Categorizing automated messages

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Abstract

This paper discusses a field study that investigates the relationship between a linguistic theory called speech act theory (SAT) and automated electronic messages. The results reveal that standards for both electronic data interchange and inter-application communication messages have the structure predicted by SAT. This provides some evidence supporting computerized systems based on SAT. The benefits of such systems are that they would be easier to construct and support than existing systems.

1 Introduction

Businesses use paper forms for standard information exchange. This exchange, when performed by computers, is called electronic data interchange (EDI). Businesses use EDI for many inter-company messages: requesting a transportation schedule, providing one, confirming that containers have been picked up, reporting a bank's assets and liabilities position, authorizing a commitment of resources, etc. With the wide availability of computers and reliable communication technologies, businesses are increasingly rely on EDI for timely information exchange. About 70,000 businesses worldwide use some form of EDI [1]. SWIFT (Society for Worldwide Interbank Financial Telecommunications) alone, for example, switched about 2.8 million EDI messages per day during 1996.

As reported in a survey done in 1989 by Straub & Wetherbe, information systems executives believe that communications technology—with EDI being mentioned specifically—is a critical information technology [2]. These executives forecast that EDI will be one of the dominant technological forces that will affect organizational change in the 1990s. Unfortunately, EDI systems are difficult and expensive to develop and are not as capable as they could be (Scala & McGrath [3]). Reasons for these drawbacks become apparent by contrasting how EDI systems add new capabilities with how this is done in another system. Each EDI message is an instance of one of hundreds of possible message types. Each of these message types has a specific, rather limited, structure. To interpret the meaning of a particular message instance, the reader must be familiar with the idiosyncracies of its message type. To say something new, a new message type must be created—someone or some committee must define fields, determine their order, determine if each is required or optional, determine how it should be interpreted and responded to, etc. Contrast this with the English language, the foundation of a very capable communication system. It comprises a very stable grammar and a large and evolving vocabulary. This combination allows speakers to express new ideas by combining existing words in novel ways within the boundaries imposed by the grammar. Given appropriate knowledge of the vocabulary, a person can understand most sentences because the grammar is constant.

Since EDI is part of a communication system among computers and people, fields that study human communication might have much to say about how to develop a more capable EDI system with less difficulty and expense. How is a flexible language (e.g.,

English) structured? What kind of utterances can be made? Can utterances be classified in any useful way? Are there general skills or knowledge that can be learned? If so, what are they and how general are they? Speech act theory (SAT), a theory of communication discussed in §2, has much to say about these questions.

EDI developed with little regard for linguistics or SAT. The research following reveals the remarkable fact that the message structure implicit in the investigated electronic messaging systems is consistent with SAT. I believe this is not simply a remarkable coincidence but indicates that SAT usefully describes the communication activities performed by EDI systems. (Stronger claims could be made and are discussed in §7.) If this were so, then possibly EDI systems could be designed to take advantage of what we know about SAT and human communication, thereby making these systems more capable and flexible.

Other papers have explored the added capabilities and increased flexibility of EDI systems based on SAT [4, 5]. Here I will summarize specific ways in which SAT would affect EDI. The most obvious application would be in the design of EDI message sets. A message set is, roughly, the electronic counterpart of a paper form. A message set definition describes how it is to be used, the fields it needs (think of blanks on the form), the values that are allowed in these fields, the definitions of those values, the order in which the fields can be listed, and the meaning of the message when it has certain values in certain fields. Applying SAT to EDI message sets results in a message set in which the message's purpose—that is, whether it requests or predicts or informs—would be explicitly represented. Currently much detailed knowledge is needed in order to determine what a message is doing. One message set can have multiple purposes (e.g., both predict and inform) or can have one of many purposes (e.g., either predict or inform). A particular message's purpose is determined by its contents. An alternative would be that each message set has just one purpose (e.g., always a prediction) whose contents merely determine the specifics (e.g., the subject of the prediction). Current practice makes it more difficult to write programs to interpret these messages, react to them, and retrieve information contained in them.

Phrase	Force
requesting a transportation schedule	requestive
providing a transportation schedule	predictive
confirming that containers have been picked up	confirmative
reporting a bank's assets & liabilities position	descriptive
authorizing a commitment of resources	permissive

Table 1: Sample phrases and their illocutionary forces

Second, all message sets in a SAT-based EDI system would have a common format in which the message's purpose (called the *illocutionary force* by speech act theorists) is separated from its content (e.g., whether it is about a purchase order, or a shipment of goods, etc.). SAT holds that *all* utterances have a common structure. Currently, each EDI message has a format distinct from all others.

Third, each message set would always have a force chosen from a small set of known forces. Speech act theorists posit that there are a limited number of forces and that these do not change with different subject areas. The forces of the examples in the first paragraph are shown in Table 1.

The possible effects of the above three proposals for firms engaging in electronic commerce are many. Developers would be able to reuse computer code among messages with the same illocutionary point, thus making addition of new messages to an EDI system less troublesome. Companies would find it easier to build both search engines that could find information hidden in huge message repositories and message management systems that could help manage the flow of information between and within organizations. Companies would be able to send new kinds of messages without going through the bureaucratic maze of defining a new message set. This would make it easier to say more things electronically and, thus, to forge deeper electronic links between organizations. These and other organizational and strategic implications are discussed in §7.

I conducted a field study (discussed in §3) of three

standards (described in §4): two for EDI and one for inter-application communication. The purpose was to determine the correspondence between the standards and SAT. SAT predicts that all utterances share the same high-level structure. Since a message from one of these standards helps two parties communicate, it can be considered an utterance. Thus, SAT asserts that these messages must have the predicted structure. I tested this prediction. The findings of this investigation supported SAT—messages *can* be mapped to the structure predicted by SAT (discussed in §§5–6). Implications and future research are discussed in §7.

2 Review of speech act theory

Work on SAT began, roughly, with the publication of Austin's *How to Do Things with Words* [6], the text of his William James Lectures at Harvard University in 1955. These lectures specified two very important, though quite general, ideas. The first rebuts the then commonly accepted idea that language's only function is to say things that are true or false. Austin felt this was not enough. He believed statements also accomplish something, that people are doing things with words.

Austin also proposed that every (for our purposes) utterance is the speaker's expression of an attitude toward some possibly complex proposition. For example, if the speaker says "It will rain," then typically the speaker is predicting it will rain. The proposition is *it will rain* and the attitude is that of a *prediction*. If the speaker says "Will it rain?" then typically the speaker is asking whether it will rain. In this case, the proposition is the same—it will rain—and the attitude expressed is that of a *question*. Thus, speakers can express different attitudes toward the same proposition. Speech act theorists call these attitudes *illocutionary forces*. Summarizing this idea: every speech act (i.e., utterance) has the structure *F(P)*, where *F*, the illocutionary force, is applied to *P*, the propositional content. This is called the *F(P) framework*.

This is a strong claim. Speech act theorists propose that the outermost operator of *every* utterance (everything we could possibly say) is not Boolean, not temporal, not even defeasible—it is an illocutionary force. If this were true, then a communication system might benefit from representing the structure explicitly so that the system could reason about it. (More on this later.)

Speech act theorists propose widely differing categorization schemes for these forces, each of which could be used as an organizing scheme for a message hierarchy. Different versions of SAT (Ballmer & Brennenstuhl [7], Searle [8]) are more or less suited to be such an organizing scheme because of the opportunities for inheritance. A less useful hierarchy would be one level deep with no inheritance. A more useful hierarchy would be deeper, allowing messages to inherit properties from other messages. A small number of illocutionary forces that are categorized into a relatively deep tree would be ideal for a communication system based on SAT.

I work with the version of SAT proposed by Bach & Harnish [9]. It is representative of other proposals such as the one by Searle [10] and the one by Ballmer & Brennenstuhl [7]. The linguistic community has not settled on any one scheme and, for the purposes of this paper, there are not big differences among them. Also, they define a system of inferential communication that is a useful basis for electronic communication (Kimbrough & Moore [11, 12]). Roughly, under an inferential communication theory, which is also supported by some cognitive scientists and philosophers (Grice [13], Nolan [14], Sperber & Wilson [15]), the recipient must infer what the speaker means and then take the message as a basis of inference for how to act. This is in contrast to Searle's position that communication is a decoding system and that all the information needed to understand a message is contained in the message itself [8, 16, 17]. The effects of this choice are discussed in §5.

Bach & Harnish propose two major categories of illocutionary forces and six main sub-categories with further subcategorization. The two major categories, *communicative* and *conventional*, designate how the hearer should process the utterance. "Communicative illocutionary acts succeed by means of recogni-

tion of intention, whereas conventional ones succeed by satisfying a convention." [9, p. 110] For example, if a speaker performs a requestive, an example of a communicative illocutionary act, then this act succeeds if the hearer recognizes that the intent of the speaker was, in fact, to perform a requestive ("recognition of intention"). Conventional forces can only succeed under much more restrictive circumstances (i.e., "by satisfying a convention"). For example, appointing a person to a position can only be done in a certain way by certain people at certain times. It is not simply by recognizing the intent of the speaker to appoint, but it is the satisfaction of the conventions of appointing that determines whether the act succeeds or not. As for the six main sub-categories:

> "*[C]onstatives* express the speaker's belief and his intention or desire that the hearer have or form a like belief. *Directives* express the speaker's attitude toward some prospective action by the hearer and his intention that his utterance, or the attitude it expresses, be taken as a reason for the hearer's action. *Commissives* express the speaker's intention and belief that his utterance obligates him to do something (perhaps under certain conditions). And *acknowledgments* express feelings regarding the hearer or, in cases where the utterance is clearly perfunctory or formal, the speaker's intention that his utterance satisfy a social expectation to express certain feelings and his belief that it does." [9, p. 41]
>
> "*Effectives* effect changes in institutional states of affairs... *Verdictives* are judgments that by convention have official, binding import in the context of the institution in which they occur." [9, p. 110–11]

Figure 1 lists the four categories of forces that are communicative illocutionary acts. (The two categories of conventional illocutionary forces are discussed below.) Table 2 provides informal definitions, Appendix A provides their formal definitions, while Table 3 provides examples of utterances that typically would have these forces. Bach & Harnish also

Force	Description
acknowledgment	perfunctorily express certain feelings
advisory	advise that the hearer should do something
ascriptive	claim that some result or situation is related to some other situation
assentive	agree to something claimed by the hearer
assertive	tell someone some fact
concessive	express something contrary to what was believed
confirmative	tell someone something he/she already knows
descriptive	describe something
disputative	claim there is reason to not believe something
dissentive	disagree with something claimed by the hearer
effective	saying it makes it so
informative	tell someone some fact that they probably don't know
offer	an offer to do something
permissive	tell someone they can perform some act
predictive	describe some event that has yet to occur
prohibitive	require that the hearer not do a certain thing
promise	commit yourself to something
question	ask a yes/no question
requestive	ask something
requirement	ask someone else to do something from a position of authority
retractive	claim that the speaker no longer believes some fact
retrodictive	describe some event that has occurred
suggestive	claim that there is some reason to believe some fact
suppositive	claim that it is worth considering the consequences of something
verdictive	a judgment that has official, binding import

Table 2: Informal definitions of illocutionary forces

Communicative

Constatives assertives, predictives, retrodictives, descriptives, ascriptives, informatives, confirmatives, concessives, retractives, assentives, dissentives, disputatives, responsives, suggestives, suppositives

Directives requestives, questions, requirements, prohibitives, permissives, advisories

Commissives promises, offers

Acknowledgments apologize, condole, congratulate, greet, thank, bid, accept (acknowledge an acknowledgment), reject (reject an acknowledgment)

Conventional

effectives appoint, nominate, suspend, demote, enlist, apply, resign, abdicate, arrest, indict

verdictive acquit, certify, disqualify, clear, rule, adjudicate

Figure 1: Classification of forces and verbs

include a *constative* of type "responsive." This is meant to distinguish illocutionary acts in which the speaker is responding to an earlier inquiry by the hearer. That an utterance is considered to be a response is classifying the utterance based on discourse (or dialogue) related information. Other discourse type information would indicate if the utterance is an interruption of a continuing conversation, an elaboration of a previous utterance, or a correction of a previous utterance. Many researchers (e.g., Litman & Allen [18], Cohen & Perrault [19], McCafferty [20], and Moore [21]) have argued for communicative frameworks in which the discourse information is considered separately from that of illocutionary force. I agree with this position. Since inclusion of this force would confound the results of the study, I do not include "responsives" in the list of possible illocutionary forces.

Conventional illocutionary acts can only be distinguished at the verb level. Examples of verbs with an effective or verdictive illocutionary force are in Figure 1. An example of an utterance classified as an effective is "I nominate Seymour Evil as the next president." An example of a verdictive is "I certify that Eustus L. Emons is insane."

Force	Example
acknowledgment	Thanks for sending the shipment.
advisory	You should pick up the shipment before it rots.
ascriptive	The shipment was not sent because we lost your paperwork.
assentive	Yes, we should pay for the shipment.
assertive	The goods are ready to be shipped.
concessive	We now believe that it was our fault that the shipment was not delivered.
confirmative	We verified that we sent the shipment.
descriptive	The shipment weighs 50 pounds.
disputative	We weighed the shipment and it does not weigh 45 pounds as you claimed.
dissentive	I don't believe that you are ready to use this shipment yet.
effective	Yes, I accept your offer to insure the shipment.
informative	We have enough in stock to send two more shipments if you need them.
offer	I will insure the shipment if you want me to.
permissive	You may install the contents without my supervision.
predictive	I believe the shipment will get there tomorrow.
prohibitive	You may not use the contents until I arrive.
promise	You will be satisfied with this product.
question	Did the shipment arrive?
requestive	Please open the shipment when it arrives.
requirement	Open the package now.
retractive	Now I don't believe that the shipment will get there tomorrow.
retrodictive	We packed the contents with great care.
suggestive	Shipments are usually picked up at 4pm.
suppositive	I wouldn't use that for that purpose because it might break.
verdictive	I find you not guilty of shipping hamsters across state lines.

Table 3: Examples of each illocutionary force

Speech act theorists contend that all utterances can be described within the *F(P)* framework. Bach & Harnish propose the thirty-plus illocutionary forces in the six categories listed above; others propose different numbers of forces in different categories. The exact categorization scheme used is not important for this paper. What is important is the contention that all utterances—verbal, electronic, or otherwise—have an illocutionary force. It is this contention that is investigated in this paper.

3 A field study

The best way to determine if all utterances can be understood within the *F(P)* framework is to translate all utterances into the framework. However, there are infinitely many utterances, so this is not possible. It is also not clear that a random sampling of utterances is feasible. For example, what would the population be? What would a random sample look like?

A more feasible test is to translate some appropriate sample of utterances. Since I am concerned with electronic commerce and the realm of doing things electronically and automatically, appropriate samples are existing sets of utterances that reflect the diverse activities performed electronically. The scientist's challenge is two-fold. First, find a diverse set of utterances so the results can be regarded with some confidence. Second, choose an application domain close enough to electronic commerce so the results are considered relevant. Satisfying these requirements should increase the external validity of this study (Cook & Campbell [22]). I conducted this test by completing a kind of field study. First, I gathered some data—two EDI standards and an inter-application communication (IAC) standard. These were not random choices. They are existing, rich, diverse commercial standards developed independently of SAT. Each domain serves a different purpose, and the messages within each set differ. Presumably the creators of a standard defined it so that a complete range of activities could be performed electronically. The central task of this study is organizing messages from these standards into a framework. The purpose of this task is to validate the framework though others (discussed below) are also of some interest.

Speech act theorists predict all utterances should map to the *F(P)* framework. In this study I test this prediction by attempting to classify each message of each standard into one or more of the illocutionary forces. The usefulness of SAT (for electronic commerce and otherwise) will be measured by its performance along several dimensions:

Successfully mapping onto the F(P) framework SAT will clearly have failed if even one message cannot be mapped onto the *F(P)* framework. SAT predicts all utterances fit this framework—so even one failure will contradict SAT. However, two types of messages will not be included: messages that are text-only, non-formal messages that act more like email, and messages that simply transport data from sender to recipient as a freight car would. In the first type, the message's content is not part of the standard. It is impossible to categorize these messages not because SAT fails but because the standard provides nothing to categorize. In the second type, the message performs a *physical* act but not a *communicative* act. It is more like a delivery of bananas than a communication of some intent.

Successfully mapping a message does not mean each message will map onto only one illocutionary force. SAT does not predict this about normal language nor is it present. Suppose a person says "Please come in here and shut the door." This naturally maps onto two separate acts—a request to come into the room and a request to shut the door. It would be surprising if each message mapped onto just one illocutionary force.

Mapping onto much of the illocutionary force categorization The hierarchy of illocutionary forces described by SAT can be thought of as a tree. Mapping the messages onto SAT will be much more useful if both the tree's depth (categories and each level of sub-categorization) and breadth (illocutionary forces) are used, or covered. Property inheritance is more useful to application developers if many categories and sub-categories are used—i.e., the depth is utilized. Using a higher percentage of the forces—

i.e., utilizing the breadth—indicates the force is contributing to more of the message's meaning than if a lower percentage of the forces were used.

To understand the importance of this, consider the extreme example in which all messages map into one illocutionary force—that is, messages `X`, `Y`, etc. all map onto force `A`. This example suggests the illocutionary force does not contribute much to understanding the message. Even if it does contribute, other factors clearly outweigh its importance. The cost of adding this information to a message's representation would probably outweigh its usefulness.

How much the standards segment the hierarchy The more that different standards use the same parts of the tree, the more useful SAT becomes. If the tree were segmented by the standards, then the generality of SAT would have to be questioned. It would cause one to hypothesize that as more message standards are analyzed, more illocutionary forces, subcategories, and categories would be needed. It would also raise interesting questions about SAT, such as: Is it always the case that certain illocutionary forces are used together? Is this to the exclusion of other forces? Does this say anything about the complexity of the communication?

4 Message standards

This section describes the application domains and message standards used in this study. These include two EDI standards and two inter-application communication (IAC) standards. I included the IAC standards because their uses are similar to those of EDI. Whereas EDI involves applications at one company sending messages to applications at another company, IAC involves applications sending messages to other applications generally, but not universally, on the same computer. Further, though not by any means a requirement, applications that are acting on the receipt of an EDI message could send IAC messages to other applications and could, thus, be seen as participating in electronic commerce. It is not too much of a stretch to envision an IAC message containing information of the type that is currently only contained in EDI messages—and *vice versa*.

EDI: UN-EDIFACT open standard The United Nations supports Electronic Data Interchange for Administration, Commerce, and Transport (UN-EDIFACT) [23]. This standard defines "a set of internationally agreed standards, directories and guidelines for the electronic interchange of structured data, and in particular that related to trade in goods and services between independent, computerized information systems" [23, p. 5]. This is the official international standard for EDI. The American National Standards Institute (ANSI) X.12 EDI standard [24] has been the EDI standard in the United States; however, ANSI has stated that it is their intent to migrate to the UN-EDIFACT standard after 1997 [25]. These messages span many industries. Companies send these messages to their trading partners. Some messages require a return message; others require the company to send goods; others are purely informational messages.

EDI: SWIFT proprietary standard "SWIFT is a world-wide organization working in partnership with its customers to provide them with communication and financial data processing services of the highest quality, security and integrity." [26, p. 5] SWIFT developed a standard for sending messages about financial securities, such as trading of securities, settlement of trades, and securities lending and borrowing. Companies send these messages to their trading partners and to other institutions involved in financial transactions. Similar to the UN-EDIFACT messages, these messages may or may not require responses.

IAC on the Macintosh: Apple Event Registry The Apple Event (AE) Registry [27] defines standard IAC messages (known as Apple Events on the Apple Macintosh). Applications use these messages to send information to other programs and to get them to perform tasks. Just as with the EDI standards, this standard does not exhaust all possible messages. This standard defines the basic messages that the operating system and common business applications (e.g.,

a word processing or spreadsheet program) should be able to understand. Thus, if a word processing application on a Macintosh claims to understand AEs, then it should understand the appropriate messages defined in this standard.

When an AE expects information in return, it leaves an electronic "return envelope" with the receiver to put its information into. This envelope can contain an answer to a question or information about a problem encountered by the receiver. Thus, each message that asks a question implicitly defines a separate reply message.

IAC on Windows: OLE automation & Dynamic data exchange Microsoft Windows and Windows 95 do not have a standard comparable to the AE Registry. Each application defines the OLE automation calls (the Microsoft implementation of IAC messages) that it can understand without regard to the messages that other, similar applications can understand. Thus, whereas all spreadsheets that run on the Macintosh are expected to understand the AEs for spreadsheets, each spreadsheet under Microsoft Windows and Windows 95 defines the OLE automation calls that it can understand independently of other spreadsheets. Since there is no standard set of OLE messages, OLE automation is not included in the study.

DDE messages, which are a precursor with limited functionality to OLE automation calls, have a very limited vocabulary. For example, Microsoft Excel 7 for Windows 95, Word 7 for Windows 95, and Microsoft Visual Basic can send the DDE messages defined in Table 4. The limited vocabulary, the variety in nomenclature, the lack of a standard vocabulary, and the fact that DDE has essentially been replaced by OLE are all reasons for excluding DDE messages from the study.

5 Procedure

I mapped each message in each standard to the illocutionary forces defined by Bach & Harnish. There are 260 messages in all: 125 UN-EDIFACT, 41 SWIFT, and 94 Apple Events. I used the following procedure for each standard:

1. Read the message's functional description. Where this is ambiguous, investigate the message's notes, field definitions, and the possible content of the fields.

2. Extract from the functional description a verb phrase that describes what the message means. Where this is not possible, again look to the notes for more information. I used the exact form and wording where possible, only changing to make verb tense and form more consistent among messages.

3. Continue extracting verb phrases until exhausting all the message's possibilities. Write each on a separate line. Extract verb phrases for all messages in the standard.

4. Determine the appropriate illocutionary force for each verb phrase. Use the force hierarchy shown in Figure 2. Write the chosen force next to the verb phrase.

I constructed Figure 2 based on the definitions given in Appendix A. This organizes the forces into categories that helped me find relevant possibilities most quickly. Acknowledgments are not included because no messages had any of these forces.

The following describes the steps I took and decisions I made when mapping a relatively simple message, MT 501 (shown in Figure 3).

Step 1 is information gathering—i.e., reading the scope of the message (shown in the figure) and the information in the rest of the definition (not shown). In this case the scope contains all that is needed. This other information is needed when the scope is not clear about the message's function. Step 2 requires extracting from the definition a verb phrase that describes the message's meaning. The verb phrase for this message is "instruct the receiver to sell a specified quantity of the identified security." The rest of the scope is not relevant to the determination of the message's illocutionary force; it defines who sends the message, who it's sent to, how a message should be

Description	Excel[28]	Word[29]	Visual Basic[30]
Opens a DDE channel to an application	DDEInitiate	DDEInitiate	LinkOpen
Closes a channel to another application	DDETerminate	DDETerminate, DDETerminateAll	LinkClose
Runs a command or takes other actions in another application	DDEExecute	DDEExecute	LinkExecute
Requests information from the specified application	DDERequest	DDERequest	LinkRequest
Sends data to an application	DDEPoke	DDEPoke	LinkPoke
Notify the user that new data is available			LinkNotify
Notify the user that an error has occurred			LinkError

Table 4: DDE messages from sample applications

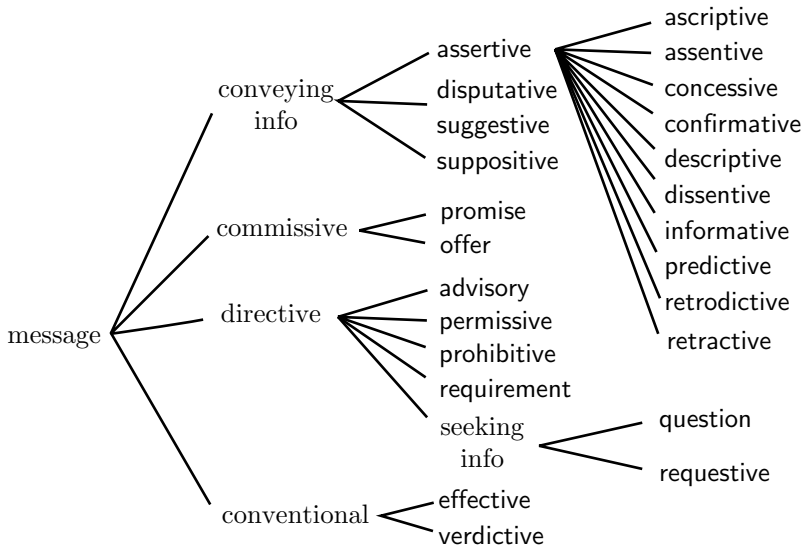

Figure 2: Hierarchy of illocutionary forces used during mapping

MT 501 Order to Sell This message type is sent by the client, or its authorized representative, to a financial institution.

It is used to instruct the Receiver to sell a given quantity of an identified security under specified conditions.

The following guidelines apply when sending an MT 501:

- When settlement instructions are not provided, standing instructions for delivery and payment apply.
- When a specific type of deal, such as spot or forward, needs to be identified, this identification will be located in field 23.

Figure 3: Definition of the scope of MT 501 from the SWIFT *Securities Market Binder* [26, p. 5-1]

interpreted when some information is missing, and how certain fields should be filled in given certain circumstances. Step 3 instructs the mapper to look for other verb phrases. As we can see, MT 501's definition does not have any.

Though steps 1–3 are essentially mechanical, step 4 is not nearly so clear-cut. The mapper's judgment comes into play when determining which illocutionary force the verb phrase carries. Ideally, the mapper reads the verb phrase and then finds the corresponding force from those shown in the classification in Figure 2 (with reference to Figure 1, the informal definitions in Table 2, and the formal definitions in Appendix A). Bach & Harnish present the forces as all being on the same "level" of the hierarchy (as shown in Figure 1). This is not the case—some are specializations of others.

Consider the utterance "It is raining" and assume that the speaker is speaking directly and literally.[1] Without knowing more about the situation it appears that this utterance is either an assertive or an informative. The definitions in Appendix A specify that an informative occurs when the speaker is telling the hearer something that the speaker assumes the hearer does not know while an assertive occurs when the speaker is simply telling the hearer something without that assumption. Since the mapper does not know if the hearer knows if it is raining (without being able to ask), this utterance should be classified as an assertive. If the mapper had known that the speaker actually did think that the hearer already knew it was raining, then the mapper would have classified the utterance as an informative.

This highlights several important facets of mapping. First, a message's force is determined by what the speaker is attempting to accomplish with the utterance and not by what he actually accomplishes or what the hearer thinks the speaker is trying to accomplish. For example, with the utterance above the force is an assertive because the speaker is attempting to tell the hearer that it is raining. It is irrelevant (for our purposes) as to whether the hearer believes that it is raining or whether the hearer thinks that the speaker is attempting to get her to turn off the garden hose. This is where the choice of an inferential model comes to the fore. Under a decoding theory there is little difference between understanding the utterance and knowing what the speaker wants the hearer to do. An inferential theory separates these two. When classifying an EDI message the mapper need only know the meaning of the message as specified by the speaker. Information about whether a particular message is understood correctly or whether or not it had the intended consequences does not change its illocutionary force. The implications of this separation are discussed in §7.

Second, it is quite possible to misclassify an utterance (i.e., a message) because of a lack of information about the speaker's intentions. This mostly has to do with the sometimes vague, and always complex, message definitions rather than with some failure of the mapper or the process. A quote from a practitioner (relayed by Ronald Lee) reflects this: "I'm the only one using a purchase order as a purchase order." Fortunately, this does not have dire consequences in most cases when mapping EDI messages; that is, it has lit-

[1] This prevents for this example the possibility that the speaker is ordering the hearer to stay in the house, requesting that the hearer go outside and roll up the windows in the car, etc. It is easy to play a game whereby you take some simple utterance and make it mean many things that are only tangentially related to their surface structure. This utterance is but one example. However, that is for another time, another place. Here we are considering EDI and assuming that the systems (and programmers behind them) are trying to get business done and not trying to fool the other party.

tle effect on how the message should be interpreted. The misclassification is generally minor because of the assumption about speaking literally and directly. A graphical interpretation of "minor" (in Figure 2) is that the differing illocutionary forces are on the same "branch" of the hierarchy. For example, if the mapper had misclassified the raining assertion as an informative, this would be considered minor since informative is on the same branch as assertive.

Further, this misclassification problem only exists because the messages are being mapped *after they have been defined*. If companies were to implement an EDI system that has each message defined in terms of its illocutionary forces, this problem need not exist. Each illocutionary force would be defined, and each message would be defined in terms of these forces. The possibility for misunderstandings would be greatly reduced because the sending party's intentions would be clear and each partner would be mutually aware that the sending party sent the message with full knowledge of these definitions.

Third, the most specific illocutionary force possible should be mapped to a message. Graphically, this can be interpreted as saying that the applicable force farthest to the right in the graph in Figure 2 should be chosen. In the above example the choice is between informative and assertive. I chose assertive because informative did not seem applicable as explained above. If it had been applicable, I would have chosen it because it would have most specifically mapped to the message.

Thus, much of a mapper's judgment comes into play in Step 4. Determining what the speaker is attempting to accomplish is very much an educated guess based on the evidence presented in the message's definition. As mentioned above, much of the difficulty of this decision for an actual implementation would be removed because trading partners would define the messages in terms of the illocutionary forces before they are used. The benefits of this are discussed in §7.

Returning to MT 501: Applying Step 4 to this message involves determining the force carried by "instruct the receiver to sell a specified quantity of the identified security." This involves choosing the appropriate force from Figure 2. In this case I started

MT 550 Notice of Rights This message type is normally sent by a Custodian to its customer. It may also be sent by a Financial Institution involved in a securities transaction to other interested parties.

It is used to provide the Receiver with details of rights to a current or future debt or equity subscription.

The following guideline applies when sending an MT 550:

- This message normally requires a response (e.g., an MT 553).

Figure 4: Definition of the scope of MT 550 from the SWIFT *Securities Market Binder*

at the left side of the tree and moved to the right by choosing the appropriate branches. In this message the speaker is *instructing* the receiver—that is, the speaker is *directing* the receiver to do something. This narrows down the search for an illocutionary force to the *directive* branch of Figure 2. For definitions of each force (those items in Figure 2 in this font) I first referred to Tables 2 and 3; if this was not sufficient, then I referred to the definitions in Appendix A. This verb phrase seems to map to requirement: "ask someone else to do something from a position of authority." The "position of authority" is a contractual obligation that already exists between the sender and the receiver that specifies that the receiver will dispose of assets owned by the sender under instructions from the sender. MT 501 fits the definition of requirement. Looking in Appendix B, MT 501 is listed on just one line and is classified as a requirement. This is one verb phrase from one message from one standard. Each line in the appendix represents other verb phrases, the associated illocutionary force, and a similar mapping process.

Not all mappings are as straight forward as that for MT 501. Consider MT 550 shown in Figure 4. The mapper must first determine the verb phrase(s) this message definition contains. I propose that there is but one: "provide the Receiver with details of rights to a current or future debt or equity subscription." It could be argued that this actually should be two verb phrases: "provide details of rights to a *current* subscription" and "provide details of rights to a *fu-*

ture subscription." However, this message describes the *current* status of the recipient's rights in regards to the current or future subscription. If a separate verb phrase were to be needed for the rights to the future subscription (thereby changing it to a predictive), the message would have to convey information either about the possibility that the recipient will have future rights or about the projected amount of future rights that the recipient might have. Since neither is the case, I propose that MT 550 has just one verb phrase. Further, I propose that this verb phrase is a descriptive since the sender describes an object and intends that the recipient believe the description (see the definition of descriptives in the appendix).

The definition of MT 550 also states that it normally requires a response instructing the custodian of any actions it should take. I could not find anything in the extended definition (in the scope or field definitions) that explicitly requests or requires that the recipient respond to the message. Thus, I assumed that this "normal requirement" is an industry practice that has been established. That a response would end up being send as a result of the original MT 550 message seems to be less of a result of some request for that response and more of an expected or intended effect that the speaker hoped the message would have. This expected or intended effect is exactly what linguists define as the perlocutionary effect of a message. Thus, I did not classify MT 550 as having either a requirement or requestive force.

Other messages are more explicit about their ability to perform multiple functions (e.g., MT 526 shown in Figure 5). Depending on the contents of the message, one particular MT 526 might be categorized as an informative ("list"), a retrodictive ("notify"), a requestive ("request"), or a confirmative ("confirm"). It holds any one of these forces to the exclusion of the others. Other messages can be used in different ways at the same time.

MT 526 General Securities Lending/Borrowing Message
This message type is sent from one financial institution to another, both of which are involved in the lending of securities. It is used to:

- list specified securities available for lending by the Lender or its agent
- list specified securities no longer available for lending by the Lender or its agent
- request the borrowing of a specified security from the Lender or its agent
- notify the Borrower or its agent of a partial or total return of the securities out on loan
- notify the Lender or its agent of a partial or total return of the securities borrowed
- request the potential Lender to hold the specified securities until further notice
- confirm that specified securities are being held
- request the potential Borrower to confirm a securities loan or cancel a request to hold securities until further notice.

Figure 5: Definition of the scope of MT 526 from the SWIFT *Securities Market Binder*

6 Results

Appendix B shows how I mapped the messages in each of the three standards. The results generally supported SAT. The following is an analysis of each dimension of the study.

Successfully mapping onto the F(P) framework
I mapped all the well-defined messages onto the *F(P)* framework. The SWIFT standard contains two messages (598, 599) that could not be mapped because their contents were not well defined. Message 598 is defined as a "proprietary message" with no further explanation. Message 599 is defined as a "free format" message. Its contents are not interpretable by a machine. Both of these messages are not well-defined and were not included in this test.

Similar to Message 599, UN-EDIFACT messages DIRDEF ("transfer contents of a directory set"), GENRAL ("send general application support information"), GESMES ("transmit statistical data set") and RDRMES ("report raw data") perform more of a transportation function than a communicative function. Other messages have sections that can contain plain text (e.g., section FTX in UN-EDIFACT message

ORDRSP) in addition to the computer-processable sections. These plain text sections are similar to the free text message SWIFT 599. All of these messages and sections were excluded.

A more interesting verb phrase that could not directly be mapped is from STATAC: "remind of payment due." "Remind" does not fit the definition of any illocutionary force. It is actually a perlocutionary effect that the speaker hopes the message (in this case, an assertion that payment is due) will have on its recipient. This definition went beyond simply defining what the message means to defining its possible effects on the recipient. As stated in §5 this study separates these two. The first relates to the illocutionary force and the second to the perlocutionary effect.

Another interpretation of "remind" is that it occurs when a speaker asserts some fact that the speaker thinks the hearer already knows but may have forgotten. This reading would classify this phrase as an assertive. The primary use of STATAC is to provide information about the status of an account (a descriptive). Again, there is nothing in the extended definition that indicates that the message is serving as a reminder separate from its function as a descriptive. Thus, I read the "reminding" function of this message as an expected effect the speaker hopes the message to have—that is, as its perlocutionary effect. As a perlocutionary effect, "remind" is not appropriate for inclusion in this study.

There were not any AEs that could not be mapped; however, five AE replies (messages replying to an inquiry from another AE) fit this category: CreateElement, GetData, DoScript, EditGraphic, and ImageGraphic. Each of these simply transmit data from one program to another without any communicative intention.

The above were the only messages that I was not able to map onto the *F(P)* framework. Certainly, this investigation does not provide the final word on this subject. The main objection is that the author performed the mappings that are the foundation of the investigation and its conclusions. To counter this objection I have presented as much of the raw data as is feasible within these pages. Much of the rest of the needed information is available on the Web (either from Premenos or my web site, both of which are mentioned in the Notes at the end of this article). This allows the interested reader to perform the mapping herself and compare results with those presented here.

Mapping onto much of the illocutionary force categorization For each standard Table 5 displays the number of messages that can possibly have each illocutionary force. The number of messages in each standard (displayed in the first row of the table) does not equal the sum of the numbers below it in the table for two reasons. First, some messages in each standard can have one of several forces. Second, others can have several forces each time they are sent depending on how they are constructed.

This table relates to Appendix B in the following way. The table shows that 6 messages in the UN-EDIFACT standard can have a confirmative illocutionary force. The first 7 rows of the appendix show confirmative messages in this standard. It also shows that the CODECO message can have the confirmative force in two different ways. CODECO counts as one confirmative since the table shows the number of messages, not verb phrases, that were mapped to each force. Other values in the table are computed similarly.

The UN-EDIFACT standard covered the largest proportion of the tree: 13 forces (20 if you count the different types of effectives) and five of six categories (constatives, directives, commissives, effectives, and verdictives). This still leaves 10 other forces without messages mapped to them plus the whole acknowledgment category. Thus, this investigation neither fully supports nor refutes the contention that the standards would map onto much of the illocutionary force categorization. There are at least two possible reasons for this. First, the difficulty—in a bureaucratic sense—of the standardization process limits the number of messages that will ever be defined and the speed at which they are defined. Second, people do not expect computers to express certain types of messages. For example, a condolence in any type of automated system would be perceived as inappropriate.

The SWIFT standard covered the next largest por-

Category	Force	UN-EDIFACT	SWIFT	AE	AE reply
	# of msgs	125	41	59	35
		Communicative			
Constatives	confirmative	6	8		
	descriptive	36	8		34
	disputative	1			
	informative	24	12		35
	predictive	20	4		
	retrodictive	28	13	3	1
Directives	permissive	3			
	question			1	
	requestive	22	6	55	
	requirement	12	13		
Commissives	offer	5			
	promise	7			
		Conventional			
Effectives	8 verbs	17			
Verdictives	1 verb	1			

No messages categorized as an advisory, ascriptive, assentive, assertive, concessive, dissentive, prohibitive, retractive, suggestive, or suppositive. Further, no messages were classified as an acknowledgment of any kind.

Table 5: Messages assigned to each force (note: a message can be assigned to more than one force)

tion of the tree: 7 forces and only two of six categories (constatives and directives). It is instructive to note which categories are not included in the SWIFT standard but are covered by the UN-EDIFACT standard: commissives (promises and offers), effectives (e.g., accept, cancel, reject), and verdictives (e.g., attest). These are the forces with which commitments are made and work is done. This pattern of exclusion makes it clear that SWIFT uses their EDI system to transfer information. Very little of the system is used to actually do financial trading; this is left up to people (or some other system).

The AE standard only expresses four illocutionary forces directly (the AE column of Table 5). This is a clear signal that the designers of the AE communication system had a narrow vision of how applications would use them. Similar to the SWIFT standard, it only has constatives and directives. Further, it does not have any retrodictives (statements about the past) or predictives (statements about the future). AEs focus strictly on current events and the current environment.

However, this system is not quite as simplistic as it seems. Two other places within AEs can contain an illocutionary force. First, the reply message can express an illocutionary force (as shown in the AE reply column of Table 5). This adds one more force (descriptive) to the list of forces used by AEs (either directly or within a response). Second, the message can express another illocutionary force within the message; this is called an *iterated illocutionary force*. As I have assumed throughout this article (and, I hope, have begun to show), all utterances (and, hence, all EDI messages) fit within the *F(P)* framework. As defined in §2, P is the message's propositional content. Sometimes this P can have, instead of just a simple predicate, a more complex form such as $F_1(P)$ where F_1 is any illocutionary force. For example, you can request that Fred inform Barney that Betty went outside—F is request, F_1 is inform, and P is that

Table 6: Mapping information for Apple Events

Illocutionary Force	Inside request	Apple Events
descriptive	1	GetClassInfo
informatives	5	CountElements, GetDataSize, GetEventInfo, BeginTransaction, IsUniform
permissives	1	EditGraphic
retractives	1	Undo

Betty went outside. The second column of Table 6 counts the F_1 for all the AEs of the form $F(F_1(P))$ where F is a requestive force. The third column lists the corresponding AEs. For example, GetEventInfo is listed on the informative row. This message "requests information about the Apple events in a suite." Rewording this to clarify the structure of the sentence we get "the sender requests that the receiver inform the sender about the Apple events in a suite." This corresponds to a message with an $F(F_1(P))$ structure, that is request(inform(P)). By considering this iterated force, we can see that AEs use two more forces, permissives and retractives. However, this still leaves AEs using only 7 illocutionary forces.

Looking at the forces in Figure 2 that are not in Table 5 highlights that there are many forces which did not have any messages mapped onto them. An implication which might be drawn is that these forces are somehow ill-defined, ill-conceived, or somehow faulty. This should not be concluded for at least two reasons. First, the sample is too small to conclude no messages fit into these categories. Messages from other standards might map onto these forces. Second, these are simple electronic messaging systems whose expressive power and purpose are limited. Many normal language expressions would fit into these categories. These systems developed under the restriction of their highly limited languages. Given this limitation it would have been surprising to see a wide variety of messages spanning the $F(P)$ hierarchy. Instead, what was observed was a limited set of expressions that are needed for the systems to function. A more powerful messaging system would encourage the use of a wider range of expressions.

How much the standards segment the hierarchy As shown in Table 5, there was significant overlap between standards. With these three standards, descriptives, informatives, requestives, and requirements account for a high percentage of the messages. For the two EDI systems, adding in the predictives and retrodictives accounts for another large portion of the messages. Further, only one force (question) was used by either SWIFT or AE and not used by UN-EDIFACT. Clearly, these standards did not segment the illocutionary force hierarchy.

7 Discussion

7.1 Implications

The results of this study paint an interesting picture. The message structure implicit in three separate electronic communication standards all map onto the $F(P)$ framework proposed by SAT. These standards were not defined with SAT in mind nor was SAT defined with electronic communication in mind. It is hard to think of a reason that the mapping should have been successful except for the possibility this framework (or something like it) is correct. These three standards were a convenient sample but there is no reason to think other standards would present a significantly different result. This is evidence in favor of SAT.

Not only is SAT supported but the researchers who have proposed that SAT be used as the basis for electronic communication systems are also supported (Aurämaki et al. [31], Kimbrough & Moore [32], Lehtinen & Lyytinen [33], Mora et al. [34], Winograd & Flores [35], Woo [36, 37]). This study does not indicate the ultimate correctness or utility of SAT. It does indicate that it is feasible to construct electronic messages within this SAT framework.

It is feasible and also preferable. Previous researchers have demonstrated the benefits of explicitly representing the illocutionary force in electronic messages (e.g., Kimbrough & Moore [32, 4], Medina-Mora et al. [34] Winograd & Flores [35], Woo

[36]). These benefits include better message handling, reusability of message handlers, better message retrieval, clearer message definitions, and the ability to automate more complex tasks.

Better message handling For example, consider the following simple example. Suppose the illocutionary force is added to a message's header. This gives programs receiving the message more information with which to determine how to handle it. It might have a rule defined to put aside anything but a requestive. Because the force is easily available for inferencing, the system can do more with the message than it could do without it.

Certainly, more can be done with the force than simply putting it in the header. Moore & Kimbrough have proposed [32], defined [5, 12], and demonstrated [4] a formal language for business communication (FLBC). This language allows fully formal messages to be composed and interpreted with few limits on the contents of the messages.[2]

```
Am I familiar with the organization asking this
 question?
If yes, then:
  Do I know what they're asking?
  If yes, then
    Are there any restrictions on this
     information?
    If yes, then:
      Does this company pass these restrictions?
      If yes, then:
        Process this request.
      Otherwise:
        Tell them the answer is not available.
    Otherwise:
      Process this request.
  Otherwise:
      Tell them I do not understand the question.
Otherwise:
  Tell them to describe themselves more fully.
```

Figure 6: Outline of a possible message handler for a requestive

Reusability of message handlers A message handler is a piece of a computer program that handles a certain type of message. With an EDI system based on an illocutionary force framework, the basic set of message handlers would include one for each force. The requestive handler might have a logical form similar to that in Figure 6. (This is given only to illustrate what I mean by a message handler. It is not meant to indicate how it should actually be constructed. That is for another paper.) Defining one handler for *all* requestives (or assertives, etc.) is possible because the distinguishing characteristic of a requestive (or assertive, etc.) is how it is understood. Writing some code that will handle (i.e., understand) *all* requests having to do with a business sounds like an impossible task but is not. Separating the illocutionary force from the perlocutionary effect makes it possible. I propose that the speaker's communicative intention (i.e., illocutionary point) can be understood for all requestives using the same, relatively small, section of code but most messages will need additional code to handle differing perlocutionary effects.

What does this all mean? Suppose that a company's EDI system knows about 20 business objects (e.g., purchase orders). Further, it must handle requests (about the status of each, about when they were processed, etc.) and be able to accept new descriptives and informatives about each. With current methods this would require *at least* sixty separate message sets, field definitions, and handlers. Under my proposal this company would write three message handlers. If any further processing were necessary for any particular requestive (or descriptive, etc.) to handle the perlocutionary effect of the message, then up to sixty pieces of code would have to be written, though it is my experience in developing prototypes that this number will be much smaller. However, even if there are sixty pieces of code that have to be written, they will be much simpler than required using current techniques because much of the processing is already included in the handler for its illocutionary force (e.g., Figure 6). In short, integrating SAT into an EDI system should significantly increase the reusability of message handlers, making deploy-

[2]The definition of this language can also be seen at my web site (mentioned in the `Notes` at the end of the paper).

ment of additional messages more cost effective.

Better message retrieval Explicitly representing the illocutionary force improves retrieval via the same mechanism that improves message handling. The retrieval system is given more information than it was previously. This allows the system to construct more precise queries than it could have without the information.

Clearer message definitions As discussed in §5, much of the difficulty of mapping arises because the messages are being mapped after they have been defined. An alternative is to use the hierarchy to guide the message definition process. More will be said on this below. In short, since the definitions would rely only on known building blocks (i.e., the illocutionary forces) instead of ambiguous natural language, they would *have* to be clearer than they are now.

Automate more complex tasks Since more types of messages could be automated more easily than is possible now, more tasks would be automated. The inferencing required for responding to these messages is also more complex than was previously needed (Kimbrough & Moore [38]). Thus, a greater number of more complex tasks could be automated than was possible without the force.

Thus, the benefits that would accrue to business would be many if the findings of this paper, or something like them, were true.

The larger point here related to EDI is how to define a message set so that its meaning is evident, unambiguous, and automatically inspectable.[3] Each of these attributes would simplify the creation of EDI systems while simultaneously making them more powerful (see below) and more wide-spread. Of course I propose that SAT is part of the solution—SAT imposes a discipline on the message definition process that provides several benefits and contributes to the above goals. First, since a message's meaning is partially defined by its force, a message from one message set should not be able to have one of several different illocutionary forces. Each message set should have only one illocutionary force and that force should be explicitly represented. If a message expressing another force were needed, then a new message set should be defined. This would make it easier to interpret and locate messages that have a specified force.

For example, in Figure 7(1) company **A** uses one version of UN-EDIFACT message SSREGW to advise company **B** that a social security number has been allocated to someone. Company **B** replies with another version of SSREGW that both informs company **A** that it understands the original message and that confirms the SSN that has been allocated. The illocutionary force of the first message is retrodictive while the second message carries both informative and confirmative forces. The logical structure of the conversation is shown in Figure 7(2). My point here is that if this is what actually occurs, then the message flow should reflect it. Why shouldn't company **B** be able to tell company **A** that it received the message without, at the same time, confirming the allocated number?

Second, applying SAT unambiguously acknowledges that EDI does not simply involve sending forms back and forth. These organizations are conversing within the context of some business process in which they hope to accomplish some work. Since this *is* the case, why not use a conversational structure that we know a bit about (i.e., natural language) to represent the expected conversational structure? Moore [21] outlined the basic steps for using Petri nets to represent conversational structure based on illocutionary forces and, more generally, SAT and other linguistic theories. Statecharts [39] could be used for the same purpose. Lee [40] used Petri nets to represent bureaucratic systems. These authors demonstrated that computer processable and inspectable representations can be used to represent conversational structure and business processes. Using these representations a company could define its standard business process for handling a purchase order. This could define, in a computer processable and inspectable language, the messages it expects to be sent during the completion of this task and the order in which it expects them to be sent. When the company gains a

[3] A related discussion appears in [5].

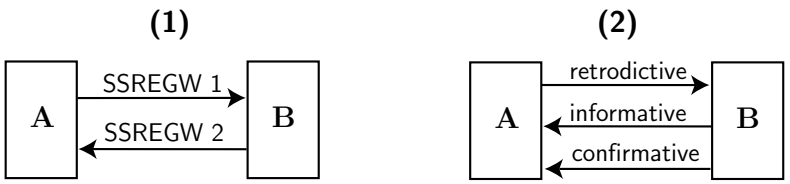

Figure 7: Changing the conversation structure

new business partner, it could send the relevant business processes to the partner so that the EDI systems of both companies would understand the processing necessary for a purchase order. A predicate logic representation of Figure 7(2) could easily be developed and included in the definition of SSREGW to show the expected conversational structure when a SSN is allocated.

Third, and related to the previous point, SAT requires that a message's intended meaning be separated from the eventual effect on its recipient. This clarifies what the message definition should and should not include. Since the message definition is analogous to something like Figure 7(2), and since the people defining the message know the intended effect of each illocutionary force (see Appendix A), they do not have to include in the definition of the message that, e.g., company **B** is expected to believe that the SSN was allocated by company **A**. The message recipient gains this expectation, and others like it, through inferences included in the handler for the illocutionary force.

Fourth, applying SAT and using the *F(P)* framework allows a natural representation of iterated illocutionary forces. Previous researchers have claimed that iterated forces occur naturally within messages (Kimbrough et al. [32, 41, 42]). This study found a significant example of iterated operators in the Apple Events messages. If this were a general finding, then it would be a compelling reason to use a formal language for communication that could explicitly (and naturally) represent this information.

In short, the definition of message sets will change under this message processing regime. Messages are already defined by the set of illocutionary forces. Conversational structures that define the expected course of events for accomplishing certain goals would be defined. This "expected course of events" (i.e., the conversational structure) would include the expected order of messages and their illocutionary forces (as in Figure 7(2)). The task of standards bodies would change to defining both these conversational structures and the vocabulary that is needed to carry them out. The result should be that 1) it is easier to express new types of messages (something that currently involves creating a new message set), and 2) more types of messages *can* be expressed in an automated EDI message and not have to be handled manually or in a free-text EDI message. Both should allow more to be said electronically so that EDI could become a part of more processes.

Certainly, the marginal cost of handling an electronic message is smaller than that for handling a telephone call or reading a free text EDI message. The technology proposed here results in both automation of more types of electronic messages and reduction in development costs. This should have two results. First, a firm should see more competition for its electronic business (e.g., both in electronic markets and suppliers or customers that use EDI). Second, since the amount of customer-specific technology has also been reduced, switching costs should be reduced. Thus, economic relationships will be more fluid and extensive. This is is broad agreement with Kimbrough & Moore's argument for more powerful systems for electronic commerce [32].

All the above benefits can only be realized if *there is a common set of illocutionary forces across all messages that is infrequently extended.* If no common set exists, then for every set of messages new message

handling and retrieving mechanisms would have to be constructed. Further, automation of tasks would be much more difficult because new inferencing mechanisms for understanding messages would have to be built for each new message type. This brings us back to today's technologies (EDI et al.). This investigation provides some evidence that there is such a common set.

Even if there were a common set of illocutionary forces, if we could not map messages onto these forces reliably or consistently, then we would not be able to represent the illocutionary force in the message. This would have the same unfortunate effects as described just above. To summarize the above points: If messages could be mapped onto the *F(P)* framework, and if this framework were correct, then many benefits could be realized. The purpose of this investigation is to indicate the first supposition is correct and provide a bit of evidence for the second. It is left to other papers (as referenced above) to explore the benefits.

7.2 Future research

Though this study indicates answers to some questions, many more questions remain about the *utility* of applying SAT to electronic communication systems. Clearly, the *F(P)* framework may help a system understand a message but is neither necessary nor sufficient for doing so. There are not just 26 (or any finite X) number of messages. A request to paint the house is different from a request to buy two hundred gallons of paint. Both would be represented as requestives in the *F(P)* framework. A message's content and context—i.e., that information contained in the P—must be represented to allow systems to process the message. Defining a general system for representing this information would contribute to the utility of a SAT-based message system.

Another research area concerns the typology of inquiries. The Bach & Harnish categorization forces all inquiries into two illocutionary forces: requestives and questions. Questions require a yes or no response. Requestives are all other types of inquiries. As was shown in Table 6, systems can request to inform, retract, permit, or describe. The Bach & Harnish hierarchy draws no distinction between these types of requestives but does separate a yes-or-no question from the requestive. This seems to be somewhat arbitrary. Researchers need to determine what types of questions they want to ask. Great disagreement in the philosophy literature exists as to what types of questions can be asked (e.g., Harrah [43]). Researchers should then determine if an addition to the hierarchy is needed to handle these new types or if it is correct and useful the way it stands.

In addition to this simple question about the Bach & Harnish hierarchy, there is the question of whether or not there is a better hierarchy. One good place to start investigating this question is to map these message standards (and others) to this hierarchy and alternatives. This process can reveal whether the mapping can be done and can also reveal weaknesses or strengths of each hierarchy (as we saw in this study).

A more fundamental question is whether or not SAT is correct. It may be the case that people do not communicate in the manner described by speech act theorists. This line of research will not prove that SAT is correct but it could provide some support for the contention that it is correct or incorrect. If a robust, expressive, and powerful communication system can be built based on SAT, then supporters of SAT would have strong evidence that it is correct. On the other hand, if no such system can be built, then supporters of SAT would have to explain the failure. Currently, however, SAT represents the best work of linguists and philosophers of language describing how people communicate. The study described here represents one effort that takes this finding seriously. Much effort remains before we are finished.

Finally, it is difficult to define what it means to say "SAT is correct" or that "this hierarchy is correct." One possibility is that it means there are no alternative ways to think about language that provide more insight than this way. If that is how the statements should be interpreted, then I think that, ultimately, it might better serve the IS researcher and practitioner to substitute the word *useful* for *correct* in the above two statements. It is the *utility* of SAT and a corresponding hierarchy that we are interested in. Certainly, researchers should pursue answers to

the two questions as phrased above. Happily, answering the two "utility" questions should provide insight into the two "correct" questions. Certainly, relevant research questions concern defining a SAT hierarchy and determining how businesses might become more efficient and effective by using a messaging system based on it.

Notes

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(File: `cat-edi.tex`; a previous version of this paper appeared in the *Proceedings of HICSS-29*.)

A Formal definitions of illocutionary forces

The following are definitions of the illocutionary forces classified as *constatives*, *directives*, or *commissives* on pages 42–55 of [9].

advisory (admonish, advise, caution, counsel, propose, recommend, suggest, urge, warn) In uttering e, S advises H to A if S expresses:

1. the belief that there is (sufficient) reason for H to A, and
2. the intention that H take S's belief as (sufficient) reason for him to A.

ascriptive (ascribe, attribute, predicate) In uttering e, S ascribes F to o if S expresses:

1. the belief that F applies to o, and
2. the intention that H believe that F applies to o.

assentive (accept, agree, assent, concur) In uttering e, S assents to the claim that P if S expresses:

1. the belief that P, as claimed by H (or as otherwise under discussion), and
2. the intention (perhaps already fulfilled) that H believe that P.

assertive (affirm, allege, assert, aver, avow, claim, declare, deny (assert... not), indicate, maintain, propound, say, state, submit) In uttering e, S asserts that C if S expresses:

1. the belief that C, and
2. the intention that H believe that C.

concessive (acknowledge, admit, agree, allow, assent, concede, concur, confess, grant, own) In uttering e, S concedes that P if S expresses:

1. the belief that P, contrary to what he would like to believe or contrary to what he previously believed or avowed, and
2. the intention that H believe that P.

confirmative (appraise, assess, bear witness, certify, conclude, confirm, corroborate, diagnose, find, judge, substantiate, testify, validate, verify, vouch for) In uttering e, S confirms (the claim) that C if S expresses:

1. the belief that C, based on some truth-seeking procedure, and
2. the intention that H believe that C because S has some support for P.

descriptive (appraise, assess, call, categorize, characterize, classify, date, describe, diagnose, evaluate, grade, identify, portray, rank) In uttering e, S describes o as F if S expresses:

1. the belief that o is F, and
2. the intention that H believe that o is F.

disputative (demur, dispute, object, protest, question) In uttering e, S disputes the claim that P if S expresses:

1. the belief that there is reason not to believe that P, contrary to what was claimed by H (or was otherwise under discussion), and

2. the intention that H believe that there is reason not to believe that P.

dissentive (differ, disagree, dissent, reject) In uttering e, S dissents from the claim that P if S expresses:

1. the disbelief that P, contrary to what was claimed by H (or was otherwise under discussion), and

2. the intention that H disbelieve that P.

informative (advise, announce, apprise, disclose, inform, insist, notify, point out, report, reveal, tell, testify) In uttering e, S informs H that C if S expresses:

1. the belief that C, and

2. the intention that H form the belief that C.

offer (offer, propose; also volunteer, bid) In uttering e, S offers A to H if S expresses:

1. the belief that S's utterance obligates him to A on condition that H indicates he wants S to A,

2. the intention to A on condition that H indicates he wants S to A, and

3. the intention that H believe that S's utterance obligates S to A and that S intends to A, on condition that H indicates he wants S to A.

permissive (agree to, allow, authorize, bless, consent to, dismiss, excuse, exempt, forgive, grant, license, pardon, release, sanction) In uttering e, S permits H to A if S expresses:

1. the belief that his utterance, in virtue of his authority over H, entitles H to A, and

2. the intention that H believe that S's utterance entitles him to A.

predictive (forecast, predict, prophesy) In uttering e, S predicts that C if S expresses:

1. the belief that it will be the case that C, and

2. the intention that H believe that it will be the case that C.

prohibitive (enjoin, forbid, prohibit, proscribe, restrict) In uttering e, S prohibits H from A-ing if S expresses:

1. the belief that his utterance, in virtue of his authority over H, constitutes sufficient reason for H not to A, and

2. the intention that because of S's utterance H not do A.

promise (promise, swear, vow; also contract, bet, swear that, guarantee that, guarantee x, surrender, invite) In uttering e, S promises H to A if S expresses:

1. the belief that his utterance obligates him to A,

2. the intention to A, and

3. the intention that H believe that S's utterance obligates S to A and that S intends to A.

question (ask, inquire, interrogate, query, question, quiz) In uttering e, S questions H as to whether or not C if S expresses:

1. the desire that H tell S whether or not P, and

2. the intention that H tell S whether or not C because of S's desire.

requestive (ask, beg, beseech, implore, insist, invite, petition, plead, pray, request, solicit, summon, supplicate, tell, urge) In uttering e, S requests H to A if S expresses:

1. the desire that H do A, and

2. the intention that H do A because (at least partly) of S's desire.

requirement (bid, charge, command, demand, dictate, direct, enjoin, instruct, order, prescribe, require) In uttering e, S requires H to A if S expresses:

1. the belief that his utterance, in virtue of his authority over H, constitutes sufficient reason for H to A.

2. the intention that H do A because of S's utterance.

retractive (abjure, correct, deny, disavow, disclaim, disown, recant, renounce, repudiate, retract, take back, withdraw) In uttering e, S retracts the claim that C if S expresses:

1. that he no longer believes that C, contrary to what he previously indicated he believed, and

2. the intention that H not believe that C.

retrodictive (recount, report) In uttering e, S retrodicts that P if S expresses:

1. the belief that it was the case that P, and

2. the intention that H believe that it was the case that P.

suggestive (conjecture, guess, hypothesize, speculate, suggest) In uttering e, S suggests that P if S expresses:

1. the belief that there is reason, but not sufficient reason, to believe that P, and

2. the intention that H believe that there is reason, but not sufficient reason, to believe that P.

suppositive (assume, hypothesize, postulate, stipulate, suppose, theorize) In uttering e, S supposes that P if S expresses:

1. the belief that it is worth considering the consequences of P, and

2. the intention that H believe that it is worth considering the consequences of P.

B Classification of messages

Table 7: Classification of UN-EDIFACT and SWIFT messages

Illoc. Force	Message ID	Verb phrase
		UN-EDIFACT messages
confirmative	CODECO	confirm that containers have been delivered
confirmative	CODECO	confirm that containers have been picked up
confirmative	CONWQD	justify to receiver information already given
confirmative	COSTCO	confirm that goods have been stuffed into (or stripped from) containers
confirmative	JOBCON	confirm receipt of information about jobs
confirmative	ORDRSP	confirm acceptance
confirmative	SSREGW	confirm a registration number
descriptive	BANSTA	provide status information
descriptive	BAPLIE	transmit information about equipment on a means of transport
descriptive	BAPLTE	transmit information about the total numbers of equipment on a means of transport
descriptive	BOPBNK	report a bank's assets and liabilities position
descriptive	COMDIS	provide details about an existing dispute
descriptive	CONDRO	describe general project organization
descriptive	CONRPW	give details of networks where construction work will be undertaken
descriptive	CUSRES	report errors in data
descriptive	DESADV	inform the recipient about goods in a consignment
descriptive	DOCADV	indicate terms and conditions of a documentary credit
descriptive	DOCAMA	inform the beneficiary of the terms and conditions of an amendment to a documentary credit
descriptive	DOCAMI	indicate terms and conditions of an amended documentary credit
descriptive	DOCINF	indicate terms and conditions of an issued documentary credit
descriptive	FINSTA	provide a statement of booked items in an account
descriptive	IFTIAG	convey information relating to one conveyance of a means of transport on the dangerous goods carried on board
descriptive	IFTMAN	give details of the arrival of a consignment
descriptive	IFTSTA	report transport status
descriptive	INVRPT	specify information relating to held inventories
descriptive	JAPRES	provide detailed information of the employment of an applicant
descriptive	JAPRES	provide detailed information of the rejection of the applicant by the employer
descriptive	JAPRES	provide detailed information of the rejection of the offered job by the applicant
descriptive	JOBMOD	modify information about a previously offered job
descriptive	JOBOFF	specify details for job vacancies at an employer to an agency
descriptive	MEDPID	pass detailed information on persons between organizations
descriptive	ORDERS	specify details for goods ordered under conditions agreed upon
descriptive	PARTIN	transmit basic information regarding trading partners
descriptive	PAXLST	transmit passenger data
descriptive	PAYEXT	provide details
descriptive	PRICAT	transmit information regarding catalog details for goods offered for sale
descriptive	BOPDIR	report foreign assets
descriptive	SAFHAZ	communicate data on materials supplied

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Illoc. Force	Message ID	Verb phrase
descriptive	SANCRT	provide details about the means of conveyance of a product
descriptive	SSIMOD	communicate details related to worker identity
descriptive	STATAC	provide information about status of an account
descriptive	SUPMAN	specify membership information
descriptive	TANSTA	transmit current status about non-cargo deadweight items
descriptive	WKGRDC	specify details of a decision
descriptive	WKGRRE	detail information about a person
disputative	RECADV	report discrepancies about physical receipt of goods
effective: accept	DOCARE	advise the acceptance of an amendment
effective: accept	IFTMBC	accept the booking of a consignment
effective: accept	JAPRES	specify decisions of an employer related to job applications
effective: accept	JAPRES	specifies acceptance of an employer related to job applications
effective: accept	RECECO	accept request for credit protection
effective: accept	WKGRDC	inform of the acceptance of a work grant request
effective: agree	COMDIS	notify the receiver that the sender agrees to the settlement
effective: apply	RECECO	apply for credit protection
effective: cancel	RECECO	cancel credit protection
effective: claim	INVOIC	claim payment for goods or services supplied under conditions agreed upon
effective: declare	CUSDEC, CUSEXP	declare information about goods for import, export, or transit
effective: non-accept	DOCARE	advise the non-acceptance of an amendment
effective: non-accept	ORDRSP	notify of non-acceptance
effective: reject	IFTMBC	reject the booking of a consignment
effective: reject	JAPRES	specify decisions of an employer related to job applications
effective: reject	JAPRES	specifies rejection of an employer related to job applications
effective: reject	RECECO	reject request for credit protection
effective: reject	WKGRDC	inform of the rejection of a work grant request
informative	CONITT, CONTEN	communicate project design changes

continued on next page

Illoc. Force	Message ID	Verb phrase
informative	CUSREP, CUSEXP	report on the means of transport on which cargo is carried
informative	APERAK	inform that a message has been rejected due to errors
informative	APERAK	acknowledge a message
informative	BANSTA	report on errors in a message
informative	BOPDIR	report responses to a questionnaire
informative	COEDOR	report containers that are in stock
informative	CONDRA	give information about engineering computer files
informative	CONPVA	advise receiver about the value of work already performed
informative	CUSRES	report errors in data
informative	IFCSUM	provide a statement for a means of transport for cargo
informative	IFTCCA	provide the calculation of transport charges
informative	IFTDGN	declare that goods are dangerous goods
informative	IFTFCC	specify freight, handling, and transport costs
informative	IFTMAN	give notice of the arrival of a consignment
informative	IFTRIN	provide transport rate information
informative	INSPRE	notify the recipient about premiums due from a client
informative	ORDRSP	acknowledge understanding of data
informative	QALITY	transmit results of tests
informative	RESETT	send information necessary for reinsurance settlement
informative	RETACC	report a position with respect to one reinsurance contract
informative	SSREGW	communicate social security numbers
informative	WKGRRE	modify an existing work grant request
offer	CONTEN	submit a tender (a commercial offer to execute the project work)
offer	IFTMBC	define the terms under which requested services would take place
offer	JOBAPP	propose applicants for a job
offer	ORDRSP	propose an amendment
offer	QUOTES	provide information for potential sales of goods
permissive	AUTHOR	authorize a bank to execute a transaction
permissive	COREOR	give permission for containers to be picked up
permissive	DELFOR	authorize commitment of resources
predictive	CREADV, CREEXT, CREMUL	inform account owner that its account will be credited
predictive	CREADV, CREEXT, CREMUL	provide the payee details of a transaction that will occur
predictive	CUSCAR, CUSEXP	report that consignments will be arriving
predictive	DEBADV, DEBMUL	inform account owner that its account will be debited
predictive	DELFOR, DELJIT	specify short-term delivery schedules requested by a buyer
predictive	CALINF	provide information about planned arrival of a vessel
predictive	CODENO	notify for which cargo that customs documents will expire at short notice
predictive	COMDIS	notify the receiver that certain actions will be taken

continued on next page

Illoc. Force	Message ID	Verb phrase
predictive	CONAPW	advise authorities of sender's intention to start work
predictive	COPARN	announce the impending arrival of containers
predictive	COPINO	notify the receiver of the delivery or pick-up of containers
predictive	COPINO	indicate a location at which the means of transport is to arrive
predictive	DELFOR	provide details about a product's future production schedule
predictive	DESADV	advise the recipient as to when goods will be dispatched
predictive	IFTSAI	provide transport schedule
predictive	PRPAID	notify about premiums that will be collected
predictive	SLSFCT	forecast data related to products or services
predictive	TANSTA	transmit forecast status about non-cargo deadweight items
promise	CONRPW	giving legally binding information about existing services or networks
promise	IFTMCS	provide actual details of the service to be provided
promise	PRODEX	provide information about movement of products that will occur
promise	REMADV	provides detailed accounting relative to a payment to be made
promise: contract	IFTMBF, IFTMIN	book forwarding services for a consignment
promise: contract	CONEST	amend the original contractual documentation with changes approved by both parties
promise: contract	IFTMIN	provide final details of services to be provided, resulting in a contract
requestive	RESMSG, SUPRES	request services
requestive	AUTHOR	request authorization to execute a transaction
requestive	CONAPW	request receiver to send information
requestive	CONITT	issue an invitation to tender to contractors
requestive	CUSRES	request a declaration about goods
requestive	DOCAMR	request a bank to amend terms and conditions
requestive	DOCAPP	request issuance of a documentary credit
requestive	FINCAN	request cancellation of a financial message or transaction
requestive	IFTCCA	request the calculation of transport charges
requestive	IFTMBP	request forwarding services for a consignment
requestive	IFTRIN	request transport rate information
requestive	IFTSAI	request transport schedule
requestive	IFTSTQ	request an international multimodal status report
requestive	JINFDE	request additional information about a person and/or a job
requestive	ORDCHG	request to change a purchase order
requestive	RECLAM	request settlement concerning a loss
requestive	REQDOC	request sending of data
requestive	REQOTE	solicit price
requestive	SSREGW	request details about a worker's social security insurance record
requestive	TANSTA	advise of a desired arrival condition
requestive	WKGRRE	request a work grant or permit
requirement	PAYEXT, PAYMUL, PAYORD	instruct to debit

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Illoc. Force	Message ID	Verb phrase
requirement	PAYEXT, PAYMUL, PAYORD	arrange for payment
requirement	COHAOR	order that receiver perform special handling on containers
requirement	CONDPV	instruct receiver to pay subcontractors
requirement	COPARN	order to release containers
requirement	COPRAR	order that containers have to be discharged from or loaded into a seagoing vessel
requirement	COREOR	order to release containers
requirement	COSTOR	order that goods should be stuffed into (or stripped from) containers
requirement	DIRDEB	instruct a bank to claim some amount from another bank
requirement	HANMOV	identify handling services to be performed by a distribution center to move goods from seller to buyer
requirement	MOVINS	instruct regarding the loading and discharging of cargo
retrodictive	BOPBNK, BOPCUS, BOPDIR	report transactions
retrodictive	CREADV, CREEXT, CREMUL	inform account owner that its account has been credited
retrodictive	CREADV, CREEXT, CREMUL	provide the payee details of a transaction that has occurred
retrodictive	CUSCAR, CUSEXP	report consignments that have arrived
retrodictive	DEBADV, DEBMUL	inform account owner that its account has been debited
retrodictive	APERAK	inform that a message has been received
retrodictive	BOPINF	report receipt of payment in settlement of a transaction
retrodictive	COARRI	report that containers have been discharged
retrodictive	COARRI	report that containers have been loaded
retrodictive	CODENO	notify for which cargo regulatory customs clearance has taken place
retrodictive	COMDIS	notify the seller that something was found wrong with goods delivered
retrodictive	CONQVA	submit progress details to a client
retrodictive	CUSRES	notify of release or clearance of a shipment
retrodictive	CUSRES	declare that a previous message has been accepted
retrodictive	CUSRES	declare that a previous message has been rejected
retrodictive	DESADV	advise the recipient as to when goods were dispatched
retrodictive	ORDRSP	acknowledge receipt of a purchase order
retrodictive	SSREGW	acknowledge receipt of a notification of registration of a worker
retrodictive	PAYDUC	detail payments made
retrodictive	PRPAID	notify about premiums that have been collected
retrodictive	RECADV	report physical receipt of goods
retrodictive	RECLAM	send information concerning a loss
retrodictive	SLSRPT	transmit sales data
retrodictive	SSRECH	gives details of a worker's social security insurance history

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Illoc. Force	Message ID	Verb phrase
retrodictive	SSREGW	advise that a national has registered
retrodictive	SSREGW	advise of a SSN allocated to a national
retrodictive	SUPCOT	detail payments made
retrodictive	VESDEP	inform of the closing of a file
retrodictive	VESDEP	give information on actual operations
verdictive: attest	SANCRT	attest to the status of a product
		SWIFT messages
confirmative	512	confirm the details of a securities trade and its settlement
confirmative	516	confirm the details of a securities loan
confirmative	516	confirm the details of a partial recall or return of securities out on loan
confirmative	526	confirm that securities are being held
confirmative	530	confirm the receipt of securities
confirmative	531	confirm the receipt of securities
confirmative	532	confirm the delivery of securities
confirmative	533	confirm the delivery of securities
confirmative	563	confirm the completion of a corporate action undertaken by the Sender on behalf of the Reciever
confirmative	563	confirm the final execution advising the Receiver of the status of a corporate action transaction
descriptive	510	provide a detailed accounting of securities purchased by the sender
descriptive	531	include the itemised accounting details of the receipt of specified securities
descriptive	533	include the itemised accounting details of the delivery of specified securities
descriptive	550	provide details of a formal notice of rights to a current or future debt subscription
descriptive	552	describe an offer by a third party in respect of a specified security
descriptive	571	list the quantity and identification of securities held by the sender for the receiver on a particular date
descriptive	573	provide details of transactions received but not yet effected
descriptive	583	provide details on one transaction or event
informative	526	list securities available for lending
informative	526	list securities no longer available for lending
informative	526	notify the return of securities borrowed
informative	534	advise the Receiver of a problem
informative	539	inform that the receiver appears not to have been credited so far
informative	539	inform that the Beneficiary is unable to identify the transaction
informative	539	inform that the account the sender indicated is not held by the receiver
informative	539	inform that the account the sender indicated is held with us under another title
informative	560	specify particular matters of the meetings
informative	562	acknowledge the receipt of a corporate action instruction
informative	572	inform that the securities listed have been loaned out
informative	573	inform that securities are not deliverable as they are pledged as collateral
informative	574	identifies orders to buy or to sell which have been accepted but which have not yet been executed
informative	577	provide certificate numbers of securities

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Illoc. Force	Message ID	Verb phrase
informative	579	replace or supplement the "certificate numbers" field in another message
informative	580	report information on the receipt of securities including the cancellation of such a transaction
informative	581	notify of a change in the amount of collateral held
predictive	554	advise the receiver of an event related to cash income that will take place
predictive	555	advise the receiver of an event related to income in the form of additional securities that will take place
predictive	556	provide notice of a forthcoming redemption
predictive	582	advise that funds will be remitted by the sender
requestive	526	request the potential Lender to hold securities
requestive	526	request the borrowing of securities
requestive	526	request the potential Borrower to confirm a securities loan
requestive	539	request to please send the particulars of a transaction
requestive	539	request to investigate a discrepancy and instruct the sender accordingly
requestive	539	request to authorize the sender to debit the recipient's account
requestive	559	specifies any questions concerning the claim for payment or reimbursement
requestive	560	request the receiver to inform its bond customers about a meeting
requestive	560	invite shareholders to give proxies
requestive	570	request for a statement concerning securities
requirement	500	instruct the receiver to buy a specified quantity of the identified security
requirement	501	instruct the receiver to sell a specified quantity of the identified security
requirement	520	instruct the receiver to receive securities
requirement	521	instruct the receiver to receive securities
requirement	522	instruct the receiver to deliver securities
requirement	523	instruct the receiver to deliver securities
requirement	553	instruct the custodian as to any required action
requirement	559	claim reimbursement of income or redemption proceeds
requirement	559	claim for payment of the principal paying agent's fees and expenses
requirement	561	give voting instructions
requirement	573	instruction from your counterparty with settlement date later than statement date
requirement	580	instruct an International Clearing System to receive securities
requirement	581	claim an increase or decrease to the collateral amount
requirement	582	claim reimbursement of funds paid on behalf of the receiver
retrodictive	510	convey the payment details of the purchase that has occurred
retrodictive	519	report brief information about a securities deal that has been executed
retrodictive	526	notifies the return of securities previously out on loan
retrodictive	539	provide information of a receipt or delivery of securities
retrodictive	551	provide particulars of an event affecting a security, including an early notice of rights, a notice of money income or of income in the form of securities declared but not yet booked
retrodictive	554	advise the receiver of an event related to cash income that has taken place
retrodictive	555	advise the receiver of an event related to income in the form of additional securities that has taken place
retrodictive	556	advise of the money amount of the completed redemption

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Illoc. Force	Message ID	Verb phrase
retrodictive	557	provide advise of details and disposition of the proceeds following a presentation of coupons
retrodictive	562	advise a change in the status of an action previously instructed by or executed on behalf of the receiver
retrodictive	572	provide the details of all changes in holdings which occurred during a specified period
retrodictive	582	advise that funds have been remitted by the sender
retrodictive	583	advise a change in the status for good delivery
		Apple Event messages
question	DoObjects-Exist	ask if a set of objects exists
requestive	Open-Application	request to perform any tasks that your application would perform when a user launches the application
requestive	Open-Documents	request to open specified documents
requestive	Print-Documents	request to print specified documents
requestive	Quit-Application (required)	request to perform any tasks that your application would perform when a user chooses Quit from the File menu
requestive	Clone	request to create a clone of a set of objects
requestive	Close (core)	request to close a set of objects
requestive	Count-Elements	ask for the number of elements of a particular object class in each object in a set of objects
requestive	Create-Element	request to create a new element
requestive	Delete	request to delete one or more elements
requestive	GetClassInfo	request information about the properties and elements of an object class
requestive	GetData	request the data for a set of objects
requestive	GetDataSize	request the sizes, in bytes, of the data for a set of objects
requestive	GetEventInfo	request information about the Apple events in a suite
requestive	Move (core)	request to move a set of objects
requestive	Open	request to open a set of objects
requestive	Print	request to print a set of objects
requestive	Quit-Application (core)	request to perform any tasks that your application would perform when the user Chooses Quit from the File menu
requestive	Save	request to save a set of objects
requestive	SetData	request to set the data of a set of objects to a particular value
requestive	About	ask the Finder to display the About This Macintosh window
requestive	Close (Finder)	ask the Finder to close one of its windows
requestive	Drag	ask the Finder to move copies of one or more icons in the same folder to a new folder
requestive	Duplicate-Selection	ask the Finder to duplicate one or more icons in the same folder
requestive	EmptyTrash	ask the Finder to empty the Trash

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Illoc. Force	Message ID	Verb phrase
requestive	GetInfo-Selection	ask the Finder to display Info windows for one or more icons in the same folder
requestive	AliasSelection	ask the Finder to create aliases for one or more icons in the same folder
requestive	Move (Finder)	ask the Finder to move one or more icons to a new folder
requestive	SetPosition	ask the Finder to move one of its windows to a specified location
requestive	Open-Selection	ask the Finder to open one or more icons in the same folder
requestive	PageSetup	ask the Finder to display the Page Setup window for a specified Finder window
requestive	PrintSelection	ask the Finder to print the contents of one or more documents
requestive	PrintWindow	ask the Finder to print the contents of one of its windows
requestive	PutAway-Selection	ask the Finder to put one or more icons back into the folders from which they were last moved
requestive	Grow	ask the Finder to set the size of a Finder window
requestive	Restart	ask the Finder to terminate all open applications and restart the computer
requestive	Reveal	ask the Finder to display the window for the folder that contains specified icons
requestive	Reveal	ask the Finder to select specified icons
requestive	ChangeView	specify what view of a folder window's contents the Finder should display
requestive	GetPrivilege-Selection	ask the Finder to display Sharing windows for one or more icons in the same folder
requestive	Show-Clipboard	ask the Finder to display the Clipboard window
requestive	ShutDown	ask the Finder to terminate all open applications in preparation for turning off the power
requestive	Sleep	put a portable computer into its power-conserving state
requestive	Zoom	ask the Finder either to make a Finder window larger or smaller
requestive	Begin-Transaction	request to begin a transaction and return a transaction ID
requestive	Copy	request to copy the objects in the current user selection and put them on the Clipboard
requestive	Create-Publisher	request to create an Edition Manager publisher
requestive	Cut	request to remove the set of objects in the current user selection and put them on the Clipboard
requestive	DoScript	ask an application that understands a scripting language to perform the actions specified in a script
requestive	EditGraphic	request to let the user edit a graphic
requestive	ImageGraphic	request to convert a graphic from one format to another and/or to enhance it
requestive	IsUniform	request for information about a set of objects
requestive	MakeObjects-Visible	ask an application to bring a set of objects into view within one of the application's windows
requestive	Paste	request to make a copy of the objects on the Clipboard and either have them replace the current user selection or move them to the current insertion point
requestive	Redo	request to reverse the action of the undo operation that immediately preceded the Redo Apple event
requestive	Revert	request to replace a set of objects with the versions of the object that were most recently saved

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Illoc. Force	Message ID	Verb phrase
requestive	Undo	request to undo the result of the immediately preceding Apple event or user action
retrodictive	Application-Died	notify that an application launched by your application has terminated
retrodictive	End-Transaction	inform an application that an Apple event transaction is complete
retrodictive	Transaction-Terminated	inform an application that a transaction in progress has been terminated
		Apple Event reply messages
descriptive	GetClassInfo	inform about the properties and element classes of the object class
descriptive	GetDataSize	a list of descriptor records specifying the size, in bytes, of a specified object
descriptive	GetEventInfo	a list containing descriptor information about Apple events
informative	Count-Elements	specify the number of elements of the specified class in a particular object
informative	DoObjects-Exist	specify whether or not all of the objects exist
informative	Move	specify the object that has been moved
informative	Begin-Transaction	the transaction ID
informative	IsUniform	indicates whether all the objects in the set have the same value for the specified property
retrodictive	Clone	specify the object or objects that have been cloned

Apple Event reply messages (lists are too big to fit easily in above table):

descriptive OpenDocuments, PrintDocuments, QuitApplication (required), Clone, Close, CountElements, CreateElement, Delete, DoObjectsExist, GetClassInfo, GetData, GetDataSize, GetEventInfo, Move, Open, Print, QuitApplication (core), Save, SetData, BeginTransaction, Copy, CreatePublisher, Cut, DoScript, EditGraphic, EndTransaction, ImageGraphic, IsUniform, MakeObjectsVisible, Paste, Redo, Revert, TransactionTerminated, Undo — describe the error that occurred when the event was handled

informative OpenDocuments, PrintDocuments, QuitApplication (required), Clone, Close, CountElements, CreateElement, Delete, DoObjectsExist, GetClassInfo, GetData, GetDataSize, GetEventInfo, Move, Open, Print, QuitApplication (core), Save, SetData, BeginTransaction, Copy, CreatePublisher, Cut, DoScript, EditGraphic, EndTransaction, ImageGraphic, IsUniform, MakeObjectsVisible, Paste, Redo, Revert, TransactionTerminated, Undo — inform of the result code for the event

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