domain R of the universal quantifier, which he called the 'reference-class', must be suitably restricted. It can be seen, therefore, that the Event theory is basically a revised version of the material conditional theory that plays tricks with the event quantifier domain.

The way by which the notion of event got into Lycan's theory was rather unusual. It was syntactically motivated. He first argued that, unlike *because* and *after*, *if* is not a subordinate conjunction, and so the *if*-clause in *Q if P* should not be viewed as a

[45] Lycan actually also assigned truth conditions to sentences containing 'unless', 'only if' and 'even if'. For our present purpose, we only review that assigned to *if*-sentences.
[46] According to Lycan, 'In' is a sentential operator with two arguments, and In(*e*, *Q*) is read as 'In the event *e*, *Q*'(Lycan 2001: 18).

subordinate clause. Next, he noted that *if*-clauses were much more like relative clauses along with *when*-clauses and *where*-clauses, and then argued that *if* was very much similar syntactically to *when* and *where*. And since there was a tacit reference to place and time in a *when*-clause and a *where*-clause (e.g. 8a, b), so there should be also a tacit reference to events in an *if*-clause (e.g. 8c - f), so claimed Lycan.

8a. *Sharon will leave when you leave.*

(= Sharon will leave <u>at the time that</u> you leave)

b. *Sharon will live where you live*

(= Sharon will live <u>at the place that</u> you live)

c. *Sharon will leave if you leave.*

d. *Sharon will leave <u>in the event that</u> you leave.*

e. *Sharon will leave <u>in case</u> you leave.*

f. *Sharon will leave <u>in any circumstances in which</u> you leave.*

Lycan explicitly stated that the notion of event in his theory is roughly equivalent to ‘case’ or ‘circumstance’, and intuitively it is not unlike the notion of situation in Barwise and Perry’s situation theory (2001: 17 and footnote 1).

According to the Event theory, the restriction of the event quantifier domain R is crucial in the interpretation of conditionals in a given ‘utterance-occasion.’ Lycan discussed several criteria for the restriction of R, so that some events should be excluded while some others must be included (2001: 18-19):

(i) exclude from the class of *actual* events some logically possible events, like landings of creatures from Mars (actual events are those that is possible to realized in the actual world);

(ii) include some *non-actual* events, those that 'the utterers know and/or explicitly assume are not actual,' or events incompatible with a realized events;[47]

(iii) include only events that the speaker considered as having *real* possibility, in the sense that they are *envisaged* by or tacitly in the mind of the speaker;

(iv) exclude *irrelevant* events that have nothing to do with the speaker's subject-matter or deliberations.

Lycan demonstrated how the Event theory works by analyzing many problematic examples, including the solution of some paradoxes stemming from the material conditional theory. For example, a paradox arises from 'A conditional is true whenever its consequent is true' is as follows:

9a. Premise: '(Q) Richard will go on a five-mile run tomorrow' is true

b. Conclusion: 'If (P) Richard is killed by a terrorist bomb this afternoon, then (Q) Richard will go on a five-mile run tomorrow' is true.

The argument (9) is clearly invalid. By the Event theory, the truth conditions of (9b) is

[47] Indeed, this notion of 'non-actual' event is highly problematic (as we shall argue below); this was also admitted by Lycan (19, footnote 5).

$\forall e$ [In (e, P) $\rightarrow$ In (e, Q)]. According to Lycan, although the quantifier domain includes all actual events in which Q, it also includes some non-actual event E in which P (this event E must be a non-actual event because Q is true and incompatible with P). Hence, for this E, In (E, P) is true and In (E, Q) is false, making (9b) false, thus resolving the paradox.

3.2 Some Objections to the Event Theory

Although the Event theory of conditionals gives contextual factors a role to play in the interpretation of conditionals, and it has achieved some claimed benefits like resolving some traditional paradoxes associated with the material conditional theory, there are, as expected, also problems with this framework. In particular, since it is built on the material conditional theory, it inherits some disadvantages of the latter. Consider Marcia's statement in (1) above: '(Q) I will call you on Monday if (P) I get home before 10.00 p.m.' and suppose the hearer is Rose. According to the Event theory, the logical form that represents the semantics of (1) is:

10. $\forall e$ [In(e, Marcia gets home before 10 p.m.) $\rightarrow$ In(e, Marcia calls Rose Monday)],

which can be roughly paraphrased as 'in any event in which Marcia gets home before 10 p.m., it is also an event in which she calls Rose on Monday.' The logical form (10) is claimed to have specified the truth condition of (1).

We think that there are at least two problems for (10) to characterize the semantic meaning of (1). First, we believe that conditional statements are in fact non-truth-functional. If this is arguable, (10) will not capture the meaning to (1). Suppose Marcia wanted to call Rose on Monday to discuss an issue X that had to be resolved. And suppose further that Marcia did get home before 10.00 p.m., but a moment later somebody informed her that issue X had been resolved. Then Marcia called Rose on Monday to let her know that no discussion was needed because issue X had already been resolved. Under these circumstances, although the antecedent and the consequent of (1) were both true, it sounds odd to say that Marcia has fulfilled her promise and say that the *whole* conditional statement (1) was true (or what Marcia has said was true) under those circumstances. This is because the two concrete situations (or events as called by Lycan), although realized, are not connected by that particular promise. It was just not Marcia's promise that made them true. On the other hand, if Marcia did get home before 10.00 (antecedent true) but did not call Rose on Monday (consequent false) due to a connection failure in the phone company, it is seems controversial (even before a judge) to say that (1) was false, or that Marcia failed to keep her promise merely because the antecedent was true and the consequent was false, much the same way as 'The present king of France is bald' is said to be false.[48]

[48] This concerns the notion of background conditions, which will be discussed in the Chapter 6.

What constitutes the falsehood of (1) seems to be the lack of the very promise of Marcia. We would say that in both of the above cases (1) lacks a truth value, i.e. neither true nor false. In brief, conditional statements are not truth-functional, and hence against any formalism that builds on this property, in particular the material conditional theory and the Event theory.

Another objection involves the universal quantification in (10). Suppose Marcia has kept her promise; she did get home at 9.30 p.m. (P is true) and that she did call the hearer on Monday (Q is true). Intuition would say that what Marcia has said in (1) was true. But how does the Event theory account for this intuition? In the supposed scenario, there exists a realized event *E* in which Marcia got home before 10.00, which is also an event that she called Rose on Monday. However, according to the semantic interpretation of the universal quantifier, we need to check all the events in its domain of quantification before we can say whether (1) was true; one realized event *E* is not enough for (1) to be true according to the truth conditions (10). This reflects a mismatch between intuition and Lycan's formalism that involves a universal quantification.

3.3 A Regularity Approach and Its Evidence

According to situation theory, the meaning of a simple declarative sentence is a regularity between two types of situations, the type of utterance situations and the type of described situations. In the case of conditionals, Barwise (1986a) did not directly discuss the meaning of a conditional sentence. This was implicit in his proposal for interpreting the explicit contents of conditional statements. So, he did not distinguish between the semantics and the pragmatics of conditionals. This might be because pragmatics as a well defined discipline was still in its infancy during the early days of development of situation theory. However, as pragmatics has now developed into an established field, we find it worthwhile to separate the discussion of semantics and pragmatics. We shall therefore extract the semantic part of Bawise's theory of conditionals in this section, and leave the pragmatic part to the next chapter.

According to situation theory, semantics is the study of the relation between linguistic expressions and the world. With this perspective, which it claims to have respected the subject matters of linguistic expressions, the meaning of a sentence is taken as a regularity between types of situations rather than truth values (Barwise & Perry 1983: 22-23). Therefore, and along the lines of Barwise (1986a), the meaning of a conditional sentence *If P,* (*then*) *Q* should be a regularity between the type of situations in which the conditional sentence is uttered and the type of situations described by the conditional sentence. But what is this type of described situations, which is taken as the (context independent) semantic value of the conditional sentence?

It is the regular relation holding between the two types of situations described by *P* and *Q*. Specifically, if S_P is the type of situations described by *P* and S_Q the type described by *Q*, the semantic value of the sentence *If P,* (*then*) *Q* is given by the following type of situations:

‘S_P involves S_Q’ or ‘S_P => S_Q’, represented in infon form as

<< *INVOLVES*, S_P , S_Q ; 1>>.[49]

This is understood as: if a situation of type S_P is realized, so is a situation of type S_Q (Barwise1986a).[50] As noted in Chapter 1, the relation *INVOLVES* that holds between two types of situations can be a causal relation from any of the two directions, or a conventional relation. (Barwise & Perry 1983: 101; Barwise 1989: 52).

We illustrate the regularity approach as follows. Consider (1) again. Getting home before 10.00 p.m. is a type of situations, and calling Rose on Monday is another type. There are many concrete potential situations more or less the same that correspond to these types of situations. For examples, Marcia may get home at 9.30 p.m. or any other time before 10.00 p.m., and she may call Rose on Monday at 11.00 a.m. or any other time as long as it is on Monday. So, (1) will be describing a regular relation between situations of one type with situations of another type.

In light of the regularity approach, we can solve a paradox that arises from the

[49] In fact, there should be an unknown parameter *B* stemming from the background conditions that associate with a conditional, and which has to be pragmatically enriched. See Chapter 6.
[50] Reprinted in Barwise (1989a: 113).

material conditional theory: that $\sim(P \rightarrow Q)$ is equivalent to $P \,\&\, \sim Q$. Consider the following argument (drawn from Lycan 2001: 26):

11a. Premise: It's not true that if (P) a benevolent God exists, then (Q) there is random gratuitous evil in the world.

b. Conclusion: (P) A benevolent God exists and (~Q) there is no random gratuitous evil in the world.

Surely, the existence of God will not be proved so easily by argument (11) alone. With the regularity approach, premise (11a) can be paraphrased as 'No regularity between P and Q.' So, there are two mutually exclusive cases: either (i) no existence of situations of type P; or (ii) there exists a situation of type P and that it is also of type ~Q. Since argument (11) only counts case (ii) as the conclusion, it is therefore invalid.

In contrast, sticking to the machinery of its universal quantification over events, the Event theory argues with the equivalence $\sim\forall e\,(W) \Leftrightarrow \exists e\,(\sim W)$ that there exists an event *E* such that conclusion (11b) holds, but only that this *E* may be a 'non-actual' event. However, one may find the notion of 'non-actual' event problematic.[51] How do we make sense of the statement 'There exists a non-actual event in which something X exists'? It seems that either if something X exists in an event then this event is not a non-actual event, or that nothing can exist in a non-actual event (event that does not

[51] This query also applies to Lycan's argument in (9).

realize in the actual world). If we are to adopt the notion of non-actual event, then all kinds of things can exist, which is controversial. For example, one would say that unicorn does not exist, but Lycan would say that unicorn exists in a non-actual event. In this way, conclusion (11b) could be made valid: things (like gods, no evil, etc) just exist in a non-actual event. But this seems not to be a convincing way to explain away the paradox.

On the regularity approach, argument (9) above is invalid not because there exists a non-actual event *E* that makes the antecedent true and the consequent false, but because (9b) is itself meaningless. The regularity approach denies outright that there is such a regularity described by the conditional statement in (9b). There will be no regularity whereby the type of situations in which Richard is killed this afternoon involves the type of situations in which Richard will run tomorrow.

4. Conclusion

We have argued that it is the regularity between the antecedent and the consequent, rather than the truth of each, that forms the basis of the semantics of a conditional sentence. Although the truth-conditional Event theory has made a stride in trying to allow contextual factors to play a role in the interpretation of conditionals, we have shown that it faces some difficulties stemming from universal quantification, the notion of non-actual events, and drawbacks inherited from the material conditional theory. We have demonstrated that the regularity approach seems to be better than the Event theory, both in fitting linguistic data and resolving paradoxes.

Chapter 6

The Pragmatics of Conditionals

WE SHALL DEVELOP a pragmatic analysis for the meaning of conditional statements in this chapter and study its implications. A pragmatic analysis recognizes the fact (now has been common knowledge) that it is within a context of use that people produce and comprehend intended meaning. We shall show that the background conditions associated with conditional statements and world knowledge are two crucial contextual factors that affect the comprehension of conditionals. We then demonstrate how our pragmatic analysis leads to the resolution of some semantic paradoxes involving conditionals. We shall also discuss the phenomenon of conditional perfection, and argue for an explicature analysis against an implicature analysis for its adequate explanation.

1. Explicatures of Conditionals

According to the relevance-theoretic comprehension principle, the hearer chooses a context so as to make an enriched logical form of the utterance relevant enough for her to take it as the explicature, the best hypothesis for the explicit speaker meaning conveyed by the utterance. In this section, we shall look at the notion of background conditions associated with a conditional statement, and argue that the consideration of background conditions as contextual information is crucial for the derivation of explicature. With an explicature analysis, we can easily resolve some paradoxes stemming from the material conditional theory. We therefore see that only by getting at the explicatures can we give a relevant interpretation of conditional statements.

1.1 Background Conditions Associated with Conditionals

One kind of contextual information involved in the use of a conditional sentence to make statements is *background conditions,* the conditions under which a statement can be successfully made. The notion of background conditions was introduced in Barwise (1986a) in his study of conditionals, and further elaborated in Barwise & Seligman (1994, 1997) in their study of regularity. They are preconditions that must be fulfilled before a regularity holds. Hence, once a conditional sentence is used to make a conditional statement (i.e. in stating a regularity), background conditions are invariably involved. And because the consideration of background conditions is crucial in the comprehension of conditional statements, it indirectly supports the regularity approach to their semantics.

To illustrate how background conditions arise in natural language conditionals, we consider the verbal statement of a simple version of Boyle's Law, which describes the behavior of a gas as governed by the equation $P = kT$, where P is the pressure of the gas, T is the temperature and k is a positive constant. We can restate this equation as a conditional assertion in (1). However, as Barwise (1986a) pointed out, (1) should never be interpreted as stating that temperature will increase in *all* circumstances in which pressure increases. In fact, the regularity described in (1) only holds when the volume V of the gas is kept constant, among many other known or unknown preconditions. Thus, when volume is changing, an increase in pressure may not bring about an increase in temperature. But as Barwise & Seligman (1997: 21) noted, this should not be considered as a counterexample that makes the simple Boyle's Law 'false'. Rather, it just implies that (1) only operates within a certain limited domain or range, outside which the regularity described by (1) no longer holds.

1. If pressure increases, temperature will increase.

Whether a conditional statement is successfully made by a speaker depends very much on the fulfillment of the associated background conditions. Consider again the conditional statement (1) in Chapter 5, reproduced here as utterance (2). When Marcia made the statement, background conditions must be fulfilled in order that her statement became successful. For example, Marcia's phone should be working properly; the phone company had no connection problem; Marcia was not held up by traffic congestion before 10.00 p.m.; no burglar forced into her house and tied her up before calling Rose; etc. Thus, when Marcia did get home before 10.00 but did not call Rose on Monday because she was tied up by a burglar, then a background condition of (2) was not satisfied, and her statement became unsuccessful. In that case, nobody could (or at least should) accuse Marcia of not keeping her words.

2. Marcia: I will call you on Monday if I get home before 10.00 p.m.

Indeed, we look at background conditions as behaving like pragmatic presuppositions (Strawson 1950). If the presupposition of, say, a definite description (like 'the present King of France') is not fulfilled, then the whole statement containing the description is just unsuccessful, meaningless, and can never be true or false. In almost the same way, if the background conditions of a conditional statement are not satisfied, the conditional statement is also unsuccessful, and therefore lacks a truth value.

1.2 Explicating Conditionals

With the consideration of contexts, it is not difficult to see why the material conditional theory fails to be a good model for natural language. The theory is one that ignores the context under which a conditional statement is made. It causes troubles for a sensible comprehension of a discourse which involves subtle contextual shift. A contextual shift may occur when the same sentence is used in a different occasion. In the case of conditionals, contextual shift is frequently brought about by the violation of background conditions.

Consider again the argument (6) in Chapter 5, which is reproduced here as (3), within the common knowledge that a wet match will not light. (3a) and (3b) can be combined to yield ‘Match M will light’ only when (3a) is under the context of ‘Match M is dry,’ which is a background condition of (3a). Now, with the presence of (3c) ‘Match M is wet,’ the context under which (3a) is stated alone has actually shifted. In the new context, that background condition for (3a) is violated. Without the awareness of this hidden contextual shift, formal combination of (3a) and (3b) must lead to absurdity in (3d) (since it contradicts the given common knowledge). This illustrates that the material conditional theory is inadequate when context is taken into consideration.

3a. If (P) match M is scratched, (Q) it will light.

b. (P) Match M is scratched.

c. (R) Match M is wet.

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d. (R) Match M is wet and (Q) it will light.

An explicature analysis, which takes context into serious account, becomes indispensable in the comprehension of conditionals. In the presence of (3c), the hearer will not interpret (3a) merely as the literal ‘If match M is scratched, it will light.’ Rather, for the most relevant comprehension of the premises (3a, b, c) as a whole, she will naturally explicate (3a) to its explicature, which is presumably (4). With this explicature (4), the hearer will definitely not come to the invalid conclusion in (3d). An explicature analysis thus resolves the paradox. In general, searching for valid and thus relevant conclusions or arguments serves as a guide for the explicating process.

4. If match M is scratched $|_{\text{M is dry}}$, it will light.

   (or in infon form <<*INVOLVES*, $S_{M\_scratched}$, S_{M_light} $|_{\text{M is dry}}$; 1>>)

1.3 More Paradoxes Resolved

We shall discuss two more paradoxes stemming from the material conditional theory that can be resolved by the explicature analysis.[52] Consider the inference in (5) arising from contraposition: (P → Q) <=> (~Q → ~P) (Lycan 2001: 32). The conclusion (5b) is nonsensical. The problem is not so much with contraposition as with the consequent ~P in (5b). The correct ~P should be ‘*it is not the case that* it rains tomorrow.’ As a regularity, (5b) can be paraphrased as ‘if a cloudburst situation is realized, so is a *not_the_case_that_it_rains* situation.’ For this regularity to be

[52] A collection of paradoxes can be found, among others, in Cooper (1968).

meaningful, and hence relevant, ~ P should be interpreted as 'it will not rain *but pours*.' This consideration of relevance leads to the explicature 6(a) of 5(a). Now perform contraposition as usual with 6(a), we arrive at the valid conclusion of 6(b). So, contraposition still works; paradox lost.[53]

5a. If (P) it rains tomorrow, (Q) there will not be a terrific cloudburst.

b. => If (~Q) there is a terrific cloudburst tomorrow, (~P) it will not rain.

6a. If it rains tomorrow $|_{\text{it does not pour}}$, there will not be a terrific cloudburst.

b. => If there is a terrific cloudburst tomorrow, it will not rain but pours

Another example is the so-called Sobel paradox (adapted from Lycan 2001: 58). The formal argument in (7) is valid, but the natural language counterpart in (8) is clearly absurd. Again, the problem stems from the background conditions of (8a), which is 'Betty is not coming.' Since (8c) stipulates that Betty is now coming, the hearer will naturally explicate (8a) to the explicature 'If Albert comes to the party $|_{\text{Betty is not coming}}$, the party will be great' for a relevant interpretation of the whole premises (8a, b, c). Hence, formally combining (8a) with 'Albert is coming' in (8c) to yield 'the party is great' become illegitimate. The correct conclusion should be 'The party is awful.' No more paradox.

7. $P \rightarrow Q$

[53] The explicature analysis is better than the Event theory in this and similar examples, as Lycan (2001: 32) admitted that his theory is equivocal in these cases, struggling with the proper restriction of the quantifier domain.

$P \& R \rightarrow \sim Q$

$P \& R$

Therefore: $Q \& \sim Q$

8a. Premises: If (P) Albert comes to the party, (Q) it will be great.

b. If (P & R) Albert and Betty come to the party, (~Q) it will be awful.

c. (P & R) Albert is coming and Betty is coming.

d. Conclusion: (Q & ~Q) The party will be great and awful.

2. Conditional Perfection

Conditional perfection, or conditional strengthening in some literature, is a linguistic phenomenon in which a conditional statement is frequently seen to be *perfected* or *strengthened* to a bi-conditional statement. It is first discussed in Geis & Zwicky (1971) with their classic example (9a).[54] Thus, the utterance of (9a) seems to *invite* an inference of (9b) or its equivalent (9c). The effect is that the conditional (9a) now conveys the content of the bi-conditional (9d). As the antecedent of a conditional is frequently interpreted as a 'sufficient condition' of the consequent (e.g. van der Auwera 1985, 1997a, b), a sufficient condition is sometimes said to be perfected or

[54] In fact, according to van der Auwera (1997a), this phenomenon was actually first raised by the French linguist Ducrot in a 1969 paper, which was written in French, and was even mentioned earlier in Bolinger (1952). But discussions on conditional perfection usually started from Geis & Zwicky's 1971 English paper.

strengthened to a necessary and sufficient condition in this connection.

9a. If you mow the lawn, I'll give you five dollars.

b. If you don't mow the lawn, I won't give you five dollars.

c. I'll give you five dollars only if you mow the lawn.

d. I'll give you five dollars if and only if you mow the lawn.

Discussions on conditional perfection are mainly of three types. van der Auwera (1997a, b) tried to explain it in terms of Gricean conversational implicature by employing the first Quantity Maxim. In contrast, Atlas & Levinson (1981), Levinson (2000a) and Horn (1984, 2000) invoked the second Quantity Maxim for its explanation. On the other hand, von Fintel (2001) questioned the generality of conditional perfection, though he argued that a weaker kind of strengthening that comes from quantity implicature seems to associate invariably with all conditional statements. Apart from these three, there are also mentions of conditional perfection elsewhere in the literature. For instance, Wilson & Sperber (2004) gave a very brief explanatory remark on this issue in terms of the notion of processing effort in relevance theory. Lycan (2001) also hinted briefly in a footnote that restriction of quantifier domain in his Event theory could possibly offer an explanation.

In this section, we shall tackle the phenomenon of conditional perfection with the explicature analysis. We shall first argue that the concept of 'sufficient condition,' whether understood as ‘sufficient cause’ or ‘sufficient indicator,’ should not belong to the basic semantics of conditionals. That the antecedent sounds like a sufficient condition (cause or indicator), we shall argue, is a result of the pragmatics of conditionals, not their semantics. Next, we shall review critically the scalar implicature analysis of conditional perfection. We shall argue that such an analysis fails to explain perfection in some cases, and predicts that perfection occurs for some others when intuitively no perfection should occur. Third, we shall argue that conditional perfection should be understood from an explicature analysis approach in which the hearer is seen to choose contextual assumptions for her relevant comprehension of a conditional statement. The explicature analysis will decide whether there is only a one-way information flow from the antecedent to the consequent or ultimately a two-way flow, in which case conditional perfection occurs.

2.1 The Puzzle of Sufficient Conditionality

It is sometimes said that a conditional statement ‘If P, (then) Q’ conveys the meaning that P is a sufficient condition of Q, and that this sufficient conditionality should be taken as the basic semantics of the conditional. For example, introductory logic textbooks said that *if* introduces a sufficient condition, one that ‘guarantees that something else will obtain.'[55] van der Auwera (1985, 1986, 1997b) and Sweetser (1990) proposed that 'If P, (then) Q' means that P is a sufficient condition of Q.

We shall first argue that if 'sufficient condition' is understood as carrying a causal sense or a sense of one thing bringing about another, that is, if 'P is a sufficient condition of Q' is to be read as 'P is sufficient to cause/bring about Q', then 'If P, (then) Q' does not invariably convey that P is a sufficient condition of Q, simply because it is odd or even meaningless to say that P causes or brings about Q.

Consider the following scenario. Suppose Pludow died and it has been identified that there were two and only two ways that caused her death: one was a car accident and the other was her plunging down from 35/F. It has been ruled out that Pludow died from a car accident. Then one can make the assertion (10). Now, is it meaningful to say that 'Pludow died' is a sufficient condition of 'Pludow has plunged down from 35/F'? It seems not. After all, it is odd to say that 'Pludow died' caused or brought about 'Pludow has plunged down from 35/F.' In fact, when it was learnt that Pludow had been scolded by her mother before she plunged, it might be that 'Pludow's being scolded by her mother' rather than 'Pludow died' that should be seen as a sufficient condition for her plunging (Figure 6-1).

10. If Pludow died, she has plunged down from 35/F.

[55] For example, Barwise & Etchemendy (1999: 180)

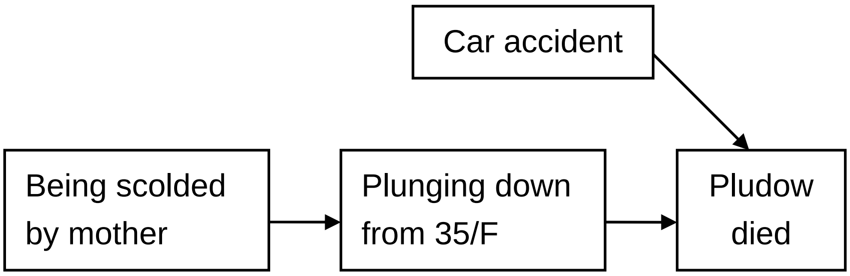

Figure 6-1

For another illustration, it was said that the philosopher Schopenhauer had once promised that he would donate a coin to the charity if he did not hear any gossiping of women when dinning in a restaurant. This leads one to assert (11). One way to conceive of (11) is that the philosopher's putting the coin back into his pocket is a sufficient condition for the gossiping of some women. But this sounds odd. How could Schopenhauer's behavior have the magic to cause or bring about the gossiping of some women?

11. If Schopenhauer put the coin back into his pocket, then some women were gossiping.

The point illustrated in the above two examples is not new (e.g. see McCawley 1993). It is a misconception that the basic semantics of 'If P, (then) Q' is 'P being a (causal) sufficient condition of Q.' We believe that the misconception arises from the fact that the causal concept of sufficient condition is frequently modeled by the material conditional $P \rightarrow Q$, which is used to model natural language conditionals. This might have made people mistakenly associate a sufficient condition with the antecedent of a natural language conditional. As there is frequently a gap between the model $P \rightarrow Q$ and the things it models (namely the concept of sufficient condition and conditional 'If P, (then) Q'), so there is also a frequent gap between sufficient condition and the antecedent. Hence, great care has to be taken in the interpretation of conditionals in terms of (causal) sufficient conditions.

Indeed, interpreting conditionals in terms of (causal) sufficient and necessary conditions can be very tricky. For example, from the semantic sense of (11) *alone*, can we say that women's gossiping is a sufficient condition of putting back his coin? No, not yet. Although this seems really true[56], it does not follow semantically or literally from (11). What is literal in (11) is that women's gossiping is a necessary condition for Schopenhauer's putting the coin back into his pocket, not a sufficient condition.

For another example, consider statement (12). One interpretation is that Mary's going to the party causes John's going, in which case Mary's going is a sufficient condition for John's going. However, if it is observed that whenever John goes to a party Mary always follows him, then (12) should be interpreted as 'Mary goes' *indicating* 'John will go,' so that the causal relation is now from John to Mary, not Mary to John. In this case, John's going is a sufficient condition for Mary's going, but that this knowledge is not encoded semantically or literally in (12).

[56] It is true if the conditional (11) is pragmatically realized as a bi-conditional.

12. If Mary goes to the party, John will go too.

So, our first observation is that:

First Observation: The talk of (causal) sufficient condition is more than the basic semantics of conditionals.

Secondly, some might argue that 'P is a sufficient condition for Q' is actually to be understood as 'the realization of P is sufficient for the realization of Q,' without necessarily carrying a sense of causation.[57] On this interpretation, the basic semantics of 'If P, (then) Q' is that the realization of P is a 'sufficient indicator' for the realization of Q. But the problem is the same: how do we know semantically or literally from 'If P, (then) Q' that P is 'sufficient'? How does one know *merely* from the semantic meaning of 'If you plunge down from 35/F, you will die' that plunging down from 35/F is 'sufficient' for dying? So, our second observation is that:

Second Observation: Sufficiency involves assumptions or knowledge that go beyond the basic semantics of a conditional sentence.

van der Auwera (1997b: 179) emphasized that sufficient conditionality is the basic semantics of a conditional: sufficient conditionality is '*the* semantic primitive [of a conditional], *sine qua non* and non-reconstructible' in terms of 'some variant of material, strict or other implication.' (Italics his) But Auwera added that this sufficient

[57] But we really doubt whether this is the case in most use of the term 'sufficient condition' in the literature.

conditionality is to be understood *ceteris paribus*, i.e., P is a sufficient condition only relative to a context of necessary conditions (in our terminology the background conditions). Thus, according to him, in the statement ‘If you strike a match it will light,’ striking is a sufficient condition only when the speaker presupposes that the match is dry, that it has the right chemical composition, that there is enough oxygen, etc. ‘…[I]n absolute terms, striking a match is thus *not* sufficient’ (Auwera 1997b: 180, italics his). We have two comments on these. First, Auwera’s remarks on the nature of sufficiency are surely correct, but we have argued, and shall argue more below, that this should belong to the pragmatics rather than the semantics of conditionals. Second, it is not known whether Auwera distinguished between ‘sufficient cause’ and ‘sufficient indicator’ when he used the term ‘sufficient conditions.’

We believe that the best way to understand the semantics of conditionals is not through the concept of causally sufficient condition, but from the perspective of information flow supported by conditionals. By avoiding the talk of sufficient condition, we really get at the pure semantic meaning of conditionals. From an information flow perspective, the semantics (or semantic value) of the sentence *If P*, (*then*) *Q* is a regularity represented by the infon $\langle\langle INVOLVES, S_P, S_Q|_{B,\ B'}\ ;\ 1\rangle\rangle$, which can be paraphrased as:

The realization of an S_P situation carries the information that there is a realization of an S_Q situation, relative to *B* and *B*',

where *B* and *B*' are unknown parameters (to be pragmatically enriched) relating to the background conditions of the forward information flow (from P to Q) and the backward information flow (from Q to P).[58]

On a purely semantic consideration (i.e. before the inception of any pragmatic process), the direction of the flow of information is *always* from left to right in accordance with the sentence structure of the conditional. However, the direction of causing/bringing about can be either way, not specified syntactically or lexically in the conditional. Thus, while 'Kissing involves touching'[59] just happens to mean 'Kissing brings about touching,' in the case of 'Smoke involves fire'[60] a smoke situation is actually caused or brought about by a fire situation, so that the direction of causation is opposite to that of information flow. When one infers from a smoke situation to a fire situation, the inference is abductive rather than deductive. After all, solidified carbon dioxide or liquefied nitrogen, say, also produces 'smoke' or smoke-like substances, so that a fire situation is only an inference to the best explanation.

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[58] The distinction between information flow and causation is not mentioned in Barwise & Perry (1983) and Barwise (1989a). It is explicitly pointed out in Barwise & Seligman (1997: 17), but not under the discussion of conditionals. We think that the notation 'S_P => S_Q' for 'S_P involves S_Q' would mislead readers into thinking of causal relation, and therefore decide not to use this notation in this chapter.
[59] Barwise & Perry (1983: 101)
[60] Barwise & Perry (1983: 12)

2.2 A Critique of Quantity Implicature Analysis of Conditional Perfection

Conditional perfection or strengthening seems to be a fairly general and language independent phenomenon that needs an explanation. The mainstream approach is a Gricean implicature analysis, of which there are two kinds. On the one hand, Horn (1972), Noordman (1979), de Cornulier (1983) and van der Auwera (1997a, b) invoked the first Quantity Maxim: Speakers should say as much as they can, and treated perfection as a result of a scalar implicature. On the other hand, Atlas & Levinson (1981), Levinson (2000a) and Horn (1984, 2000) explained perfection as an implicature induced by the second Quantity Maxim: Speakers should say no more than they must. This sub-section will briefly review these two opposing approaches, but our discussion will focus mainly on the more case of Auwera (1997b).[61]

van der Auwera (1997b) argued that conditional perfection is a result of a Gricean scalar implicature. According to him, a Gricean scale is ‘an ordered set of assertions, such that the truth of the higher ones is *ceteris paribus* sufficient for the truth of the lower ones, but not vice versa.’ With a scale and the first Quantity Maxim, a speaker is able to convey a scalar implicature: by asserting a lower item in the scale

[61] In the short (1997a) paper, van der Auwera documented the history of the discussions on conditional perfection, while in the twin (1997b) paper, which is also a short one, he focused on the scalar analysis.

he implicates the negation of all higher items. For example,

<< All of my books are stolen, Some of my books are stolen >>

forms a scale. If a speaker asserts ‘Some of my books are stolen,’ he is implicating ‘Not all of my books are stolen,’ making ‘Some but not all my books are stolen’ the full content of what he has conveyed. To explain conditional perfection, Auwera constructed a scale:

13. <<………

‘If P, (then) Q’ *and* **‘If R, (then) Q’** *and* **‘If S, (then) Q’**,

‘If P, (then) Q’ *and* **‘If R, (then) Q’**,

‘If P, (then) Q’ >>

The idea is that in asserting ‘If P, (then) Q,’ the last item of the scale, the speaker implicates the negation of all higher items. Thus, he is implicating that there is no condition R, S, …, etc other than P that brings about Q, so that ~P will now mean ~Q. As a result, with the scalar implicature the conditional ‘If P, (then) Q’ is perfected or strengthened to a bi-conditional ‘If and only if P, (then) Q.’

Although the scalar implicature analysis seems natural, it is not completely without problems. We shall consider two difficulties facing the scalar analysis. First, consider the utterance (14a) about the speaker’s little daughter, Claire. We agree that from (14a) one is invited to make the inference (14b), so that they combine to form the bi-conditional (14c). An explanation is needed for the derivation of (14c) from (14a).

14a. If Claire rubs her eyes, then she is sleepy.[62]

b. If Claire doesn't rub her eyes, then she is not sleepy.

c. If, and only if, Claire rubs her eyes, then she is sleepy.

15. <<………

'If Claire rubs her eyes, then she is sleepy' and 'If R, then she is sleepy' and 'If S, then she is sleepy',

'If Claire rubs her eyes, then she is sleepy' and 'If R, then she is sleepy',

'If Claire rubs her eyes, then she is sleepy' >>

On the scalar implicature analysis, the derivation of (14c) is a result from scale (15). Thus, when the speaker asserts (14a), the last item of scale (15), he Q-implicates the negation of all higher items, thereby ruling out other sufficient conditions R, S, … of Claire's sleepiness.

What we want to challenge is that the derivation of bi-conditional (14c) cannot be a result from the scale (15), i.e. from ruling out other sufficient conditions R, S, … for Claire's sleepiness. For one thing, as we have already argued, it is odd to say that Claire's rubbing her eyes is a sufficient condition that causes or brings about her sleepiness (how could rubbing one's eyes possibly bring about her intention to sleep?)

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[62] An utterance drawn from Barwise (1986a).

Thus, the speaker cannot be considering causal factors of her daughter's sleepiness, and then rule out all other factors to arrive at the bi-conditional (14c).

Defenders of the scalar analysis might claim that 'rubbing her eyes,' R, S, … are all to be understood as indicators of sleepiness rather than causal factors. However, this still cannot save the scalar analysis in this example. Our main point is that: the bi-conditional (14c) seems to be a result of ruling out causal factors of *rubbing eyes*, rather than ruling out indicators of sleepiness. If this is correct, then the construction of scale (15) to explain the derivation of (14c) from (14a) completely misses the point. As we shall see immediately below, the scalar implicature analysis was done without the consideration of context, the context under which (14a) was made.

In fact, the background context behind the assertion of (14a) was this. A physiological commonsense told the speaker that when children are sleepy they usually rub their eyes. In the case of Claire, this piece of world knowledge can be stated in (16). Because of (16), the speaker took her daughter's rubbing eyes as a very reliable indicator for her sleepiness, though until later he found that pollen X could also cause her daughter to rub her eyes when she was not sleepy. Therefore, the bi-conditional (14c) is actually derived, not from the original (14a), but from the world knowledge (16). So, if one maintains a scalar implicature analysis to explain how (14c) can be derived from (16), then he is seen to be ruling out the pollen factor and all other possible causal factors for rubbing eyes. That is why we blame scale (15) for missing the point.

16. If Claire is sleepy, then she rubs her eyes.

Yet, even if the scalar implicature analysis can show how the bi-conditional (14c) can be derived from the conditional (16), one can never show with scalar analysis how (16) can be derived from the original (14a), unless he assumed the bi-conditional (14c) in the very first place. But this will make his argument from (14a) to the derivation of (14c) circular! The upshot is that: scalar implicature analysis *alone* cannot explain how the bi-conditional (14c) can be derived from the original conditional (14a). It alone fails to explain the perfection unless it invokes some contextual assumption, say, a piece of world knowledge.

Another difficulty faced by an implicature analysis is that: it cannot explain cases in which both the speaker and the hearer know that the conditional statement is only conveying a one-way information flow rather than a two-way flow, i.e. no conditional perfection occurs. Consider utterance (17). Intuitively, on asserting (17), it is hard to imagine that the manager is implicating that Peter will not be fired on occasions other than being late again. Similarly, on hearing the warning, Peter will not be so naive as to think that he will never be fired if he is not late again. Gricean or neo-Gricean theories maintain that if a generalized conversational implicature (of which scalar implicature is one kind) is not canceled by later context, it should be taken as the intended meaning. According to this nature, the perfection of (17) as a scalar implicature should be the intended meaning when (17) stands alone in a general context. But this contradicts our intuition, where (17) alone is enough to make the putative implicature defeasible.

17. The manager: If Peter is late again, he will be fired.

For the approach invoking the second Quantity Maxim, it was motivated, surprisingly, by the failure of the first Q-maxim to produce the desired implicature with respect to the scale << *if and only if* , *if* >>. To see this, apply the first Q-maxim to this scale. It seems to be a scale because a proposition made with *iff* entails the one with *iff* replaced by *if*. So, the assertion of an *if*-conditional would implicate the negation of the *iff*-conditional. Thus, with this scale not only one cannot derive the conditional perfection, but actually falsify it, which is counter-intuitive given that it is a rather general phenomenon. The second Q-maxim is therefore deployed where the speaker is seen as just asserting the most necessary part (the *if*-part) and implicate or let the hearer infer the remaining part (the *only-if* part).

Auwera (1997b) challenged this approach, which we think is convincing. He argued that if << *if and only if*, *if* >> is really a Gricean scale, then Atlas, Levinson and Horn have not explained why it is the implicature based on the second Q-maxim that wins out rather than the scalar implicature. On the other hand, if << *if and only if*, *if* >> is not a Gricean scale, as argued by Atlas and Levinson, then just by saying that conditional perfection arises from the second Q-maxim implicature has not yet explained that phenomenon.

2.3 An Explicature Analysis for Conditional Perfection

We shall now look more closely at how the hearer chooses a context to arrive at the explicature of a conditional statement. This is the subject matter of pragmatics. The context chosen decides whether she will arrive at a bi-conditional reading or just a conditional reading. This analysis appears to have no predictive power, but in fact the result is quite predictable because the choice of contextual assumptions during interpretation is quite predictable; these assumptions frequently, if not ultimately, reflect our world knowledge and life schema.

To help explain the pragmatic process more easily, we design a 'Flashlight' model for conditionals (Figure 2).[63] In this model, a conditional statement is conceived as a flashlight, where the switch is the antecedent and the bulb is the consequent. A background condition is that the batteries are charged. A contextual

[63] Inspired by Barwise & Seligman (1997: 8).

factor comes from the case. An abnormal case, say, a short-circuited one, will also cause the bulb to light. Note that there might be some unknown background conditions or contextual factors yet to be depicted in Figure 2.

Consider the conditional statement (18). The semantics of the sentence *If I turn on the switch, the bulb will light* describes a regularity that supports a one-way information flow from the antecedent to the consequent. Once this sentence is used to make a conditional statement, various background conditions and contextual assumptions are involved the production and comprehension of this statement. The ultimate pattern of information flow (one-way or two-way) realized by this conditional depends on the pragmatics (i.e. how the hearer chooses a context for comprehension).

18. If I turn on the switch, the bulb will light.

19a. If I don't turn on the switch, the bulb will not light.

b. Only if I turn on the switch will the bulb light.

c. If, and only if, I turn on the switch, the bulb will light.

(= The bulb will light if and only if I turn on the switch.)

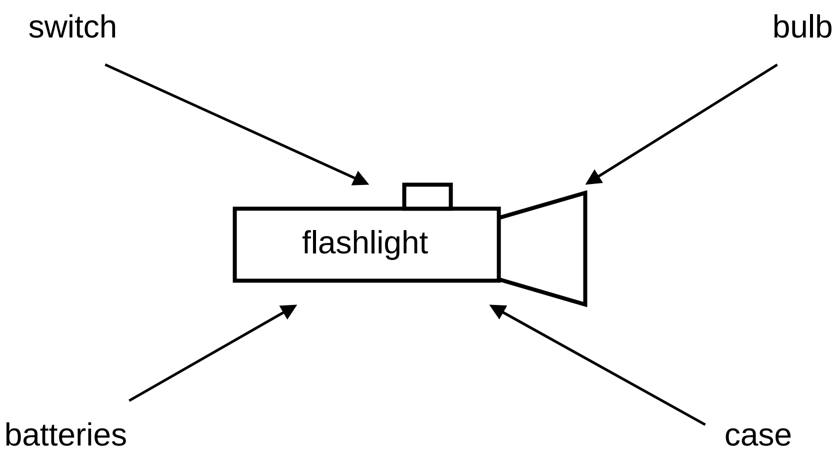

Figure 6-2

Thus, under the background condition that the batteries are charged, (18) becomes a successful statement, which supports an information flow from left to right. If it is further assumed that the case is normal, it can be easily imagined within the Flashlight model that one can immediately infer (19a), or equivalently (19b). With (19a) or (19b), the conditional (18) also supports information to flow from right to left, making (18) actually describe a two-way flow; the bi-conditional (19c) is realized. In terms of causation, turning on the switch becomes a necessary and sufficient condition for the bulb's lighting. The explicating process is as follows:

Input: If I turn on the switch, the bulb will light.

Contextual assumptions:

(i) The batteries are charged;

(ii) The case is normal (not short-circuited)

Explicature:

If I turn on the switch $|_{\text{batteries charged; case normal}}$, the bulb will light.

= (19c) If, and only if, I turn on the switch, the bulb will light.

There are two ways to challenge the bi-conditional reading (19c). One way is through the choice of another assumption about the known contextual factor. Thus, the hearer might choose the following context:

Contextual assumptions:

(i) The batteries are charged;

(ii) (20a) The case is possibly abnormal

Then, (19a) is no longer available because there is a second causal factor for the bulb's lighting. Presumably, the hearer chooses this context because the contextual assumption (20a) somehow becomes manifest in his cognitive environment and is relevant enough. In this case, (19c) will not obtain, and the antecedent of (18) will be understood as only a sufficient condition but not also a necessary condition for the consequent. The explicature is (20b).

Explicature:

(20b) If I turn on the switch $|_{\text{batteries charged; case possibly abnormal}}$, the bulb will light.

Another way to challenge the bi-conditional reading (19c) is through some unknown contextual factors that the hearer happens to know. Indeed, there might really be unknown factors that also cause the bulb's lighting. For example, it is logically possible that there might be a special kind of material *X* that can at a short distance 'induce' the bulb to light. Now, if one wears a ring made of such material *X*, then just by holding the flashlight he can light up the bulb. So, when the hearer chooses the following contextual assumptions:

Contextual assumptions:

(i) The batteries are charged;

(ii) (21a) The possible presence of material *X*

then (19a) will not obtain, and (18) will also be seen as only conveying a sufficient condition for the bulb's lighting. The explicature is (21b). When this material *X* is widely known, it will become a contextual factor that can be pictured in Figure 2 for the normal working of a flashlight. Indeed, the conditions that the case is normal and that no material *X* is present are two background conditions for the backward information flow in (18).

Explicature:

(21b) If I turn on the switch $|_{\text{batteries charged; possible presence of } X}$, the bulb will light.

We now reanalyze (14a), whose perfection we have argued is not amenable to a scalar implicature analysis. First, a background condition for the successful statement of (14a) is 'No pollen X present.' Secondly, it is easy in our explicature analysis framework for the derivation of (14c) from (14a). The hearer just chooses the following context:

Contextual assumptions:

(i) No pollen X present;

(ii) (*World knowledge*) If children are sleepy, they will rub their eyes;

(iii) Claire is a child

From this context, the hearer is actually assuming (16) (which means that she is assuming the fulfillment of the set *B'* of all its background conditions.) As a result, (16) and (14a) together yield the bi-conditional reading (14c) as the explicature of (14a); equivalently, the explicature is also 'If Claire rubs her eyes $|_{\text{no pollent X};\, B'}$, then she is sleepy.' The scalar implicature analysis is misguided in this case because one just derives (14c) mechanically in a formal manner without the consideration of context. In contrast, explicature analysis pays careful attention to contextual assumptions in the comprehension of utterances.

14a. If Claire rubs her eyes, then she is sleepy.

14c. If, and only if, Claire rubs her eyes, then she is sleepy.

16. If Claire is sleepy, then she rubs her eyes.

In the case of statement (17): 'If Peter is late again, he will be fired,' whether it will get a bi-conditional reading depends very much upon the cognitive environment of the speaker and the hearer. The intuition is that (17) would not be perfected, and that Peter's being late again would only be interpreted as a sufficient condition but not also a necessary one for his being fired. This can be easily explained by the explicature analysis: assumptions that make the manager fire Peter just pop up too easily in the hearer's cognitive environment. Thus, if the hearer chooses contextual assumption (22), then no perfection will occur, and the explicature will be (23).

Contextual assumption:

(22) Possible fire for the loss of 1 billion dollars of the company

Explicature:

(23) If Peter is late again $|_{\text{possible fire for loss of \$1 billon}}$, he will be fired

3. Conclusion

We have shown how the explicature analysis of conditionals leads to the solution of some paradoxes stemming from the material conditional theory. We have also shown that the concept of 'sufficient condition' is not the basic semantics of conditionals; rather, it is a result of their pragmatics. The basic semantics of a conditional is its underdetermined semantic value represented by the infon $\ll INVOLVES, S_P, S_Q |_{B, B'} \gg$, where *B* and *B*' are unknown parameters (to be pragmatically enriched) relating to the background conditions of the forward and the backward information flows. The pragmatics of a conditional will determine whether it realizes as a one-way information flow or a two-way flow.

The background conditions of a conditional and the world knowledge of the hearer are found to be two crucial sources of contextual factors that affect the comprehension of conditionals. Based on this, we argue for an explicature analysis against an implicature analysis in explaining conditional perfection (the realization of two-way flow). The gist of the argument rests upon the awareness that a conditional statement is a description of the flow of information under background conditions, as illustrated by (14a). Since traditional theories of conditionals only focus on the concept of truth, they tend to lose sight of the informational aspect. The statement 'if Claire rubs her eyes she is sleepy' describes not so much the truth of a causal reality as the information contained in rubbing eyes relative to a regularity under certain background conditions. The puzzles about sufficient condition and the difficulty of the implicature analysis of conditional perfection all stem from this neglect of informational aspect. Barwise's conception and insight of conditionals as regularities supporting information flow, therefore, becomes vindicated in our analysis of conditional perfection.

In fact, on the pragmatic level, we find it misleading to say that a conditional reading (a one-way information flow) is 'perfected' or 'strengthened' to a bi-conditional reading (a two-way flow). This is because they are *on a par* with each other: both cases are final results of the pragmatic comprehension process (i.e. (B) and (C) in Figure 6-3). Of course, when a two-way flow is realized during the explicating process from semantic to pragmatic levels (i.e. (A) to (C) in Figure 6-3), an *if*-statement is interpreted as an *iff*-statement, and it is only in this sense that we can describe this pragmatic enrichment as conditional 'perfection' or 'strengthening'.

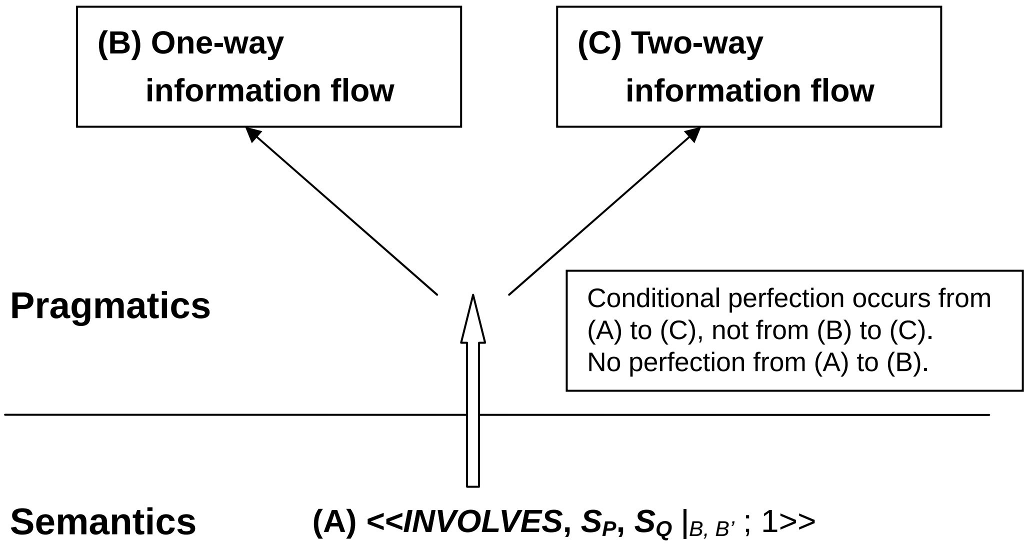

Figure 6-3

Conclusions and Suggestions for Future Research

WE HAVE DEMONSTRATED that at the heart of this thesis is the central notion of regularity. In Chapter 1, based on the claims of situation theory, we have shown that it is the regularities between types of situations that provide the possibility of communication. This is because communication is a kind of information flow, and that information flows in virtue of the presence of regularities. In Chapter 2, we have shown that this regularity model also works in the communication of explicit speaker meaning. Specifically, the guidance of relevance in comprehension is now captured within an Input-Context-Conclusion regularity, on which the derivation of the explicature of the input utterance is based. Such a regularity makes possible the contribution of contextual information to the identification of explicature, because it allows that information to flow to the hearer for comprehension.

We have also offered in Chapter 4 a formal modeling of the explicating process with the channel model, explaining in formal terms how pragmatic inference leads to the explicature of an utterance. We have shown that this channel-theoretic model is in principle adequate as a formal description of the explicating process. It has successfully described how contextual information contributes to the identification of explicature. Based on this adequacy, we also give a formal definition for the concept of explicature.

It is also found that regularity lies at the heart of the study of conditionals. In Chapter 5, we have contrasted the regularity approach to conditionals with the truth-conditional approaches in terms of its explanatory power for linguistic data and ability to resolve semantic paradoxes, showing some advantages of the former and the difficulties of the latter.

In Chapter 6, background conditions associated with conditional statements and world knowledge of the hearer are found to be two crucial sources of contextual information that affect the comprehension of conditionals. Whether a conditional is interpreted as a one-way information flow or a two-way flow depends very much upon these two kinds of contextual factors. An explicature analysis is then shown to be more adequate than implicature analyses in explaining the phenomenon of conditional perfection.

Further research along the lines of Chapter 4 seems possible; the following are some speculations. One direction is to model conditional perfection and non-perfection with the channel model. There seems to be at least two ways to do so. One way is to take the explicating process as filling the parameter *B'* in the infon <<*INVOLVES*, S_P, S_Q $|_{B'}$; 1>>, which represents the semantic value of 'If P, (then) Q.' Using the utterance 'If I turn on the switch, the bulb will light' as an example, if the infon is filled with the contextual assumption that the case is normal, then the explicature corresponds to a two-way flow; filling in with the assumption of an abnormal case will give a one-way flow. The modeling is analogous to Example A in Chapter 4.

For a more interesting way of modeling, we consider Barwise & Seligman (1997: 23, 43-45) on how to model non-monotonicity or non-weakening in logic. Monotonicity describes inference of the form: from ‘P entails Q’ to ‘P and A entail Q.’ However, monotonicity does not necessarily hold. For example, we have ‘(P) The switch being on entails that (Q) the bulb is lit’ but not ‘The switch being on and the battery being dead entail that the bulb is lit,’ i.e. P≠> Q. So, when the background condition of charged battery is violated, the consequent may not obtained. Note that the case of one-way flow can be consider as the other side of the coin, since one-way flow is just Q≠> P. As the channel model can model P≠> Q when the battery is dead, so it can also model Q≠> P when the case is abnormal.

To model non-monotonicity, Barwise & Seligman (1997) introduced the technical concept of *refinement* of a channel. The idea is to include into the tokens the flashlight instances whose battery is dead. That is, the whole system is now added the component of battery, when previously this component and that of the case are ignored so that all tokens are flashlight instances of normal functioning that lead naturally to a two-way flow. In modeling the realization of one-way flow, instead of considering dead battery, we just include into the tokens the flashlight instances where the cases are abnormal.

Another direction is to investigate how the proposed formal model can be extended to the comprehension of implicature. Future work can also be done on fine-tuning the model to cope with the case of miscomprehension. Specifically, this concerns the relaxation of assumptions made in the modeling. For instance, we may relax the assumption of constraint (C4) (in Chapter 4) to allow for its breakdown for some tokens. Further formal work seems also possible on the structure of the lattice ***G*** generated by the underdetermined infons and its relation to the explicature and the whole channel. Philosophical implications of the modeling can also be explored. For example, in possible world semantics a proposition is treated as a function from a set of possible worlds to truth values {0, 1}. In light of our proposed definition, an explicature of an utterance can somehow be regarded as a function from a set of possible infons to *information values*, i.e., relevance levels between 0 and 1. It can be conjectured that this might shed light on the problem of propositional attitude.

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