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INTRODUCTION TO HARD SCIENCE LINGUISTICS
ВВЕДЕНИЕ В ЕСТЕСТВЕННОНАУЧНУЮ ЛИНГВИСТИКУ

Ключевые слова: лингвистика как точная наука, ожидание, коммуникативное поведение, процедура ожидания, положение дел, связь, разговор, событие

Keywords: hard Science Linguistics, expectation, communicative behavior, expectation procedure, state of affairs, linkage, conversation, event

В статье автор рассматривает естественнонаучную лингвистику как объект изучения, ее термины и понятия, а также определяет свойства и задачи такой науки.

In the article the author considers the hard science linguistics as an object of study, its terms and concepts and also the properties and challenges of the science.

Preface

Victor Yngve was trained as a physicist. He changed his life's work to linguistics in the early 1950s. As his work progressed, he noticed a disturbing thread in linguistics. While his colleagues claimed that linguistics was a science, they did not act like other scientists that he knew. Their discussions and research were increasingly the examination of items unrelated to the real world. While other scientists of his acquaintance certainly were concerned with theory, their theories were based on what might be described as "hard reality".

Professor Yngve took the idea of *science* and his role as a scientist very seriously. By the mid-1980s, he began a long, often lonely, effort to determine what about so-called *linguistics-as-a-science* dissatisfied him and, more importantly, what he could do about it. Since the mid-1980s, Professor Yngve's work has been dominated by this effort. This paper will outline the results of his effort and attempt to explain the role and benefits of what has become known as *Hard Science Linguistics*.

What's in a name?

First, the name. Hard Science Linguistics or HSL is so called because Professor Yngve's goal was to place linguistics on a par with other "hard" sciences like physics and chemistry. He saw that turning linguistics into a science like the other acknowledged "hard sciences" would allow linguists to use the results of researches in other disciplines and vice versa in truly scientific ways. For instance, if linguistics operated using the same intellectual foundation as medical research or biology, it would be easier to incorporate findings about the brain and nervous system into

linguistic studies. It would be easier for linguists to talk to and cooperate with medical researchers or biologists if linguists acted in a truly scientific way.

Professor Yngve did not think that linguistics was a science for several reasons, the most important of which was his observation that most linguists studied purely theoretical matters unconnected to the real world despite what they claimed. We will see later that he referred to this as *domain confusion*. It is a misunderstanding often heard that HSL researchers and Professor Yngve reject any and all theories of linguistics, i.e., that HSL researchers are, in some way, anti-theory and that HSL rejects the entire idea of theory formation. Neither Professor Yngve nor any HSL researcher has any problem with the notion of *theory*. HSL researchers may, when their researches warrant it, construct theories to explain the phenomena that they have studied. Theories may need to be polished and improved from time to time. HSL researchers object to the study of purely theoretical linguistic objects as though they were real world objects. It is fine, as far as it goes, to use a theory to explain something which is being studied. The ultimate test of any theory is how well it describes the real world. HSL researchers have been admonished to study the real world insofar as it is linguistically relevant. This subtle distinction between what scientists do and what traditional linguists do will be developed later in this paper. The subtlety inherent in this distinction often catches even HSL researchers unaware; the distinction between the *physical domain*, i.e., the study of the real world *ala* the “hard sciences” versus the *logical domain*, i.e., the study of theoretical views of the world *ala* philosophical speculation is something that we always have to keep in mind.

Another misunderstanding that one sometimes hears is that HSL is just another school of linguistics. HSL is not simply another school of linguistics for several reasons. First, “schools” of linguistics, like generative transformational grammar or stratificational grammar, have well-developed dogmas which distinguish them from other schools and have a “head” or “founding father” whose words are often uncritically accepted as correct. HSL does not have any dogmas; “correctness”, i.e., whether the research presented to other scientists has verifiable merit or not, is a feature of research. In fact, one of the more difficult things that a newcomer to HSL must face is the lack of dogma. HSL is based upon the notion that linguistics can be a science and provides well-thought-out methods to meet that goal. HSL research is based on observation and experiment. HSL researchers can observe how people communicate with other people in a natural setting or create experimental situations with controlled variables. The results of that observation or experiment along with their analyses are returned by building models of the observed events. HSL provides a set of techniques and a basic set of concerns (an “attitude”, if you will) to its researchers. The subject of their research is up to the individual researchers. There is no HSL dogma which tells researchers what to observe or how to experiment. It is up to the researcher to decide what is linguistically relevant and, therefore, worth

observing. Other sciences have well-established research methods which HSL researchers can use when they design and conduct their own experiments. HSL researchers see their tasks in the same light as other scientists in other admittedly scientific disciplines. HSL is often difficult for newcomers. HSL is not difficult because it is complex; HSL is, at first, difficult because it is simple and leaves many questions that a new researcher has unanswered. HSL does not offer absolute truths unlike philosophical systems. HSL researchers are presumed to already have enough of a scientific background so that this material can be incorporated into their linguistic researches.

Second, unlike every school of linguistics, HSL has no theory of grammar. None. This has led some to question whether HSL is actually a form of linguistics, meaning that many linguists see linguistics as the study of grammar of some type. A central notion for HSL researchers is *people communicating with other people*. The last phrase is not just jargon for people talking or writing. We will see that “grammar” cannot be studied scientifically. The idea of *communicative behavior* is broader than just talking or writing, what many linguists think of as “using language”. It can be any form of behavior which people use to communicate with each other. For instance, many linguists from different schools have wasted much time and effort arguing over whether the sign language used by the deaf is actually a language. This is not an important issue for HSL researchers because sign language is obviously a form of behavior that people engage in when communicating with each other. As such, we can study people communicating with each other via sign language productively. HSL researchers do not talk about language. *Language*, for us, is a term overloaded with intellectual baggage. The minute you ask a question about how language works, you must answer with the question “According to whom?” This doesn’t happen in other scientific disciplines. For instance, gas in a cylinder operates the same way no matter who examines it. Yes, of course, there are theoretical debates about things still not well understood. That is not the question here. For traditional linguists, *language* is their stock and trade, like trees to an arborist or minerals to a geologist. If two geologists talked about coal, for instance, they would not talk about coal as being a different mineral for different schools of geology. Coal is coal, everywhere and for everyone. Not so with *language* or its attributes; these matters can differ sharply from school to school. If there is a dispute between two schools of linguistics, it is almost never resolved. In hard sciences, the dispute would be resolved by conducting one or more experiments. This does not happen very often in linguistics whose object of study is *language*. The reason is simple: *language* is a theoretical and not a real-world object. Experiments cannot be fruitfully conducted on theoretical objects. Let us take two lumps of coal. Many tests can be applied to them so that we can determine their various attributes and see that the two lumps are the same material. However, each of the lumps of coal is independent of the other and exists in its own physical space. If we placed the two lumps on the table and left the room, they would still be on the

table even though, by leaving the room, we could not see them. This is very different from “language”. Where is “language”? To borrow a simple and elegant example from my colleague Douglas Coleman, suppose Able and Baker were in a room with a coffee pot. Able goes to the pot to refill his cup, brings the pot to Baker and says “More?” Baker says “Thanks” and Able refills the cup. On another occasion, the exact same thing happens but when Able offers to refill Baker’s cup by saying “More?”, Baker holds his hand over the cup and says “Thanks”. Able does not refill the cup.

The words “More” and “Thanks” appear twice but have very different meanings. The lumps of coal appear only once each. Each has the same characteristics when tested. The words can be different because they are not physically real, unlike the coal. Physical reality does not change the way the words that we just read about change. “Language” is not physically real and, therefore, cannot be treated scientifically.

To many, these claims of ours are sheer heresy. We are, therefore, heretics; however you see it, the scientific basis of traditional linguistics remains a problem. HSL was meant to address this problem.

Read quickly, the last paragraph may lead the reader to think that HSL researchers are concerned with *communicative behavior*. This is not so. HSL researchers observe people. The difference is, again, subtle. HSL researchers are careful to observe the real world. As we understand it, “real world” means that part of reality which exists separate and apart from the observer. Therefore, we cannot observe *communicative behavior* only *people communicating with other people*. Eliminate the people and there is no behavior. “Behavior” does not exist separate and apart from people. This is one reason that we do not study “language”. No people, no language. We observe people. They exist.

Properly understood, HSL expands the subject matter of linguistics. HSL introduces new concerns, e.g., how “non-linguistic” items effect the ways in which people communicate with each other, and provides the means with handle these new concerns.

What we study

The notion of *people communicating with other people* comes from a central principle for HSL researchers, one which Professor Yngve has emphasized over and over. The proper study for HSL researchers is *people*. We study what people do when they communicate with each other. Another misunderstanding often heard is that traditional linguistics, i.e., every form of linguistics which is not HSL, also studies people. This is not so. Traditionally, linguistics is the study of *language* or, at best, *people using language*, as though *language* were some sort of tool, like a gardener using a hoe or a carpenter using a hammer. The desire and need to communicate with our fellow humans does not come about because we have a tool to use. It is an innate drive; it is part of being human. Furthermore, you can pick up a tool, e.g., a hammer and subject it to scientific tests. You can give the hammer to another person who can

also test it. You can compare results. You cannot go to a scientific goods store and buy a box of *language* so that you can test it in your lab. The difference here between a hammer and “language” is not that a hammer is tangible and “language” is not. We can test many intangible things. Very simply, we can ask what a hammer is made of. If we did, we would get a list of materials that unquestionably exist in the real world. Ask yourself what *language* is made of. Your answer might be “sentences”. What are “sentences” made of? Your answer might be “words”? And so on. Ask enough questions and you may get to “the bottom” but probably not before the linguist giving you answers starts sweating nervously. Different schools describe these “pieces” differently. A good example is the phoneme. Some schools define them in ways that contradict the descriptions of other schools. Disputes such as this cannot be resolved because there is no way to test a phoneme scientifically since it is a theoretical entity,. None of the items mentioned in any of the answers given by our imaginary answering linguist are testable scientifically. All are assumed to exist because those who taught us about linguistics assumed they existed as did their teachers and their teachers before them.

People can communicate with each other in any way that they deem satisfactory. Sometimes it seems that linguistics is the study of how people should talk, i.e., linguistics has on occasion become the study of style with a ranking of “real language”, slang, creoles, and the like, sometimes together with a snobbish association between the “value” of the speech and the “value” of the speakers. HSL researchers do not pretend to tell people how they should talk or write. HSL researchers do not concentrate on speech to the exclusion of all else because to do so limits our studies. By concentrating on just the aural or written forms of communicating, a researcher limits his or her ability to potentially explain what is observed. In my own work, this has become very obvious. I have spent considerable time studying the effects that *context*, what we call *the surroundings*, has on the way that people communicate with each other, see, e.g., Sypniewski (2004). This is something that traditional linguistics ignores yet it has an important effect on the way that people communicate with other people. We will go into this in more detail later but, for now, we can say that concentrating on *language* while ignoring context creates phantom problems, problems which do not really exist. Furthermore, for us, studying *language* or the *use of language* is an example of *domain confusion*. No one doubts that people communicate by using their voices. We recognize that people say things to each other. HSL emphasizes what people do when they communicate and why they do these things rather than how they say things, which is what traditional linguistics is all about.

Let us now look at some of the important details of HSL.

Some terms and notation

Before we go far in our survey, it is only proper to explain some of the terms and notation used in HSL discussions and models, many of which are unique to HSL.

It is also important to note that HSL does not use many of the terms used in traditional linguistics. You will not find references to signs, morphemes, grammar, word types, or other similar theoretical concerns in HSL discussions other than to distinguish the researchers' observations using HSL techniques from the concerns of traditional linguists.

Let's start with the notation. All of the notation can be entered from a standard computer keyboard. While there are some other pieces of notation which will be explained when they are first encountered later, we can say that there are two basic pairs of symbols, square brackets ([]) and pointy brackets (<>). We can distinguish between them this way. Square brackets represent systems. Pointy brackets represent properties, tasks, and those things which are not systems. Systems are the models of those aspects of reality which can have properties and which can do things. For example, a linkage is the model of people communicating with other people in some way. As a model, a linkage can have properties. A linkage is a system. The simplest form of linkage notation is a name surrounded by square brackets, like so: [model], where the word *model* can be replaced with any name you choose. Hopefully, it will be descriptive in some way.

By the way, HSL is not dependent on any language or script. HSL researches can be carried out just as effectively in Russian, Urdu or Latin, for that matter. One researcher might have to translate for another but that's all. The benefit of placing linguistics on a scientific footing is that one scientist does not have to explain the basis of "his" science to another.

We will discuss the modeling of people below, but for now we will say that a participant, i.e., a model of a person communicating with some other person, is also a system. Therefore, it is notated with square brackets: [Bob]. Let us say that it is linguistically important to know that Bob is tall. We say: [Bob]<height/tall>. The information in pointy brackets is a property of Bob. A system can have many properties: [Bob]<height/tall><hairType/wavy>... The names of the properties, their order, and, ultimately, their selection are up to the researcher. Unless there is some need elsewhere, the list of properties only needs to be completely expressed once toward the top of the linkage notation:

[conversation] = [Bob] + ...
[Bob]<height/tall><hairType/wavy>...
...

Example 1

followed by other notation as appropriate. There is no limit to the number of participants which a linkage may have or the number or type of properties that a system may have, at least in theory. There may be a practical limit based on how much work a researcher has the time and means to do. There is also no canonical way of setting up a linkage. As long as the model is clear and the notation is familiar, there

should be no concerns about “style”.

Please see the glossary at the end of this paper for quotations from Yngve 1996 describing various terms.

The linkage

As alluded to above, a *linkage* is what we call a linguistic model of an *assemblage* (see glossary below). A linkage has a name, if only for easy reference. There are no theoretical boundaries to a linkage. As a practical matter, we only model those items and activities which are in some way linguistically relevant and important to the model under construction. What *is linguistically relevant and important to the model under construction*? Only the researcher can answer this question for the specific linkage that he or she is building. The answer to this question may be and probably will be different for every linkage. This should alert the reader to the fact that a linkage is a model of some observation(s); it is not simply a model. We do not have a general model of people communicating with other people. We have models of specific observations.

A linkage describes the researcher’s understanding of his or her observations of some instance of people communicating with other people. For the purposes of this paper, let us call the substance of the observation or experiment an *event*. As mentioned above, an HSL researcher’s observation or experiment will generally include more than just speech. For example, take the simple event of someone answering a knock on the door. Let us call the person inside the house Bob and the person knocking on the door Mary. When Mary knocks on the door, Bob gets up from his easy chair and answers the door. When he opens it, he greets Mary, she greets him, and Bob invites Mary into his house. This is a simple situation which occurs every day.

We can call the linkage [knock on the door]. There are two participants: [Bob] and [Mary]. We can structure the [knocks on the door] linkage this way:

1. [knocks on the door] = [Bob] + [Mary] + [door]
2. [Bob]<sit in chair>
3. [Mary]<knock on door>
4. [Bob]<open door>
5. [Bob]<greet Mary>
6. [Mary]<greet Bob>
7. [Bob]<invite Mary>
8. [Mary]<enter Bob’s house>

Example 2

In example 2, the line numbers are merely for ease of reference and are not parts of the linkage. Line 1 sets up a linkage whose name is *knocks on the door*. What looks like an equation in line 1 is just a way of saying that the linkage has three constituent systems: [Bob], [Mary], and [door]. Two of those systems, [Bob] and

[Mary] are models of people. The third, [door], is a model of a thing or object thought to have some linguistic relevance. [door] was inserted here as an illustration of a prop rather than as something that is immediately important to the linkage in example 2. It might be mentioned in the elaboration of one or more of the tasks in lines 2-8.

In the above linkage, all the things in angle brackets (<>) are tasks. Somewhere in the linkage (not shown) might be a description of each task if necessary. For example, Bob's task <open door> might be described further as being composed of subtasks: <get up from chair>, <walk to door> and <turn knob>, assuming that these subtasks were at all linguistically relevant.. If we wish to specify these tasks, we might also wish to include the chair and possibly the door knob as props (models of "things"). If the researcher feels that it is not necessary to go into detail about some or all of the tasks, a further description is not necessary. While the list of tasks may look sequential, they may not be. For example, the two <greet> tasks may be simultaneous or nearly so. There is notation we can use to show this. Note, however, the [door] prop. We could also, if we wish, include a *channel* to represent the sound of the knock. Why would we do so? Bob might not have heard the knock at first. Mary may have only tapped on the door. After a brief delay (which we can also model), she may knock more forcefully. Bob might only respond to the more forceful knock. There might even be some discussion about this between Bob and Mary.

Let us examine this second possibility in more detail. Mary knocks on the door but not loudly. Bob does not hear the knock or thinks that the knock might be something else. Mary waits for a period of time and knocks again, this time more loudly. Bob responds by going to the door and opening it. When Mary enters the house, she says "I knocked twice. You probably didn't hear it the first time." Bob confirms this and may say, by way of explanation, that he was in another part of the house where hearing a knock on the door proved difficult.

Traditionally, a linguist would take the words that Bob said to Mary and *vice versa* as the sum total of the linguistic data to be analyzed. When you think about it, doing so means that the conversation between Bob and Mary might as well be random or, at the very least, generated by a computer. By expanding the scope of linguistic concerns to include items like the knock on the door, HSL can explain the conversation in a more fulfilling way. We use our experience of similar events to say that the volume of sound produced by the first knock led to the part of the conversation in which Bob felt compelled to explain why he did not respond to the first knock. That is why we can say that the knock, represented by a channel, might be linguistically relevant. Unless we take things like the sound and volume of the knock into consideration, we are left with "free-floating" words with no context.

HSL also permits us to have more than one linkage to represent an event. Some linkages can overlap others. Take another common example. Lisa goes down the hall to Jack's office for a discussion about some work related matter. For convenience, let's call this event E1. Then, while Lisa is still there, Jack's phone rings. It is his wife,

Carol, reminding him to pick up his daughter, Stephanie, after school. Let's call this event E2. How would we model this?

We notice that Jack is involved in both conversations while Lisa and Carol are involved in only one conversation each ([Lisa] in [E1]; [Carol] in [E2]) but not a conversation together. Since these events are temporally related, we may choose to model them as overlapping linkages with Jack being represented in each linkage. We could also model these as two separate linkages because, aside from the fact that [Jack] is involved in both, there is nothing in common between them. The choice is up to the researcher. Here are two simple linkages (no tasks are described here) for these two conversations:

[E1] = [Jack] + [Lisa] + ...

[E2] = [Jack] + [Carol] + [phone] + ...

Example 3

A variant, E3, here would be if Bob, who calls Jack while Lisa is in Jack's office about some other work related matter and during the conversation, learns about the discussion between Jack and Lisa and has some suggestions to make. Jack puts Bob on speaker phone so that Bob can participate in the conversation between Jack and Lisa. Initially, [Jack] and [Lisa] are participants (see glossary) in [E1] and [Jack] and [Bob] are participants in [E3]. However, when Jack puts Bob on speaker phone, [Bob] becomes a participant in [E1]. Modeling can get complex but the complexity is not due to theory; the complexity is due to the events modeled. In order to avoid the complexity, a researcher can set up just one linkage to include [Bob], [Lisa], and [Jack]. Part of the complexity in this event comes about during the observation because we do not know that Bob will join in the conversation between Jack and Lisa. Once the observation is completed, we are aware of Bob's participation. Past events are usually less complex to model than ongoing events.

Communicating Individuals, Participants and Role Parts

HSL sees human beings in different aspects: communicating individuals, role parts, and participants. At first, this distinction seems unfathomable but, with a closer examination, it makes quite a bit of sense.

Communicating individual is a term that refers to the person being observed. This is the real person doing what the real person does in the situation that the real person finds himself or herself, communicating with whomever the person wants to communicate with. *Role part* and *participant* are two aspects of the model of the *communicating individual*. The distinction between these two terms is best understood by using the metaphor of a play, say *Hamlet*. In the play, *Hamlet* is a role. Every time the play is performed, *Hamlet* does the same things. This a role, how the character Hamlet functions in the play. However, one actor who plays *Hamlet* may make his *Hamlet* very different than some other actor might. An actor who is tall, black and well-built with a bass voice (think Paul Robeson or James Earl Jones) could present his *Hamlet* very differently than a short, thin, white, rock-and-roll singer (think Mick

Jagger or Bob Dylan). A *role part* in a linkage is *Hamlet*; a *participant* is a collection of linguistically relevant characteristics that, say, Mick Jagger brings to the part. They are not the same thing and are both important.

Take a more common example. Bob walks into a restaurant and sits down. That person is a customer. A waitress named Fiona comes and takes his order. [*Customer*] and [*Waitress*] are role parts. [Customer] does not have a task to take a food order from [Waitress] nor does [Waitress] have the task of giving her order to [Customer]. [Bob] and [Fiona] (not Bob and Fiona) are *participants*, i. e., models of Bob's and Fiona's linguistically relevant behavior in a specific linkage.

Whenever we discuss something as a *part*, we refer to the functional aspect of whatever is being modeled. So, a *role part* is the functional aspect of a participant; a *prop part* is the functional aspect of a prop, etc.

Tasks

A *task* is the description of a behavior that has linguistic relevance in a particular linkage. A task has a name and often but not always a description in some detail of what occurs when the task occurs. In the [knocks on the door] linkage above, the tasks were all simple and obvious so I did not think that they required further explication. However, tasks are where a participant's communicative behavior is modeled so it is very important to describe everything which is linguistically relevant. It is beyond the scope of this paper to go into the specific ways that this might be done. The glossary has some of the notation that is used in the description of tasks. Please refer to the glossary and especially to the citations contained therein.

A task consists of an arbitrary (≥ 0) number of subtasks. There is no difference between a task and a subtask except that a subtask is part of a task. Otherwise, their notation is the same. Subtasks are included in tasks essentially to make task description more manageable.

Tasks are specific to a participant or role part. In the [knocks on the door] linkage above both [Bob] and [Mary] had a greeting task. We could have simply called both of them <greet>. In order to distinguish them more clearly, we can name them thusly: [Bob]<greet Mary> and [Mary]<greet Bob>. [knocks on the door] is a simple linkage with only two participants. If we were to model a more complex assemblage, say a party, we might wish to call the greeting task for each participant <greet> and, for each participant, describe how that participant would greet each of the others. Even though the tasks had the same name, they would be distinguishable because they are connected to the appropriate participant, e.g., [Bob]<greet> or [Louise]<greet>. We might also include another task which determined whom to greet. Tasks such as this are almost always composed of one or more setting procedures (see glossary) which is, essentially, a compound conditional statement that describes variants of a behavior. For instance, one might greet their boss differently than one would greet a long-time friend or colleague.

Tasks can take time into consideration. HSL's recognition of the importance of

time is one significant difference between HSL and traditional linguistics. The recognition of the importance of time anchors HSL in the real world. In short, we can model events in which the result of some communicative behavior does not occur immediately. In the variant of the [knocks on the door] linkage, [Bob] did not hear the first knock on the door. We can model Mary's comments to Bob when he does open the door differently depending on the amount of time it took for Bob to answer the door.

Properties

As previously mentioned, systems have properties. A property is some attribute of a system. We recognize that systems can have a vast number of properties and that it would very difficult if not impossible to list them all. It would also not be helpful. We list only those properties which have relevance in our model.

Properties can be very useful in explaining the flow of events. Properties have values. For example, a linkage may have [light switch]<up> or [light switch]<down> to model the state of a light switch or [Bob]<height/tall> if Bob is tall. The values of properties may change during the functioning of some task, e. g., we might want to say that Bob turns on a light when entering a room. [Bob] could have a task called <turn on the light> which may be modeled like this:

1. [light switch]<down>
2. [Bob]<turn on the light> → <flip the switch>
3. [light switch]<up>

Example 4

The arrow may be read as "then execute". Line 1 shows that the light switch is in the down position. Line 2 shows Bob's task of turning on the light which executes a subtask called <flip the switch>. When this is executed, the switch is in the up position as indicated by line 3. The property does not change; it has a different value. As mentioned, the values can be used in selection procedures and other tasks to control the flow of the action in the linkage.

Props

Props are systems which model objects. Traditional linguistics ignores props. Considering them as parts of a linkage is more than just window dressing on our part. The consideration of props may resolve otherwise difficult problems. Let us say that we wish to model a conversation between Larry, who goes to a store to buy a shirt and the sales clerk. We'll call the linkage [buy a shirt]. At one point, Larry must choose between three shirts. Each shirt is a different color. We will just describe parts of the linkage:

1. [buy a shirt] = [Larry] + [sales clerk] + [shirt1]<color/white> + [shirt2]<color/grey> + [shirt3]<color/yellow>
2. [Larry]<select shirt> → <say "I'll take the yellow one.">
3. [sales clerk]<ring up the shirt>

Example 5

Example 5 should be understood to have considerable material missing. In line 1, we include the three shirts from which Larry selects. We show them as having different colors. In line 2, Larry says that he will take the yellow shirt. Traditionally, the statement “I’ll take the yellow one.” would be considered to be ambiguous because “one” does not have a specific reference. Yet we speak this way all the time and are not confused by the so-called ambiguity. Ambiguity in situations like this only arises because the statement is taken out of context or, to put it in HSL terms, the surroundings and props are not considered to be important. Once they are included in our models, we note that there is no disambiguation because there never was any ambiguity to begin with.

The Surroundings

HSL refers to the physical or social environment in which people communicate with each other as the surroundings. The word *context* has several meanings in traditional linguistics. It could mean what we mean by *surroundings* or it could mean the arrangement of traditional linguistic elements in an utterance or discourse. The surroundings are not a separately modeled part of a linkage but rather a way of referring to the collective props, energy flows, etc. that are being modeled. A researching can consider that anything other than people are parts of the surroundings.

Expectations and orthoconcepts

There is considerable active research going on regarding expectations and orthoconcepts so the reader will be advised to take any comments made here as preliminary.

Expectations are properties of participants. They are somewhat unusual in that they initially have no value; they are, in some sense, latent. Expectations are just what they sound like. A participant expects something to occur or someone to say something in the foreseeable future. Expectations are, therefore, one way that HSL incorporates time into its models.

Expectations can modify the flow of communicative behavior. Let us modify example 2 a bit to include an expectation.

1. [knocks on the door] = [Bob] + [Larry] + [door]
2. [Bob]<expect Mary>
3. [Bob]<sit in chair>
4. [Larry]<knock on door>
5. [Bob]<open door>
6. [Bob]<see Larry>::[Bob]<-expect Mary>
7. [Bob]<greet Larry>
8. [Larry]<greet Bob>

Example 6

Line 2 in Example 6 contains an expectation. Bob expects Mary to knock at the door. Expectations need not but usually do contain the word “expect” in their name. At the point of line 2, the expectation has no value; it is neither fulfilled or thwarted.

In line 4, Larry knocks at the door but Bob is not aware of Larry's presence until line 6. Up to that point Bob's expectation has no value. However, once Bob sees Larry, the expectation is set to negative (<-expect Mary>; note the minus sign before the name). In line 7, Bob greets Larry but a fuller description of the task might include Bob's saying that he was surprised that Larry showed up because he, Bob, was expecting Mary. Indeed, for HSL researchers, it appears that "surprise" is closely related to failed expectations.

Expectations seem to be a natural part of the way that people communicate with each other. Like the example above, expectations change what people say and do, depending on whether the expectations succeed or fail. Traditional linguistics cannot include expectations in any analysis because traditionally, linguistics has no sense of time. Like all philosophical endeavors, linguistics has existed "out of time". HSL does not have such a limitation.

For a longer, more technical discussion of expectations please see Sypniewski 2012.

Orthoconcepts are our attempt at modeling "properties of a real observer that model a physical reality and require an observer in which to form" (Yngve 2006:268). Orthoconcepts do not depict the intricacies of neurological functioning. Orthoconcepts are our way of saying that someone has an idea about something and that that idea has some linguistic effects on how that person communicates with others. Orthoconcepts are related to an observer. A person not only engages in communicative behavior with another person but observes the real world as well. Orthoconcepts are properties of a person. "...we are modelling John's understanding of the communicative interaction in which he is taking part, but doing so in terms of the physical-domain systems involved, without creating entities by assumption. Thus, an orthoconcept is not a concept in a logical-domain sense. Rather, it attempts to explain a person's understanding in physicaldomain terms, rather than in the logical-domain terms of a concept." Coleman and Sypniewski 2010. Orthoconcepts can arise from "any property expected as the result of hearing or seeing, etc." Yngve (manuscript in progress).

Orthoconcepts and expectations are related often through expectation procedures. For a good example of expectation procedures, see Coleman and Sypniewski 2010. This paper carefully distinguishes between a physical reality and a person's understanding of the physical reality. Even if two people perceive the same reality, they may not understand it the same way. Their understanding may be based on their expectations. Their expectations may cause them to behave differently.

Domain confusion

Domain confusion is another significant notion that is unique to HSL. HSL recognizes that there are two domains: the logical domain and the physical domain. The physical domain is the study of the real world, i.e., the world independent of the observer, which is done in a scientific manner. The logical domain is the theoretical

world studied in a philosophical way. Studies in both domains produce different results. A physical domain study produces scientific results; a logical domain study produces philosophical results which cannot be considered scientifically.

Until the advent of HSL, all linguistic studies have been logical domain studies; applied linguistic studies suffer from domain confusion. The goal of HSL is the production of linguistic studies in the physical domain so that the results of those studies can be used along with the results of physical domain studies from other sciences.

Domain confusion arises when theoretical or philosophical matters are studied as though they were in the physical rather than the logical domain. For instance, word types are purely theoretical and, thus, are logical domain objects. Domain confusion arises if we study word types as though they were real properties of real objects (words) in the physical domain. It is worth noting that “logic and other philosophical disciplines have long noted a problem related to but not identical with domain confusion: reification. *Reification* or *hypostatization* treats a theoretical object as if were a real, concrete thing. By unconsciously reifying a theoretical object, researchers are led into making unsound arguments when they claim that manipulations that are only possible on real world objects are performable on a concept or that a concept developed to explain a portion of the real world has no relation to the concrete things which it was intended to describe. Domain confusion is not the same problem as reification. *Reification* refers to confusing a theoretical object with a real world object. Domain confusion is the problem of creating theories from discussions and analyses of theoretical (often reified) objects rather than creating theories based on observations and tests of real world objects and then treating the theory created from theoretical objects as though it were created from observations and tests of real world objects.” Sypniewski 2006

For a further and more complete discussion of domain confusion, see Sypniewski 2006.

Note: I would like to acknowledge the invaluable assistance of Douglas Coleman from the University of Toledo, OH, in reviewing and commenting on this paper.

A Selected Glossary of Terms and Notation

Term	Description	Notation
Assemblage	“...we will use the more specific term <i>assemblage</i> to mean ‘group of people together with their linguistically relevant surroundings involved in particular communicative behavior’” Yngve 1996:86	none
Surroundings	“...all the other real-world objects [excluding people] including energy flows that are involved in the communicative behavior” Yngve 1996:86	none

Linkage	“A <i>linkage</i> is a representation in linguistic theory of an assemblage that includes just those properties that are required to account for the communicative behavior associated with the assemblage. Yngve 1996:126	[<i>name</i>]
Communicating individual	“A <i>communicating individual</i> is a representation in linguistic theory of a person that includes just those properties that are required to account for that person’s communicative behavior.” Yngve 1996:124	none
Participant	“A <i>participant</i> is a representation in linguistic theory of a person that includes just those properties that are required to account for that person’s communicative behavior in a particular assemblage. ” Yngve 1996:125 (emphasis added)	[<i>name</i>]
Channel	“A <i>channel</i> is a representation in linguistic theory of the physical means of energy flow and the energy flow itself in an assemblage that includes just those properties that are required to account for the communicatively relevant energy flow in the assemblage.” Yngve 1996:128	< <i>name</i> >
Prop	“A <i>prop</i> is a representation in linguistic theory of a real object, instrument, or device in an assemblage that includes just those properties that are required to account for its communicative relevance in the assemblage.” Yngve 1996:129	< <i>name</i> >
Setting	“A <i>setting</i> is a representation in linguistic theory of Other parts of the physical surroundings of a group in an assemblage that includes just those properties that are required to account for their communicative relevance in the assemblage.” Yngve 1996:129	none
Individual linguistic property	“In science, properties, strictly speaking, are constructs in a theory of the real object. So the linguistic properties of a person would, strictly speaking, be linguistic properties in a representation of a person.” Yngve 1996:123	< <i>name</i> > or < <i>name/value</i> >
Set of properties	We use a similar notation for a set of inputs	{ $P_1, P_2, P_3 \dots P_n$ }
Set of properties at instant <i>i</i>	Yngve 1996:147	{ $P_1, P_2, P_3 \dots P_n$ } _{<i>i</i>}
Set of inputs and properties	Yngve 1996:147	{ $I_1, I_2, I_3 \dots I_m; P_1, P_2, P_3 \dots P_n$ }
Interval	Yngve 1996:148	Δt
Time delay	Yngve 1996:148	Δt_{i+1}
Transition	Yngve 1996:148	{ $I_1, I_2, I_3 \dots I_m;$

from i to $i + 1$		$P_1, P_2, P_3 \dots P_n \}_I \rightarrow$ $\{I_1, I_2, I_3 \dots I_m;$ $P_1, P_2, P_3 \dots P_n; \Delta t \}_I \rightarrow$
Component expression – component transition	See the principle of continuity of component properties; Yngve 1996:153	$\{I_1, I_2, I_3 \dots I_m;$ $P_1, P_2, P_3 \dots P_n \}_I \rightarrow$ $\{P_k; \Delta t \}_{i+1}$
Setting expression	An abbreviation for the above with a double colon replacing the arrow Yngve 1996:154. This notation is more common than the above	$\{I_1, I_2, I_3 \dots I_m;$ $P_1, P_2, P_3 \dots P_n \}_I :: \{P_k;$ $\Delta t \}_{i+1}$
List of reduced setting expressions (example)	These properties are binary; time delays are arbitrary. Yngve 1996:159. “Each setting expression in a reduced list is tantamount to a dynamic causal law of communicative behavior.”	$\{-p_a, -p_b, p_c \}_I ::$ $\{p_k; 7 \}_{i+1}$ $\{-p_a, p_b, p_c \}_I ::$ $\{p_k; 7 \}_{i+1}$ $\{p_a, -p_b, p_c \} ::$ $\{p_k; 4 \}_{i+1}$ $\{p_a, p_b, p_c \} ::$ $\{p_k; 7 \}_{i+1}$
Conjunction and alternation	a. Read “ p_a and p_b and p_c ” b. Read “ p_a or p_b or p_c ” Yngve 1996:163	a. $P_a \times$ $P_b \times P_c$ b. $P_a \vee$ $P_b \vee P_c$
Negation	not p Yngve 1996:162	-p
Setting procedure	A group of setting expressions which collectively set all possible values of a property Yngve 1996:163-164	$\{p_a \vee -p_b \times$ $p_c \} :: p_k$ $\{-p_a \times -p_c \} :: -$ p_k

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