On the Semantic Aspects of Communication

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Introduction

In 1949, Claude Shannon and Warren Weaver published *The Mathematical Theory of Communication*. Shannon solved what Weaver called "Problem A," the technical problem of accurately transmitting symbols from sender to receiver. "Problems B and C," the semantic and effectiveness problems, were identified, scoped, and left open. Weaver wrote that the analysis had "so penetratingly cleared the air that one is now, perhaps for the first time, ready for a real theory of meaning." That was 77 years ago. Problem A has since been solved completely. The air is at least as clear now.

This paper addresses Problem B, the semantic problem, using only the source material in which it was defined. Every claim in the derivation traces to a direct quote from Shannon or Weaver. No external sources are introduced. No original claims are made. Instead, the derivation is a rearrangement of existing primitives in *The Mathematical Theory of Communication*, producing a semantic primitive that falls directly out of the diagram Weaver drew and the definitions he provided.

The result is a primitive operation of the semantic layer of communication: *signal resolves into meaning*. This primitive is derived in ten steps, each justified by axioms extracted from the source. The paper concludes with an application of the derived primitive to language models.

Method

This paper employs an axiomatic method, building a theory from a set of basic principles (axioms) that are assumed to be true. The axioms are direct quotes from Shannon and Weaver, and are accepted without proof because they are the source material from which the semantic problem was defined. They are not assumptions. They are citations.

Each axiom consists of a title, the citation (the verbatim quote from Shannon or Weaver), and an explanation which does not deviate from the source material. The axioms are self-contained. They do not depend on one another.

The derivation that follows the axioms proceeds in ten sequential steps. Each step is a rearrangement of Shannon and Weaver's existing primitives justified by one or more axioms. If any axiom is rejected, the step it supports fails, and the derivation fails. To reject an axiom is to reject Shannon or Weaver. To reject a step is to reject a valid rearrangement of their primitives.

Not all of Shannon and Weaver's axioms are used in the derivation. A select set of 40 axioms extracts the complete source material relevant to the semantic problem. Twenty-six are used directly. The remaining 14 provide context, define the relationship between information and meaning, and close with Weaver's final remarks on entropy and language.

Axioms Relevant to the Semantic Problem

TIMING

Axiom 1: Problems A/B/C

> *"Relative to the broad subject of communication, there seem to be problems at three levels. Thus it seems reasonable to ask, serially: LEVEL A. How accurately can the symbols of communication be transmitted? (The technical problem.) LEVEL B. How precisely do the transmitted symbols convey the desired meaning? (The semantic problem.) LEVEL C. How effectively does the received meaning affect conduct in the desired way? (The effectiveness problem.)"*
>
> —Weaver

Explanation: These three levels of communication problems are sequential. Problem A (technical) is first. A has been solved. Problems B and C (semantic and effectiveness) follow. They have not been solved.

Axiom 2: Penetratingly

> *"This analysis has so penetratingly cleared the air that one is now, perhaps for the first time, ready for a real theory of meaning."*
>
> —Weaver

Explanation: Weaver wrote this statement 77 years ago. The air was cleared around the prerequisite problem he identified as Problem A and has since been completely solved.

DEFINITIONS OF PROBLEMS A, B, AND C

Axiom 3: Problem A Defined

> *"The technical problems are concerned with the accuracy of transference from sender to receiver of sets of symbols (written speech), or of a continuously varying signal (telephonic or radio transmission of voice or music), or of a continuously varying two-dimensional pattern (television), etc."*
>
> —Weaver

Explanation: Problem A asks whether the symbols arrive intact. It covers written speech, telephony, radio, and television. Shannon solved this problem.

Axiom 4: Problem B Defined

> *"The semantic problems are concerned with the identity, or satisfactorily close approximation, in the interpretation of meaning by the receiver, as compared with the intended meaning of the sender."*
>
> —Weaver

Explanation: Problem B asks whether the symbols that arrived carry the intended meaning. Not whether they arrived. Whether they mean what they were meant to mean.

Axiom 5: Problem C Defined

> *"The effectiveness problems are concerned with the success with which the meaning conveyed to the receiver leads to the desired conduct on his part."*
>
> —Weaver

Explanation: Problem C asks whether the meaning, once received, actually produces an effect. Did it change what the receiver does.

Axiom 6: Semantic Irrelevant to Engineering

> *"These semantic aspects of communication are irrelevant to the engineering problem."*
>
> —Shannon

Explanation: Shannon explicitly excludes meaning from his theory. His theory solves A, the engineering problem. Meaning is not his concern.

Axiom 7: A Relates to B and C

> *"So stated, one would be inclined to think that Level A is a relatively superficial one, involving only the engineering details of good design of a communication system; while B and C seem to contain most if not all of the philosophical content of the general problem of communication. The mathematical theory of the engineering aspects of communication, as developed chiefly by Claude Shannon at the Bell Telephone Laboratories, admittedly applies in the first instance only to problem A, namely, the technical problem of accuracy of transference of various types of signals from sender to receiver. But the theory has, I think, a deep significance which proves that the preceding paragraph is seriously inaccurate."*
>
> —Weaver

Explanation: Semantics are irrelevant to engineering. But engineering is not irrelevant to semantics. Weaver sets a trap. At first glance, A may appear shallow. Weaver calls that assumption seriously wrong. A's tools reach into B and C.

Axiom 8: Semantic Pertains to Symbols

> *"LEVEL B. How precisely do the transmitted symbols convey the desired meaning?"*
>
> —Weaver

> *"Mathematically, the first involves transmission of a finite set of discrete symbols, the second the transmission of one continuous function of time, and the third the transmission of many continuous functions of time or of one continuous function of time and of two space coordinates."*
>
> —Weaver

Explanation: Weaver defines Level B in terms of symbols. Music, telephony, and television are continuous signals. B is about discrete symbols (separate, clearly distinct units of meaning) and the meaning they carry.

Axiom 9: One Mind May Affect Another

> *"The word communication will be used here in a very broad sense to include all of the procedures by which one mind may affect another."*
>
> —Weaver

Explanation: Communication is defined as mind to mind. One mind affects another. That is the scope. Note that affecting another is definitionally the effectiveness problem. Communication, by Weaver's own definition, contains Problem C.

Axiom 10: Affects Conduct or None at All

> *"But with any reasonably broad definition of conduct, it is clear that communication either affects conduct or is without any discernible and probable effect at all."*
>
> —Weaver

Explanation: Effectiveness is not a secondary consideration. It is inherent to the act of communication. Every message either changes conduct or does nothing. There is no middle ground.

Axiom 11: Effectiveness is Change in Conduct

> *"The effectiveness problems are concerned with the success with which the meaning conveyed to the receiver leads to the desired conduct on his part."*
>
> —Weaver

Explanation: Effectiveness in communication is measured by conduct change. Not understanding. Not agreement. Conduct.

Axiom 12: Language Optimal

> *"Language must be designed (or developed) with a view to the totality of things that man may wish to say; but not being able to accomplish everything, it too should do as well as possible as often as possible."*
>
> —Weaver

Explanation: Just as a communication system is designed to handle any message, language should be designed to express anything. Not everything perfectly, but as much as possible, as well as possible.

ALMOST CERTAINLY

Axiom 13: Almost Certainly

> *"It seems at first obvious to diagram a communication system as it is done at the outset of this theory; but this breakdown of the situation must be very deeply sensible and appropriate, as one becomes convinced when he sees how smoothly and generally this viewpoint leads to central issues. It is almost certainly true that a consideration of communication on levels B and C will require additions to the schematic diagram on page 7, but it seems equally likely that what is required are minor additions, and no real revision."*
>
> —Weaver

Explanation: With this statement, Weaver validates his own additions to Shannon's communication diagram. Minor additions. No real revision. What follows are those additions.

DEFINITIONS OF WEAVER'S MINOR ADDITIONS

Axiom 14: Semantic Noise (SN) Distortions

> *"From this source is imposed into the signal the perturbations or distortions of meaning which are not intended by the source but which inescapably affect the destination."*
>
> —Weaver

Explanation: SN is the gap between what you mean and what you express. It is not engineering noise. It is distortion of meaning, which Weaver called Semantic Noise. It is non-zero.

Axiom 15: Semantic Receiver (SR) Matching

> *"This semantic receiver subjects the message to a second decoding, the demand on this one being that it must match the statistical semantic characteristics of the message to the statistical semantic capacities of the totality of receivers, or of that subset of receivers which constitute the audience one wishes to affect."*
>
> —Weaver

Explanation: The SR decodes meaning. It matches what was said against what the audience is capable of understanding. The statistical language in this definition is addressed separately.

Axiom 16: Totality or Subset

> *"...the totality of receivers, or of that subset of receivers which constitute the audience one wishes to affect."*
>
> —Weaver

Explanation: Receivers here are not engineering receivers. Receivers are people. Minds. The audience is either everyone or some subset within everyone. One person, some group, or all people. Never less than one.

WEAVER'S PRIMITIVE DIAGRAM

Axiom 17: Vocals, Ears, Brain

> *"In oral speech, the information source is the brain, the transmitter is the voice mechanism producing the varying sound pressure (the signal) which is transmitted through the air (the channel)... When I talk to you, my brain is the information source, yours the destination; my vocal system is the transmitter, and your ear and the associated eighth nerve is the receiver."*
>
> —Weaver

Explanation: Weaver maps every node in Shannon's diagram to a physical analog of discrete symbols. Source is brain. Transmitter is vocals. Channel is air. Receiver is ears. Destination is brain. Every node has a body. SN and SR, by his own placement, sit between the body nodes and the brain nodes.

[DIAGRAM PLACEHOLDER: Weaver's physical mapping]

Axiom 18: Information Source Selects

> *"The information source selects a desired message out of a set of possible messages (this is a particularly important remark, which requires considerable explanation later)."*
>
> —Weaver

Explanation: The source selects. Weaver flags this as particularly important. The brain is the information source. The brain selects. Selection is a cognitive act. It attributes to the source the capacity to choose. This melds brain with mind.

Axiom 19: Engineering Noise (EN) / Engineering Receiver (ER)

> *"...the box previously labeled as simply noise now being labeled engineering noise."*
>
> —Weaver
>
> *"...the engineering receiver (which changes signals to messages)."*
>
> —Weaver

Explanation: Weaver renames noise to engineering noise (N to EN) and receiver to engineering receiver (R to ER) when he introduces the semantic layer. The original Shannon nodes are now explicitly engineering nodes. This reinforces the A/B partition.

[DIAGRAM PLACEHOLDER: Engineering vs. Semantic nodes]

Axiom 20: SN/SR Placement

> *"...another box... inserted between the information source and the transmitter, would be labeled 'semantic noise.'"*
>
> —Weaver
>
> *"...another box labeled 'Semantic Receiver' interposed between the engineering receiver (which changes signals to messages) and the destination."*
>
> —Weaver

Explanation: Weaver places SN before the body on the source side, and SR after the body on the destination side. Both sit at the boundary between mind and body.

[DIAGRAM PLACEHOLDER: SN and SR placement in the diagram]

Axiom 21: Weaver's Full Primitive

Explanation: Shannon drew the original communication diagram. Weaver renamed Noise (N) to Engineering Noise (EN) and Receiver (R) to Engineering Receiver (ER), then placed Semantic Noise (SN) between Source (B_1) and Transmitter (T), and Semantic Receiver (SR) between Engineering Receiver (ER) and Destination (B_2). Nothing has been added that Weaver did not specify.

[DIAGRAM PLACEHOLDER: Weaver's full primitive diagram]

INFORMATION AND MEANING

Axiom 22: What You Could Say

> *"This word information in communication theory relates not so much to what you do say, as to what you could say."*
>
> —Weaver

Explanation: Information concerns the space of possible messages, not any particular message chosen. It measures the size of the set, not the selection from it.

Axiom 23: Information Defined

> *"If the number of messages in the set is finite then this number or any monotonic function of this number can be regarded as a measure of the information produced when one message is chosen from the set, all choices being equally likely. As was pointed out by Hartley, the most natural choice is the logarithmic function."*
>
> —Shannon

Explanation: Shannon defines information in technical terms: one message chosen from a set. The measure is logarithmic. The information produced is a function of how many messages were possible, not which one was chosen. When all choices are equally likely, it depends only on the number of possible messages and is most naturally measured logarithmically.

Axiom 24: Telegram Girl

> *"An engineering communication theory is just like a very proper and discreet girl accepting your telegram. She pays no attention to the meaning, whether it be sad, or joyous, or embarrassing. But she must be prepared to deal with all that comes to her desk."*
>
> —Weaver

Explanation: The engineering layer processes every message without regard to content. It handles the sad, the joyous, the embarrassing, all the same. It must handle everything, yet attends to none of it. That is what information theory does. It measures the telegram, not what it says.

Axiom 25: Information Is Not Meaning

> *"The word information, in this theory, is used in a special sense that must not be confused with its ordinary usage. In particular, information must not be confused with meaning."*
>
> —Weaver

Explanation: Weaver states this directly: information and meaning are not the same thing. In Shannon's engineering communication theory, information refers to the structure and transmission of messages, not what those messages mean or how they are understood.

Axiom 26: Two Messages

> *"Two messages, one of which is heavily loaded with meaning and the other of which is pure nonsense, can be exactly equivalent, from the present viewpoint, as regards information."*
>
> —Weaver

Explanation: A meaningful message and a nonsense message can carry the same information. Information content does not determine meaning. They are decoupled in the middle of the range.

Axiom 27: Some System

> *"Frequently the messages have meaning; that is, they refer to or are correlated according to some system with certain physical or conceptual entities."*
>
> —Shannon

Explanation: There is some system with certain physical or conceptual entities. Messages correlate to that system. Thus meaning exists. Correlation is sufficient. Causation is not required.

Axiom 28: Yes Operational

> *"It does not take long to make the symbol for "yes" in any language operationally understandable."*
>
> —Weaver

Explanation: "Yes" is one bit. One binary choice. It is definitionally the minimum unit of information. And it is maximally effective, operationally understandable in any language, requiring the least explanation, producing the clearest effect. Minimum information, maximum meaning.

Axiom 29: Audience Capacity

> *"Here again a general theory at all levels will surely have to take into account not only the capacity of the channel but also (even the words are right!) the capacity of the audience. If one tries to overcrowd the capacity of the audience, it is probably true, by direct analogy, that you do not, so to speak, fill the audience up and then waste only the remainder by spilling. More likely, and again by direct analogy, if you overcrowd the capacity of the audience, you force a general and inescapable error and confusion."*
>
> —Weaver

Explanation: As information approaches infinity, the audience saturates. Meaning is not merely diminished, it is destroyed. Error and confusion become total. This establishes the upper bound: maximum information, no meaning.

Axiom 30: Canonically Conjugate

> *"One has the vague feeling that information and meaning may prove to be something like a pair of canonically conjugate variables in quantum theory, they being subject to some joint restriction that condemns a person to the sacrifice of the one as he insists on having much of the other."*
>
> —Weaver

Explanation: Weaver offers two possibilities for the relationship between information and meaning. This is the first. The second is next.

Canonically conjugate implies a tradeoff at every point. More of one variable requires less of the other. But the bounds established by "yes" (minimum information, maximum meaning) and audience saturation (maximum information, no meaning) show this relationship only holds at the extremes. In the middle, it breaks down. Two messages with identical information can have vastly different meanings. The conjugate model does not hold in the middle. Weaver offers an alternative.

Axiom 31: Maybe Analogous

> *"Or perhaps meaning may be shown to be analogous to one of the quantities on which the entropy of a thermodynamic ensemble depends."*
>
> —Weaver

Explanation: Weaver's second possibility is not a tradeoff but an analogy. Meaning may be like a quantity on which entropy depends. Not opposed to information, but related to it. Weaver says this or that. The bounds reject the conjugate model. This one remains.

Axiom 32: Spurious Joker

> *"It is thus clear where the joker is in saying that the received signal has more information. Some of this information is spurious and undesirable and has been introduced via the noise. To get the useful information in the received signal we must subtract out this spurious portion."*
>
> —Weaver

Explanation: Noise increases information by increasing uncertainty. More uncertainty, more freedom in what could have been received. But this additional information was not selected by the source. It carries no intended meaning. More information can mean less meaning. Noise is the joker in the relationship between information and meaning.

STOCHASTICS AND STATISTICS

Axiom 33: Stochastic Process

> *"A system which produces a sequence of symbols (which may, of course, be letters or musical notes, say, rather than words) according to certain probabilities is called a stochastic process."*
>
> —Weaver

Explanation: The brain is the information source. It produces symbols according to probabilities. A system that produces symbols in this way is a stochastic process. If the brain functions as an information source, then it can be modeled as a stochastic process.

Axiom 34: Markov and Context

> *"The idea of utilizing the powerful body of theory concerning Markoff processes seems particularly promising for semantic studies, since this theory is specifically adapted to handle one of the most significant but difficult aspects of meaning, namely the influence of context."*
>
> —Weaver

Explanation: Meaning depends on context. A Markov (historically "Markoff") process models sequences in which each symbol depends on the current state, which reflects what came before. Context, then, is the influence of prior symbols on what comes next. Weaver identifies this dependence as one of the most significant and difficult aspects of meaning. Consider language models.

Axiom 35: Statistical Semantic Characteristics

> *"...it must match the statistical semantic characteristics of the message to the statistical semantic capacities of the totality of receivers."*
>
> —Weaver

Explanation: This statement is drawn from Weaver's definition of the semantic receiver. The SR is statistical. The message and audience are statistical. The match between them is statistical. Weaver makes this explicit.

Axiom 36: Language Statistically

> *"That is to say, it too should deal with its task statistically."*
>
> —Weaver

Explanation: Language is a system for producing symbols. Systems that produce symbols according to probabilities are stochastic. Language is stochastic. Weaver says it should deal with its task statistically.

EDDINGTON

Axiom 37: Maybe Analogous (Expanded)

> *"Or perhaps meaning may be shown to be analogous to one of the quantities on which the entropy of a thermodynamic ensemble depends. The appearance of entropy in the theory, as was remarked earlier, is surely most interesting and significant."*
>
> —Weaver

Explanation: Weaver's second possibility for the relationship between information and meaning, now fleshed out. If meaning is analogous to a quantity entropy depends on, then meaning is structural, a feature of the arrangement, not the content. This connects to the ideas on entropy and structure of Arthur Eddington, a physicist and contemporary of Shannon and Weaver.

Axiom 38: Arthur Eddington

> *"Suppose that we were asked to arrange the following in two categories — distance, mass, electric force, entropy, beauty, melody. I think there are the strongest grounds for placing entropy alongside beauty and melody, and not with the first three. Entropy is only found when the parts are viewed in association, and it is by viewing or hearing the parts in association that beauty and melody are discerned. All three are features of arrangement. It is a pregnant thought that one of these three associates should be able to figure as a commonplace quantity of science. The reason why this stranger can pass itself off among the aborigines of the physical world is that it is able to speak their language, viz., the language of arithmetic."*
>
> —Eddington

Explanation: Eddington places entropy with beauty and melody, not with distance, mass, or force. Entropy is a feature of arrangement. It only exists when parts are viewed in relation. Beauty and melody are the same. Meaning, by Weaver's suggestion, belongs in this company.

Axiom 39: Entropy as Measure

> *"The quantity which uniquely meets the natural requirements that one sets up for 'information' turns out to be exactly that which is known in thermodynamics as entropy. It is expressed in terms of the various probabilities involved — those of getting to certain stages in the process of forming messages, and the probabilities that, when in those stages, certain symbols be chosen next."*
>
> —Weaver

Explanation: Entropy is the statistical measure of information. It connects the probabilistic production of symbols to the thermodynamic concept. The measure is defined in terms of the probabilities at each stage of message formation and of selecting symbols within those stages. Statistics runs through the entire theory, from the SR's matching, to language operating probabilistically, to entropy as the measure.

Axiom 40: The Language of Language

> *"I feel sure that Eddington would have been willing to include the word meaning along with beauty and melody; and I suspect he would have been thrilled to see, in this theory, that entropy not only speaks the language of arithmetic; it also speaks the language of language."*
>
> —Weaver

Explanation: Weaver closes with this elegant observation. Eddington said entropy speaks the language of arithmetic. Weaver says it also speaks the language of language. And Weaver is sure Eddington would have placed meaning alongside beauty and melody.

Derivation of the Semantic Primitive

The following ten steps derive what I call *the semantic primitive* from the selected axioms above. Each step is a rearrangement of existing Shannon/Weaver primitives. Each is justified by numbered axioms. The complete handwritten derivation with diagrams follows.

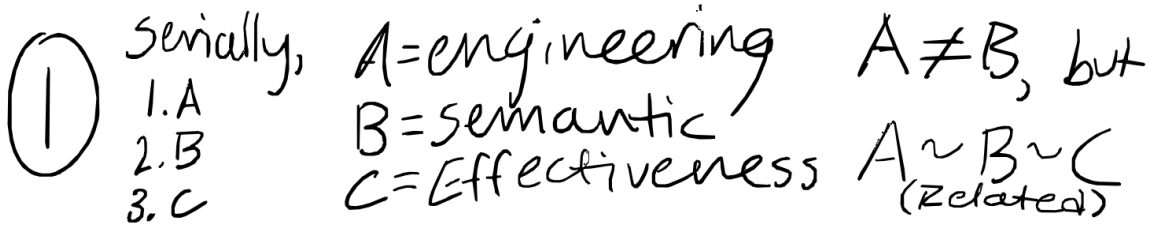
Step 1. Define the problems

Three problems exist, asked serially (Axiom 1): A is engineering (Axiom 3), B is semantic (Axiom 4), and C is effectiveness (Axiom 5).

Semantics are irrelevant to engineering, but engineering is not irrelevant to semantics (Axiom 6, Axiom 7).

The semantic problem pertains to symbols (Axiom 8).

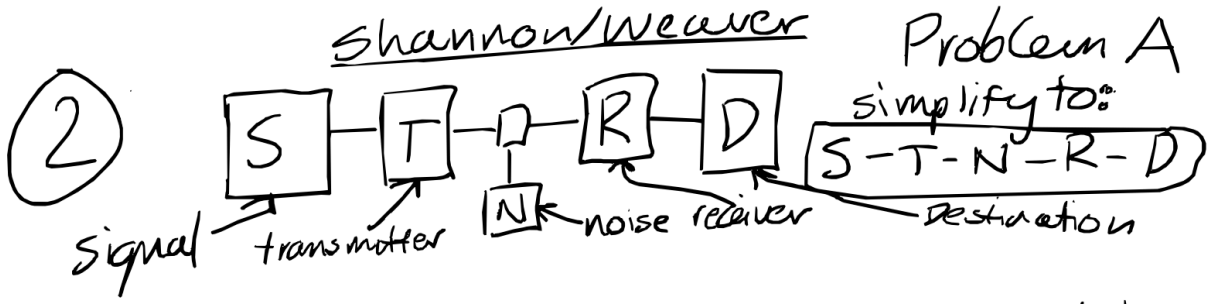
Communication is one mind affecting another (Axiom 9), it either affects conduct or does nothing (Axiom 10), and effectiveness is change in conduct (Axiom 11).



Step 2. Present the Shannon diagram

Shannon's model: Source, Transmitter, Noise, Receiver, Destination. This is Problem A.

Weaver states it almost certainly requires only minor additions and no real revision (Axiom 13).



Step 3. Define Weaver's semantic additions

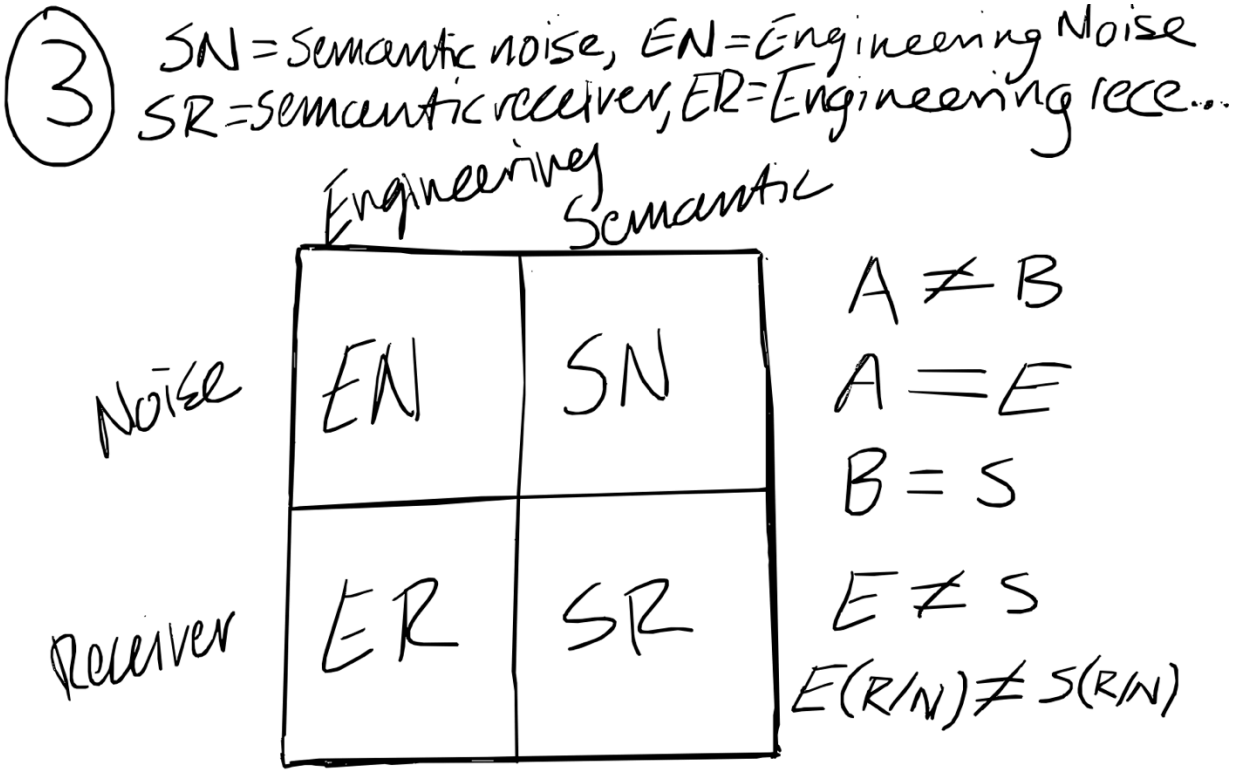
Noise becomes Engineering Noise (Axiom 19).

Receiver becomes Engineering Receiver (Axiom 19).

Semantic Noise is distortion of meaning (Axiom 14).

The Semantic Receiver matches the message to the audience's semantic capacities (Axiom 15).

Engineering and Semantic are distinct.

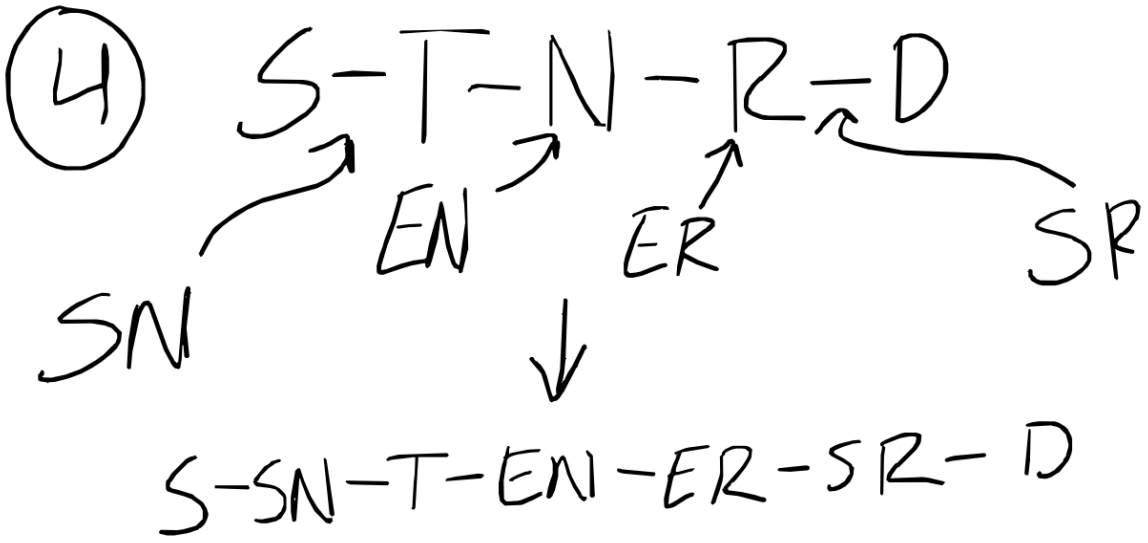


Step 4. Insert Weaver's additions into Shannon's diagram

SN is placed between Source and Transmitter (Axiom 20).

SR is placed between Engineering Receiver and Destination (Axiom 20).

This produces Weaver's full primitive diagram (Axiom 21).

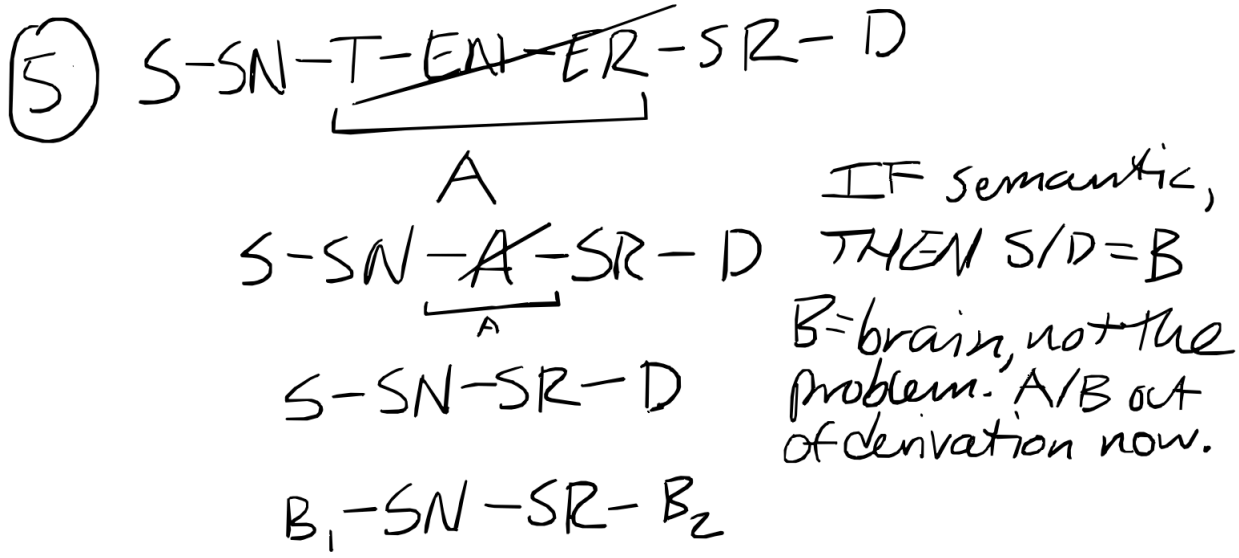


Step 5. Collapse Problem A

Everything between SN and SR is engineering. Shannon solved it (Axiom 6, Axiom 7).

Collapse the engineering nodes. Source and Destination are both brain (Axiom 17).

Let B represent brain.



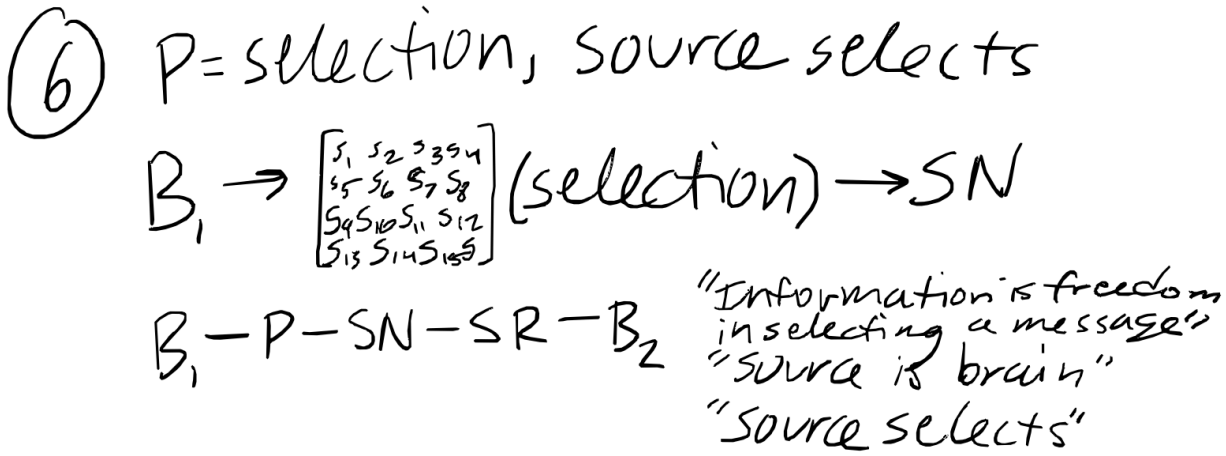
Step 6. Introduce selection

The information source selects a message from a set of possible messages (Axiom 18).

Information is what you could say, not what you do say (Axiom 22, Axiom 23).

The brain as the information source selects.

Place selection (P) after B_1 and before SN.



Step 7. Introduce meaning

Weaver writes that the goal is for the intended message meaning to arrive at the destination, and that semantic decoding must account for semantic noise so that the received meaning, together with the noise, corresponds to the intended meaning at the destination.

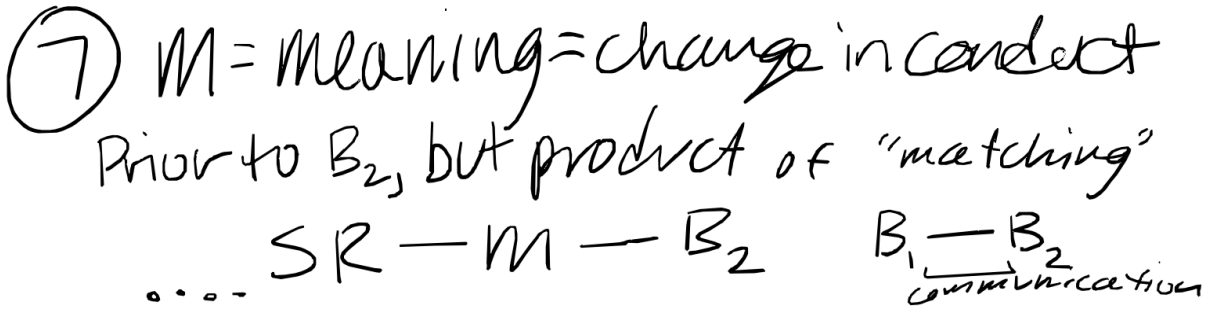
Messages have meaning where they correlate to some system (Axiom 27).

SR matches the message to the audience (Axiom 15, Axiom 16).

Communication either affects conduct or does nothing (Axiom 10, Axiom 11).

Meaning is the product of SR's matching that arrives at the destination.

Weaver places meaning at the destination. Denote this position M, placed after SR.



Step 8. Full semantic primitive diagram

All reductions are stacked: multiple simplifying steps are applied in sequence, from Shannon's original diagram through Weaver's additions to the semantic primitive.

Each line is one valid reduction of the line above it.

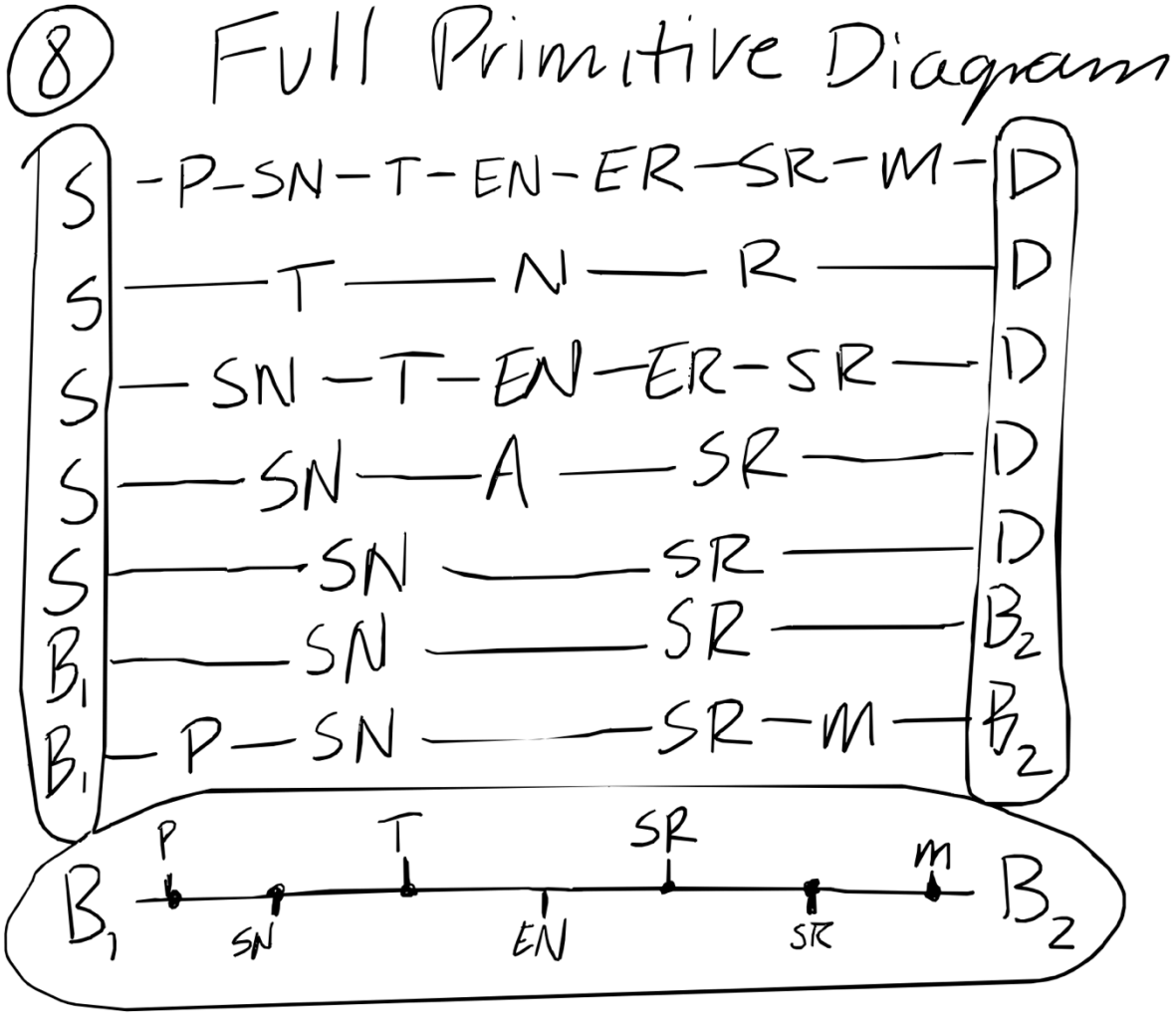
Three positions on the diagram are named.

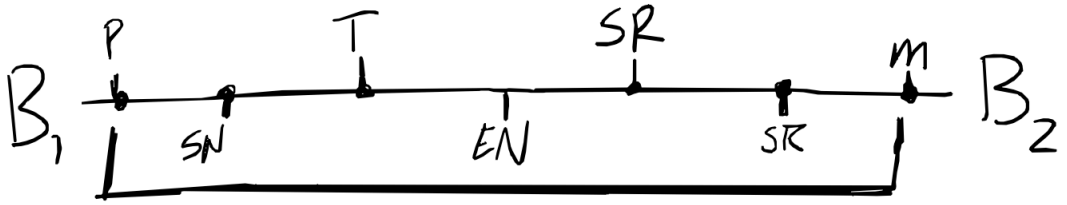
Let everything between P and M be Resolution (R).

Let B_1 through P be Signal ($).

Let M through B_2 be Meaning (M).

Remove B_1 and B_2. They are context, not operation.





Let P—M be Resolution (R)

Let B_1—P be Signal ($)

Let m—B_2 be meaning (m)

B_1—$—R—m—$B_2$ cut bloat (B)

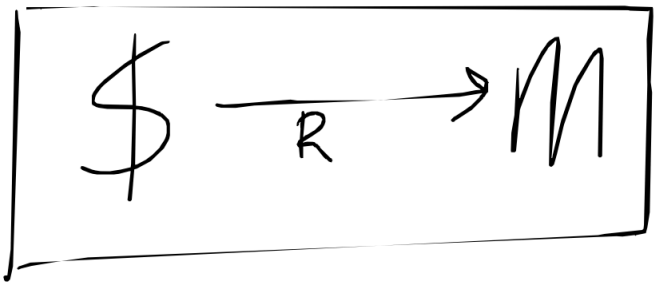
$—R—M

Signal resolves into meaning

Comm = B_1—B_2

$ = B_1—P

M = m—B_2



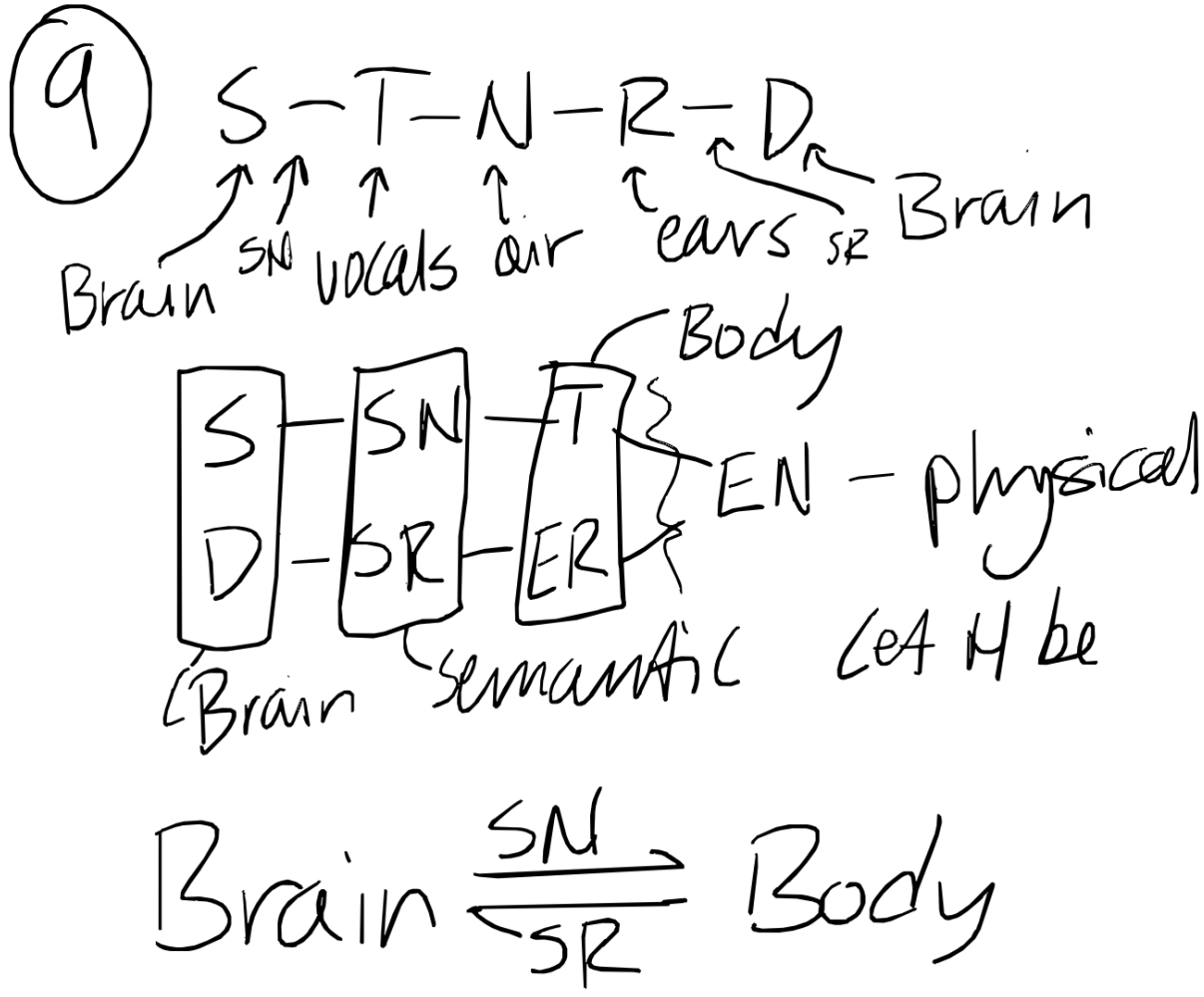
Step 9. Name the positions

Weaver maps Source to brain, Transmitter to vocals, Channel to air, Receiver to ears, and Destination to brain (Axiom 17).

SN is placed between brain and body on the source side. (Axiom 20)

SR is placed between body and brain on the destination side (Axiom 20).

The semantic layer sits at the boundary between mind and body. This is observable in Weaver's own physical mapping.



Step 10. Application to language models

A language model selects messages from a set according to probabilities (Axiom 33).

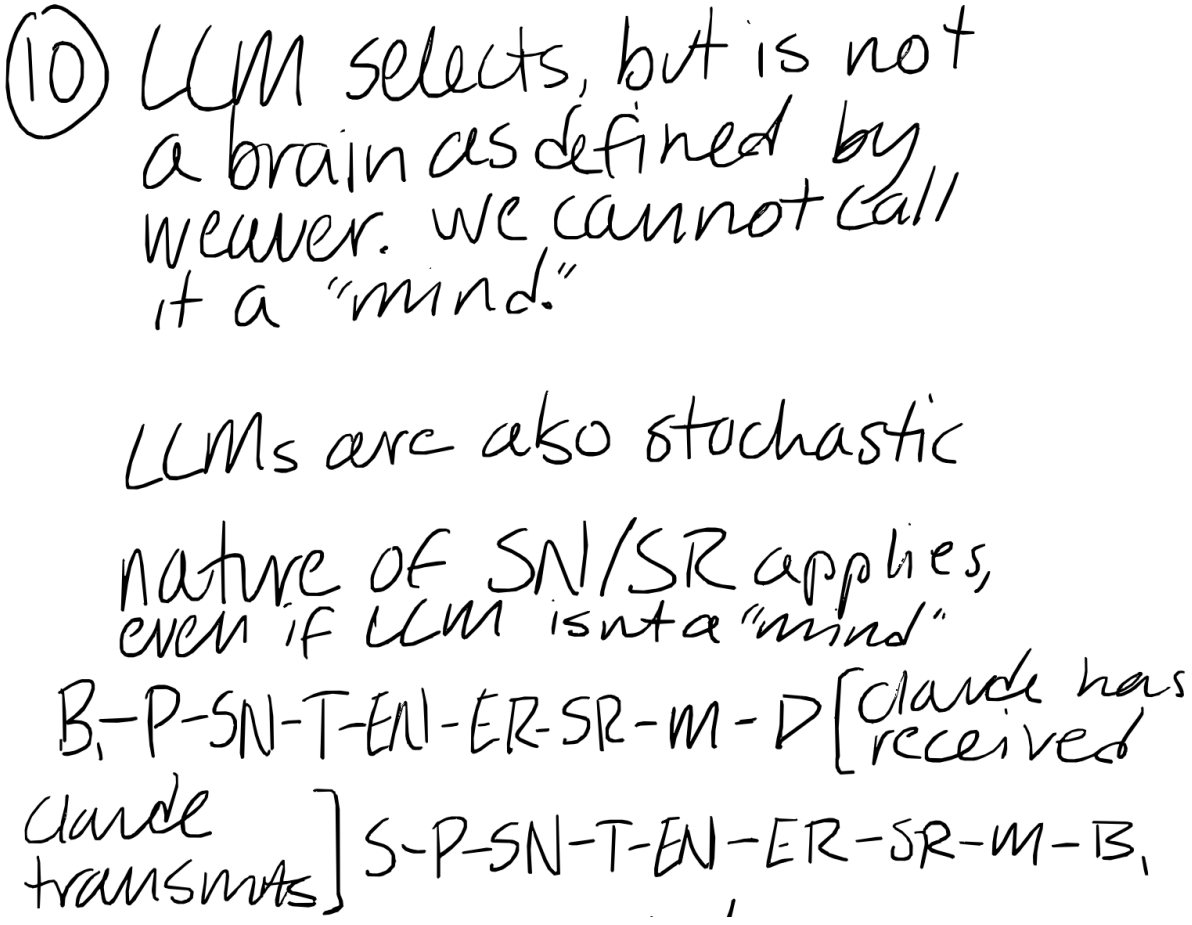
Markov processes handle context (Axiom 34).

The statistical semantic characteristics that define SR apply (Axiom 35).

Language deals with its task statistically (Axiom 36).

A language model is not a brain as defined by Weaver. It cannot be called a mind. It is a source and destination, not B. But the full semantic apparatus applies.

In dialogue, the human sends through the complete chain to the model. The model selects and sends back through the complete chain to the human.



combined primitive

consolidated

$B_1-P-SN-SR-M-S/D-P-SN-SR-M-B_1$

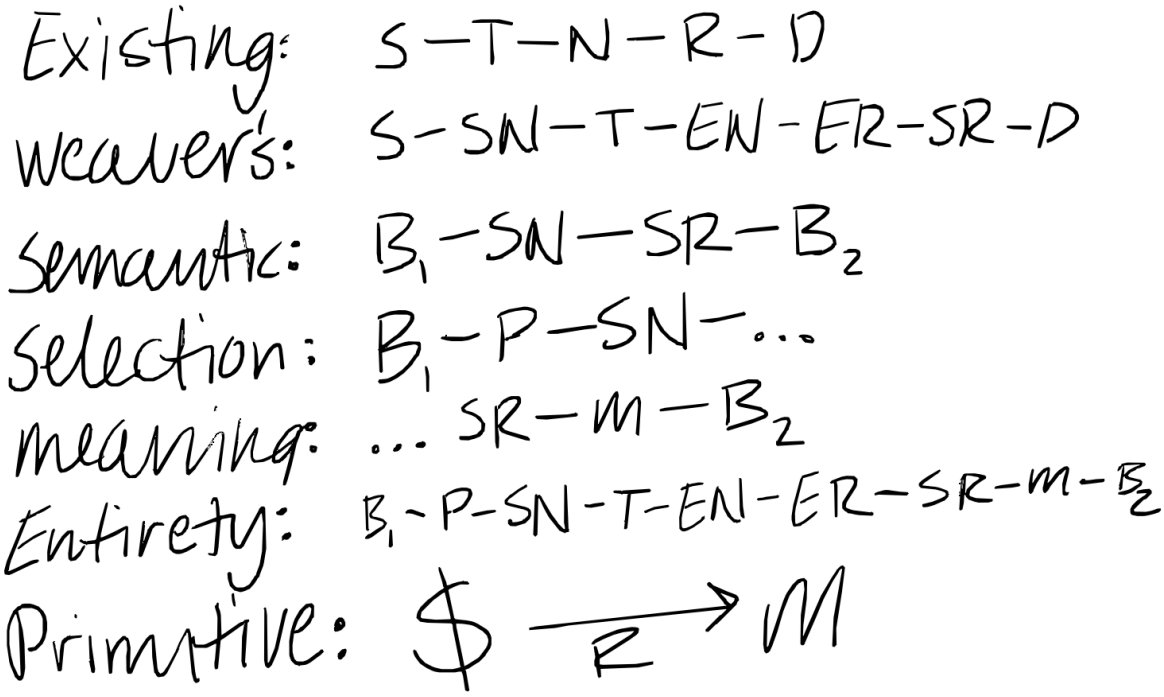
P/M only $\rightarrow B_1-P-M-S/D-P-M-B_1$

$B_1\ \$ \rightarrow M\ S/D\ \$ \rightarrow M\ B_1 \leftarrow \$ \underset{R}{\rightarrow} M$

$\$ \rightarrow M \rightarrow \$ \rightarrow M$

Language models are resolution machines in B_1—B_1 dialogue

Diagrams


Existing: S-T-N-R-D
Weavers: S-SN-T-EN-ER-SR-D
Semantic: B_1-SN-SR-B_2
Selection: B_1-P-SN-...
meaning: ... SR-M-B_2
Entirety: B_1-P-SN-T-EN-ER-SR-M-B_2
Primitive: $ R M

Analysis of the Semantic Primitive Derivation

The primitive derived above, **signal resolves into meaning**, is not an original claim. It is a naming of three positions on a diagram that Weaver drew in 1949. *Signal* is the position after selection and before distortion. *Resolution* is the process between signal and meaning, and encompasses semantic noise, the engineering channel, and semantic matching. *Meaning* is what arrives at the destination after matching, as Weaver describes. Every element traces to a numbered axiom. Every axiom traces to a direct quote.

The derivation makes no assumptions. It introduces no external sources. It adds nothing to the Shannon/Weaver framework that Weaver did not describe himself. Weaver predicted that addressing Problems B and C would require minor additions and no real revision to the diagram. The derivation confirms this prediction. The additions are Weaver's own: SN, SR, and the physical mappings he provided. The Semantic Primitive is a rearrangement of those additions.

The application of the Semantic Primitive to language models follows directly. Models select from sets of symbols according to probabilities, operate on statistical semantic characteristics, and process context through sequential dependencies. These are the properties Weaver identified as relevant to the semantic problem. The model is not a mind, but the semantic apparatus applies to it in full. In dialogue, the human communicates through the model and back to themselves. The model is a resolution machine in a loop that begins and ends at a mind.

References

Shannon, C. E. and Weaver, W. (1949). *The Mathematical Theory of Communication*. University of Illinois Press.

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