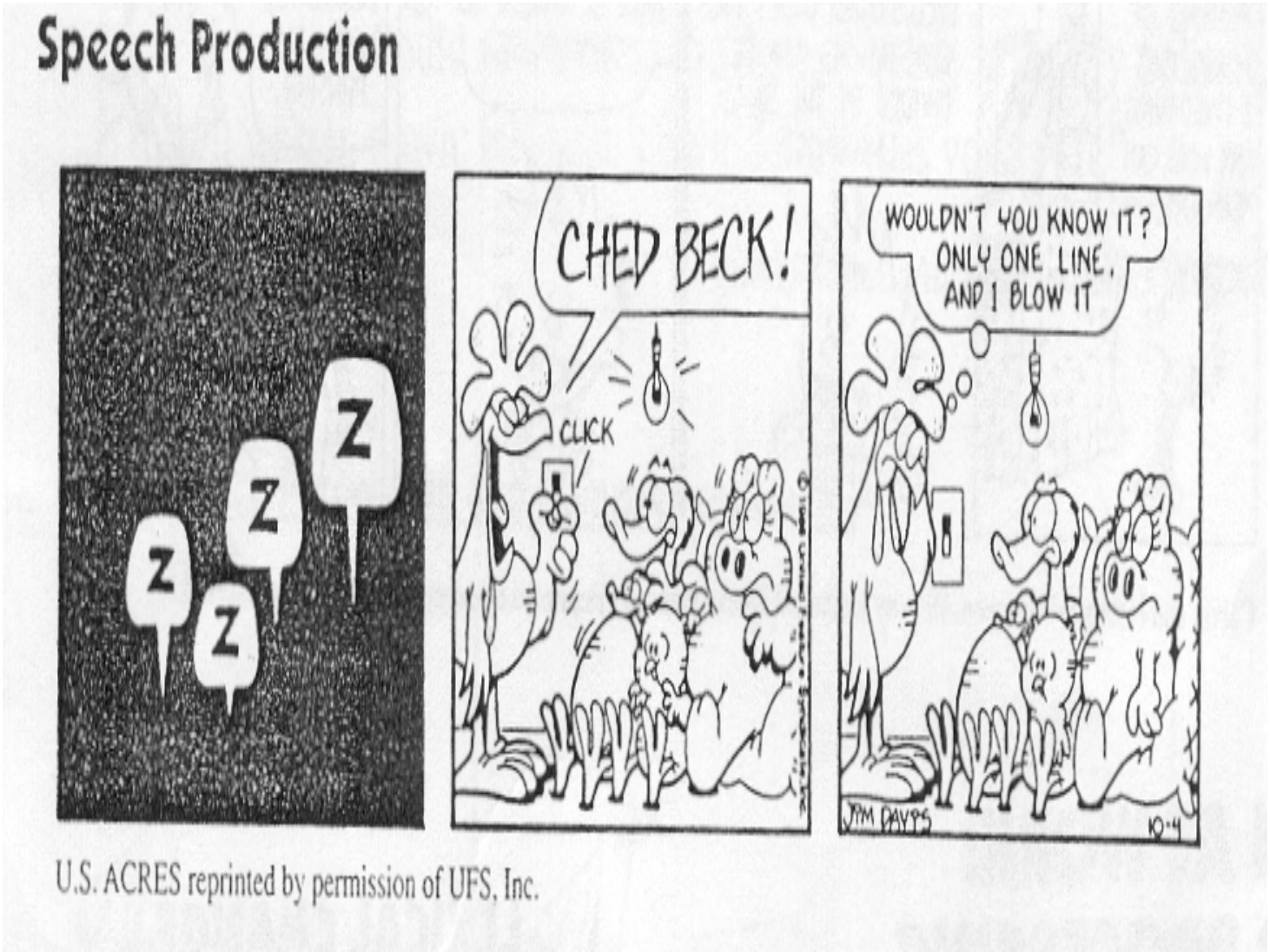
Language Production



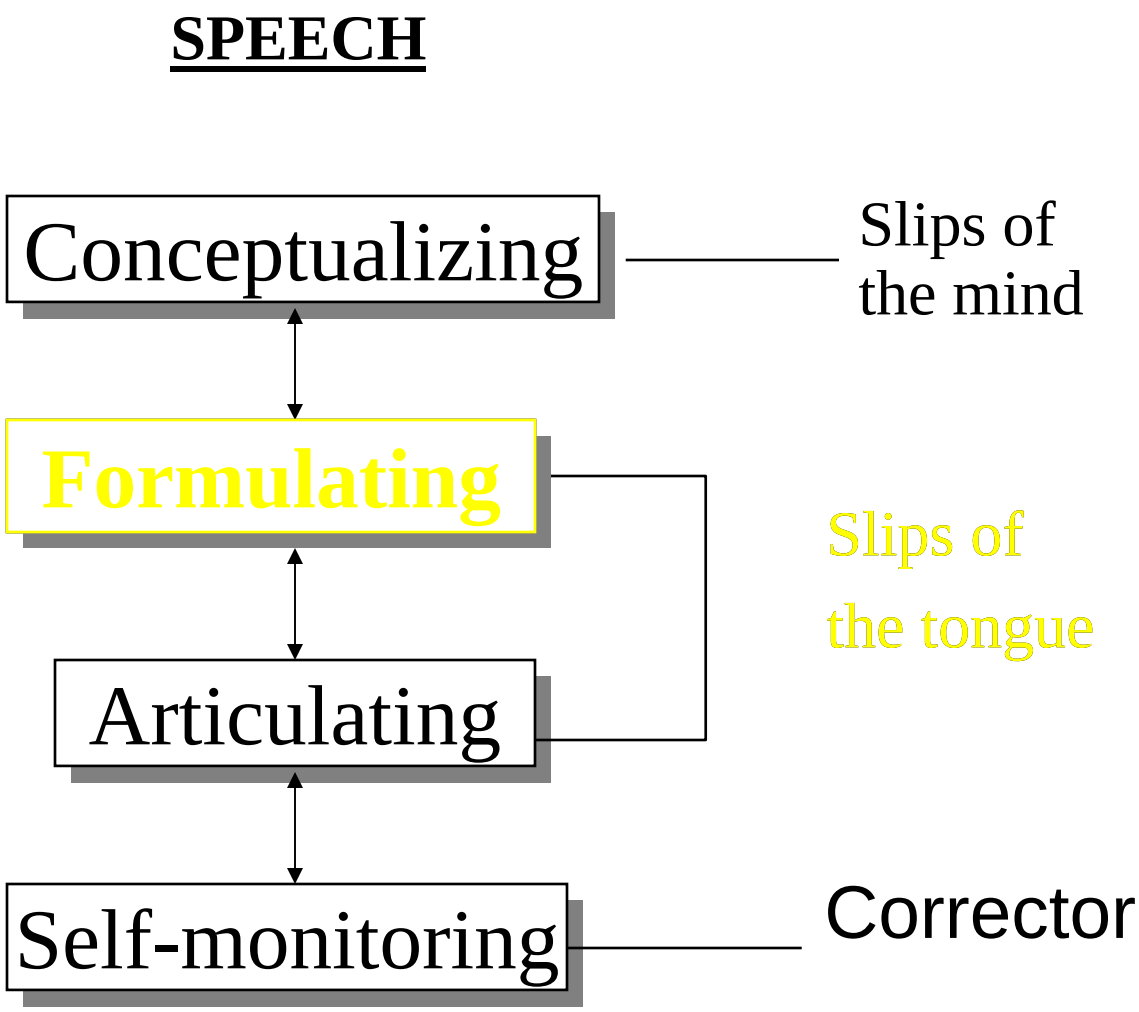
General Points about Speech Production

- 15 speech sounds per second => 2 to 3 words (7)
- Automatic, we can't tell how we do it; 'impossible to think in the middle of a word, shall I say 't' or 'd'' (Levelt)
- Production side has gotten less attention in Psycholinguistics than the comprehension side.
- Evidence for speech production behaviour has **until recently** relied heavily on speech errors (laboratory induced or natural)

Processes in Speech Production

- Decide what to say
- Select appropriate words
- Organize words into grammatical form
- Turn sentences into speech

From Thought to Speech or Written Text



Spoonerisms

- Speech error in which the initial letter or letters of two or more words are switched
- “The Lord is a shoving leopard to his flock.”

SLIPS OF THE TONGUE

- Spoonerisms: Exchange of phonemes (named after Reverend Dr. William Spooner, 1844-1930).

- You have hissed my mystery lectures =>
  You have missed my history lectures
- * In fact, you have tasted the whole worm =>
  In fact, you have wasted the whole term.

- 8 major types of slips of the tongue. These errors appear at all levels (phoneme, morpheme, word level).

- **=> Speech errors are not made at random**

Table 8-1. Major Types of Slips of the Tongue

Type	*Example*
Shift	*That's so she'll be ready in case she decide to hits it (decides to hit it).*
Exchange	*Fancy getting your model renosed (getting your nose remodeled).*
Anticipation	*Bake my bike (take my bike).*
Perseveration	*He pulled a pantrum (tantrum).*
Addition	*I didn't explain this clarefully enough (carefully enough).*
Deletion	*I'll just get up and mutter intelligibly (unintelligibly).*
Substitution	*At low speeds it's too light (heavy).*
Blend	*That child is looking to be spaddled (spanked/paddled).*

Common Types of Speech Errors

- Sound Exchanges
  - Night life
  - Nife lite
  - Beast of burden
  - Burst of beaden
  - Coin toss
  - Toin coss
- Anticipation Errors
  - Take my bike
  - Bake my bike
- Perseveration
  - Beef noodle
  - Beef needle

Speech Errors & Constituents

- Sound exchange, sound anticipation, and sound perseveration errors tend to occur within a single constituent
  - Tend not to occur across constituents

- Unlikely Speech Errors

The dancer took my bike.

The bancer took my bike.

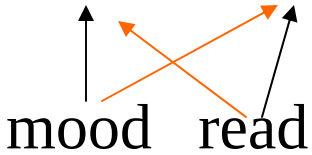
At night, John lost his life.

At nife, John lost his lite.

Stranded Morpheme/ Morpheme Exchange Error

- I’m not in the read for mooding.
- She’s already trunked two packs.
- (I’m not in the mooding for read.)

Decide on Pattern to Generate
Noun for Verb + ing
Fill in Specific Words
Noun for Verb + ing



Common properties of speech errors

1. Exchange of phonemes in similar positions

***a* hissed mystery lectures (missed history lectures)**

***b* burst of beaden (beast of burden)**

***c* nife lite (night life)**

2. On top of that, phonemic environment plays a role (see ex. c)

3. Moreover, exchange of consonants with consonants and vowels with vowels.

4. Novel forms are consistent with phonological rules of a language (blend of *slick* and *slippery* becomes *slickery*, not phonologically impermissable forms as *slickperry* or *slipkery*

=> Simultaneous activation of language units, filled in the wrong slots

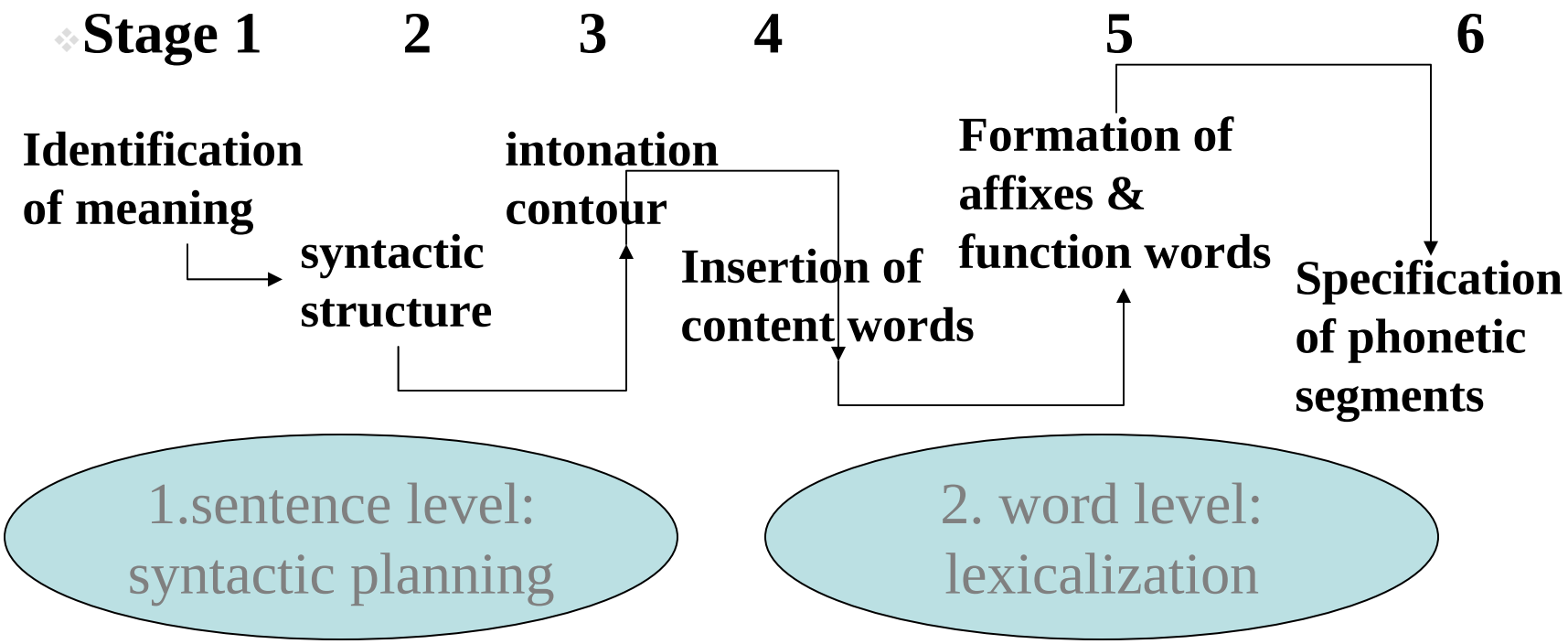
Table 8-2. Fromkin's Model of Speech Production

Stage	*Process*
1	Identification of meaning—a meaning to be conveyed is generated.
2	Selection of a syntactic structure—a syntactic outline of the sentence is constructed, with word slots specified.
3	Generation of intonation contour—the stress values of different word slots are assigned.
4	Insertion of content words—appropriate nouns, verbs, and adjectives are retrieved from the lexicon and placed into word slots.
5	Formation of affixes and function words—function words (articles, conjunctions, prepositions), prefixes, and suffixes are added.
6	Specification of phonetic segments—the sentence is expressed in terms of phonetic segments, according to phonological rules.

Source: V. A. Fromkin, "The Non-Anomalous Nature of Anomalous Utterances," *Language* 47 (1971):27–52.

Serial models of linguistic planning

- **Fromkin's model of Speech Production**



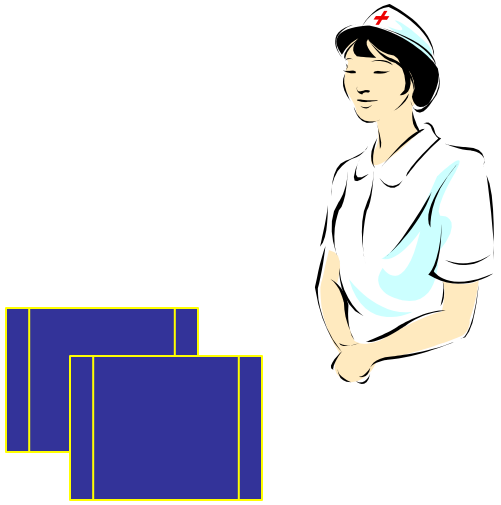
She already bagged two packs (packed two bags)

Serial models of linguistic planning

- **Fromkin's model of Speech Production**

- **Stage 1**

Identification of meaning



Target output: She already bagged two packs (packed two bags)

Serial models of linguistic planning

- **Fromkin's model of Speech Production**
- **Stage 1 2**

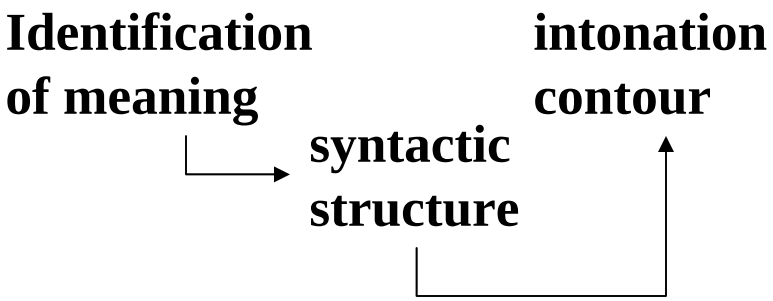
Identification of meaning → **syntactic structure**

	N/Pn	Adv	V	Adj	N
Phase 2 output:	_1_	__2__	__3__	__4__	__5__

Target output: She already bagged two packs (packed two bags)

Serial models of linguistic planning

- **Fromkin's model of Speech Production**
- **Stage 1 2 3**



N/Pn Adv V Adj N

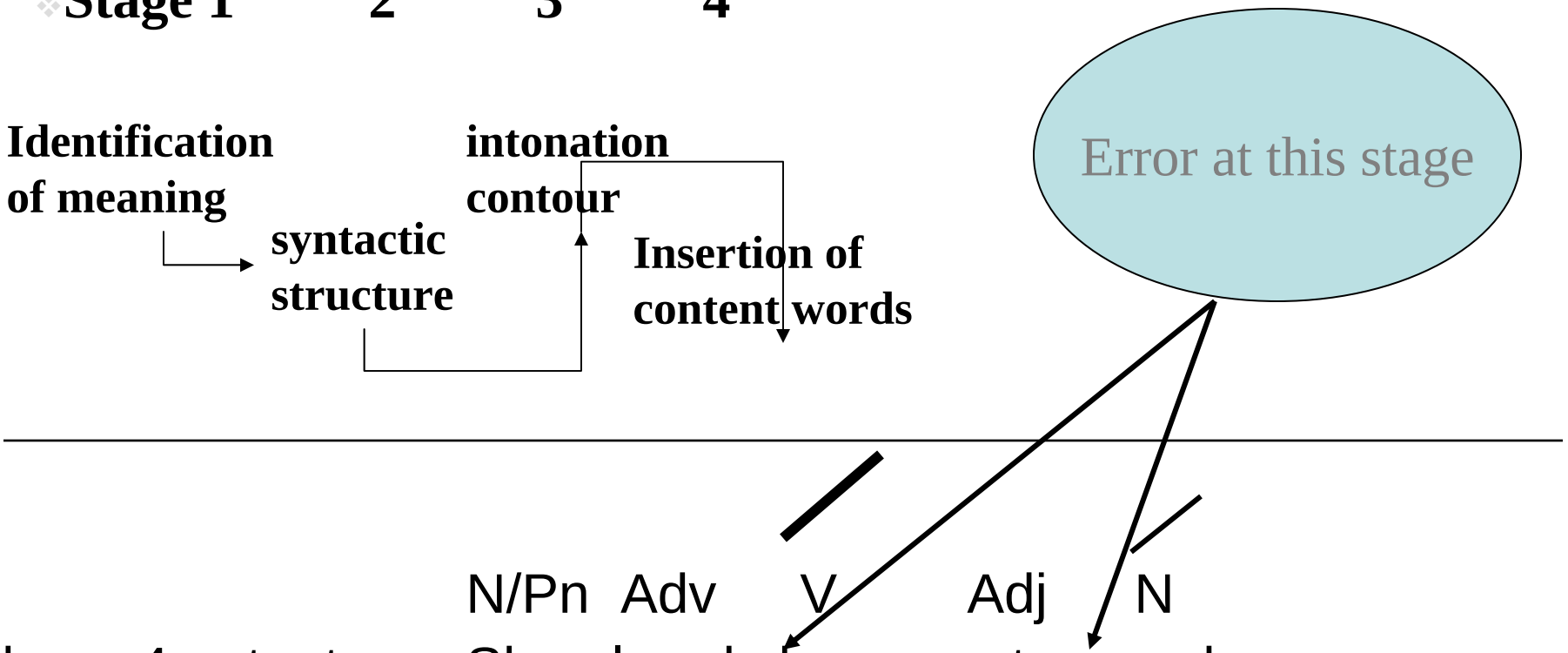
Phase 3 output: _1_ __2__ __3__ __4__ __5__

Target output: She already bagged two packs (packed two bags)

Serial models of linguistic planning

- **Fromkin's model of Speech Production**

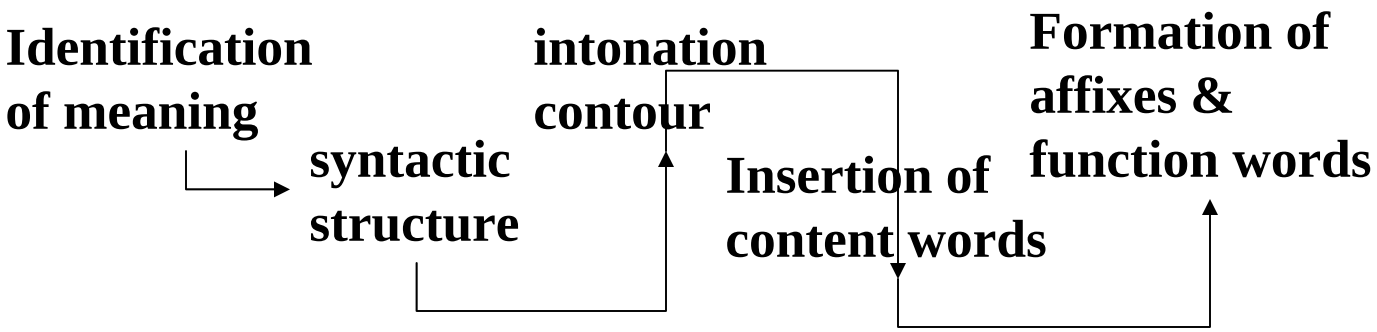
- **Stage 1 2 3 4**



Serial models of linguistic planning

- **Fromkin's model of Speech Production**

- **Stage 1 2 3 4 5**



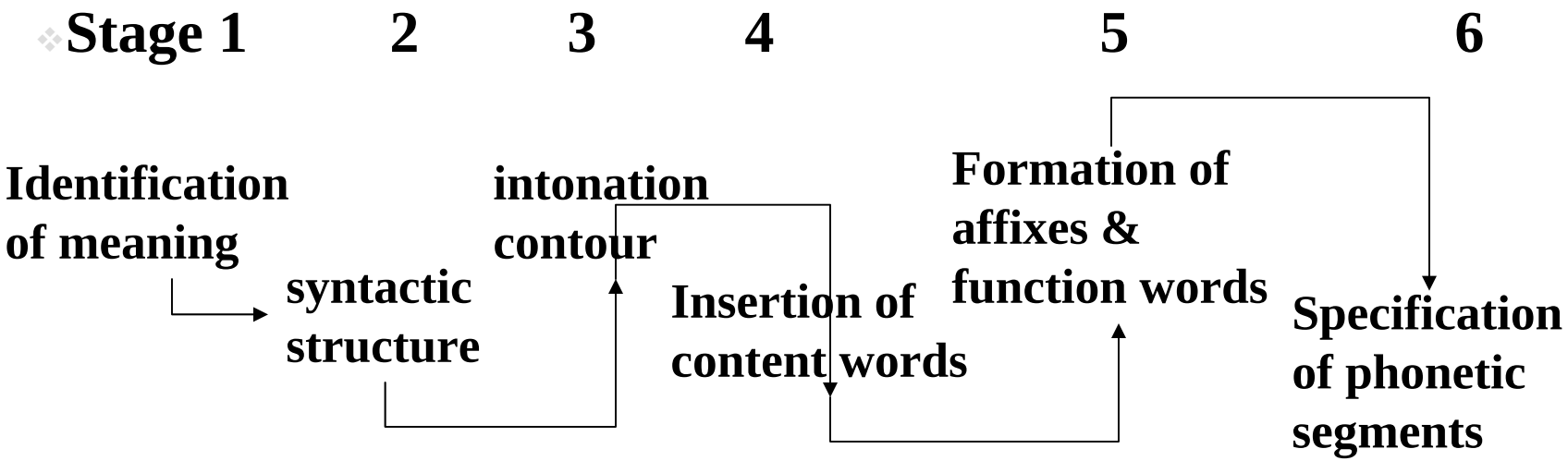
N/Pn Adv V Adj N

Phase 5 output: She already bagged two packs *

Target output: She already bagged two packs
(packed two bags)

Serial models of linguistic planning

- **Fromkin's model of Speech Production**



N/Pn Adv V Adj

N

Phase 6 output: /Sh/e/ /a/l/r/ea/d/y/ /b/a/gg/e/d/ /t/wo/ /p/a/ck/s

*

Target output: She already bagged two packs (packed two

Evidence for the model

- **AD 1: Errors typically occur at one level**

  E.G.: Level 4 word stems exchange, but level 5 suffixes stay:

  stem1+suffix1 stem2 suffix2

  packed bags => bagged packs *

- **Or Level 4 word stems stay, but level 5 suffixes exchange:**

  stem1+suffix1 stem2 suffix2

  Singer sewing => singing sewer * (machine)

Evidence for the model

- **AD 2: Errors typically accomodate themselves to linguistic environment. In other words, errors made at stage X trigger adjustments at stage X+1 (but not X-1)**

E.G.: phonological accommodation (Garrett,1980):

Stage 4 error: A weekend for maniacs => A maniac for weekends

Stage 5: morpheme stranded

Stage 6: phonological accommodation

In *weekend*s final consonant is voiced /z/,

in *maniac*s it is unvoiced /s/.

So

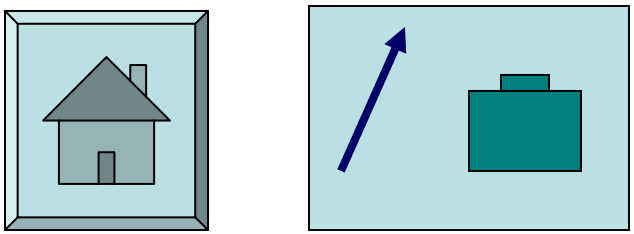
- There seem to be distinct stages in linguistic planning, each of which can be subject to error

- Different models propose different stages, or slightly different assumptions about what is activated first
- Garrett: semantic content of words specified and assigned to syntactic roles (e.g. subject –mother concept; verb: wipe concept; object: plate concept) => Ordering of words/syntactic frame

- At least it seems clear that one needs to have some kind of plan about the syntactic frame, lexical items to be retrieved, and the phonological output, before one starts to speak.
- Is everything (the whole linguistic plan) ready before we start articulating?

No

- Speech production is at least in part an incremental process
  - **Planning of complex sentences**
    - **Meyer (1996): the arrow is next to the bag**



bow suitcase sparrow bad

- **When you hear bow (sem.rel.1), uttering ‘the arrow is next to the bag’ is delayed**
- **When you hear suitcase (sem.rel.2), uttering ‘the arrow is next to the bag’ is delayed**
- **When you hear sparrow (phon.rel.1), uttering ‘the arrow is next to the bag’ is delayed**
- **When you hear bad (phon.rel.2), uttering ‘the arrow is next to the bag’ is not delayed**
- **=> When starting to speak, not everything is ready, independent modules, can work at the same time!**
- **Planning: X (fully) X+1 (partly)**
- **Articulating: X**

Constituent Structure in Generation

- Speakers generate language in phrases or constituents of phrases (clauses, NPs, VPs)
- Hesitations & Pauses
  - Mean pause length @ clause boundary = 1 s
  - Mean Pause length w/in clause = .75 s (Boomer)
  - “Um,” “Ah” vs. Silence (Maclay & Osgood)

Constituent Structure in Generation

- When speakers repeat or correct themselves, they tend to repeat or correct a whole constituent

VP | NP | NP

Turn on the heater/ the heater switch.

Not:

Turn on the heater/ on the heater switch.

VP | NP | NP

Turn on the stove/ the heater switch.

Not:

Turn on the stove/on the heater switch.

Tongue Twisters

- Have speakers attempt to read the following 3 times rapidly and repeat 3 times from memory.
  - Describe 3 errors that were made
  - Discuss whether they fit with what's been said about the nature of speech errors

- How polite is the fame of the fib to police.
- Your lapel has the fame and the fib of Lapointe.
- This locale has a yen for a yacht by LaCoste.
- You collect if you yawn, but not yet, said Colleen.
- The rebuff was too wan since it's web to rebuild.
- If the ribbon is wan it's too wet for a rebate.
- The balloon had no gun and could get the ballet.
- From the belly a gun will not get me a ballot.
- When the lubber is gone we can get him a lapel.
- You defy me the tin and I talk to defend.

A psycho-linguistic view of language

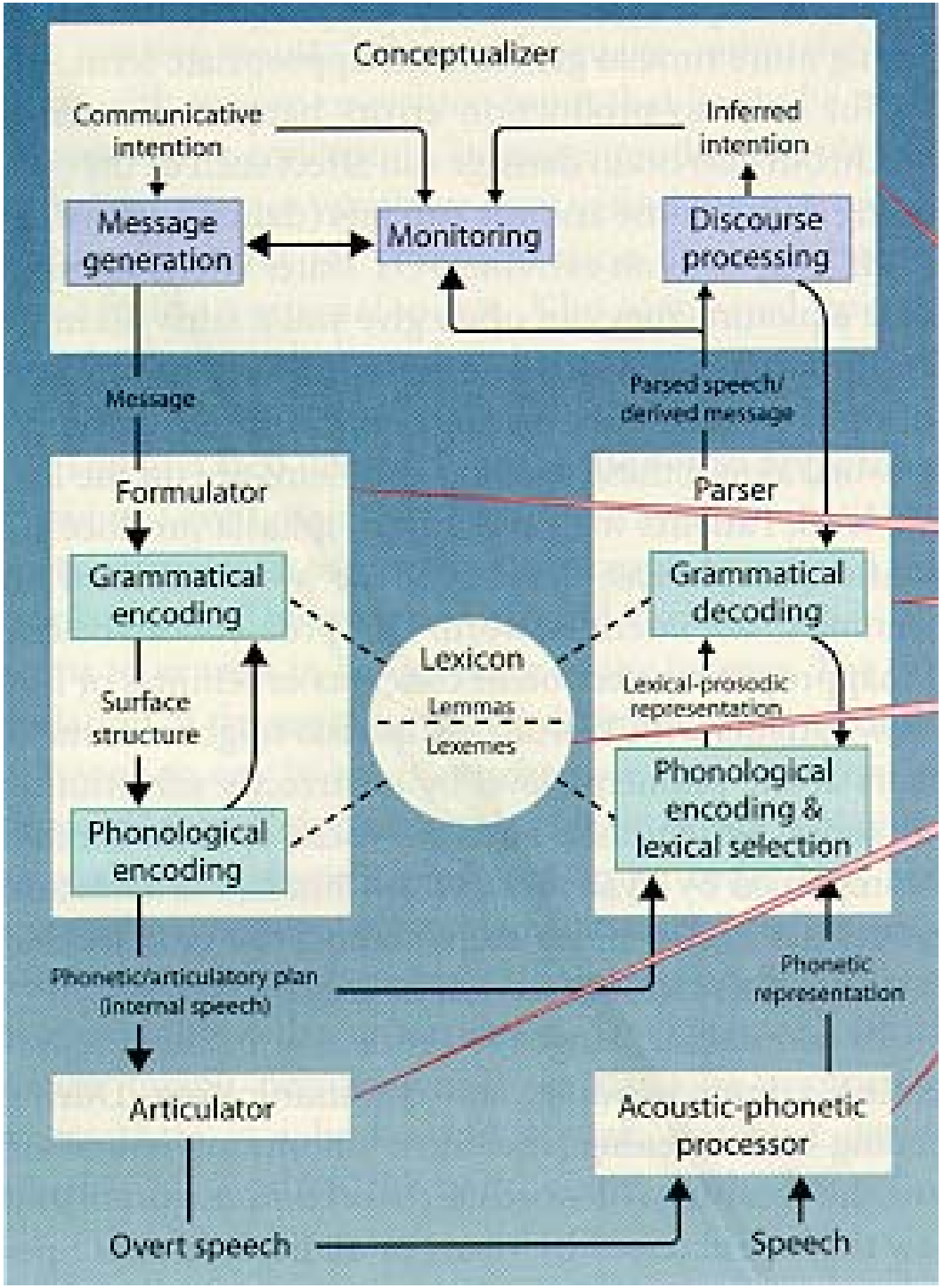
Intention to say or understand something

Meaning

Syntax

Sound

Articulation

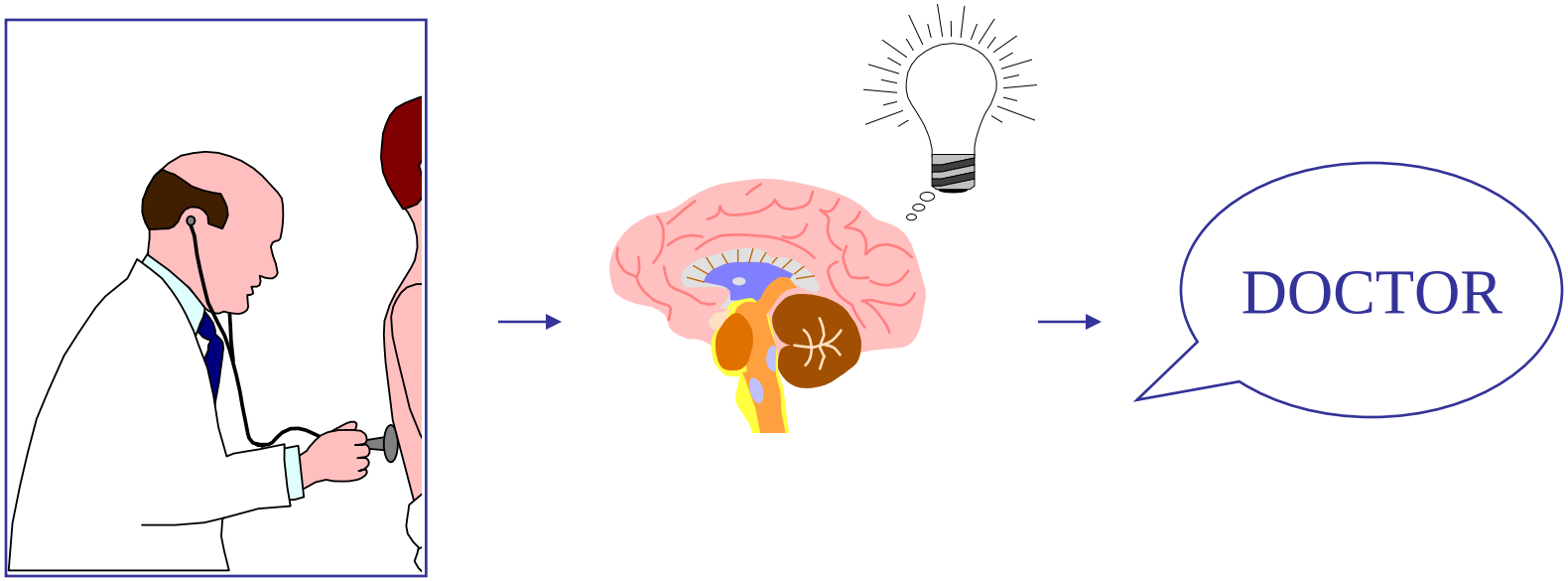

Conceptualizer
Communicative intention
Inferred intention
Message generation
Monitoring
Discourse processing
Message
Parsed speech/ derived message
Formulator
Parser
Grammatical encoding
Grammatical decoding
Lexicon
Lemmas
Lexemes
Surface structure
Lexical-prosodic representation
Phonological encoding
Phonological encoding & lexical selection
Phonetic/articulatory plan (internal speech)
Phonetic representation
Articulator
Acoustic-phonetic processor
Overt speech
Speech

Speaking

- a picture -> speech planning -> naming

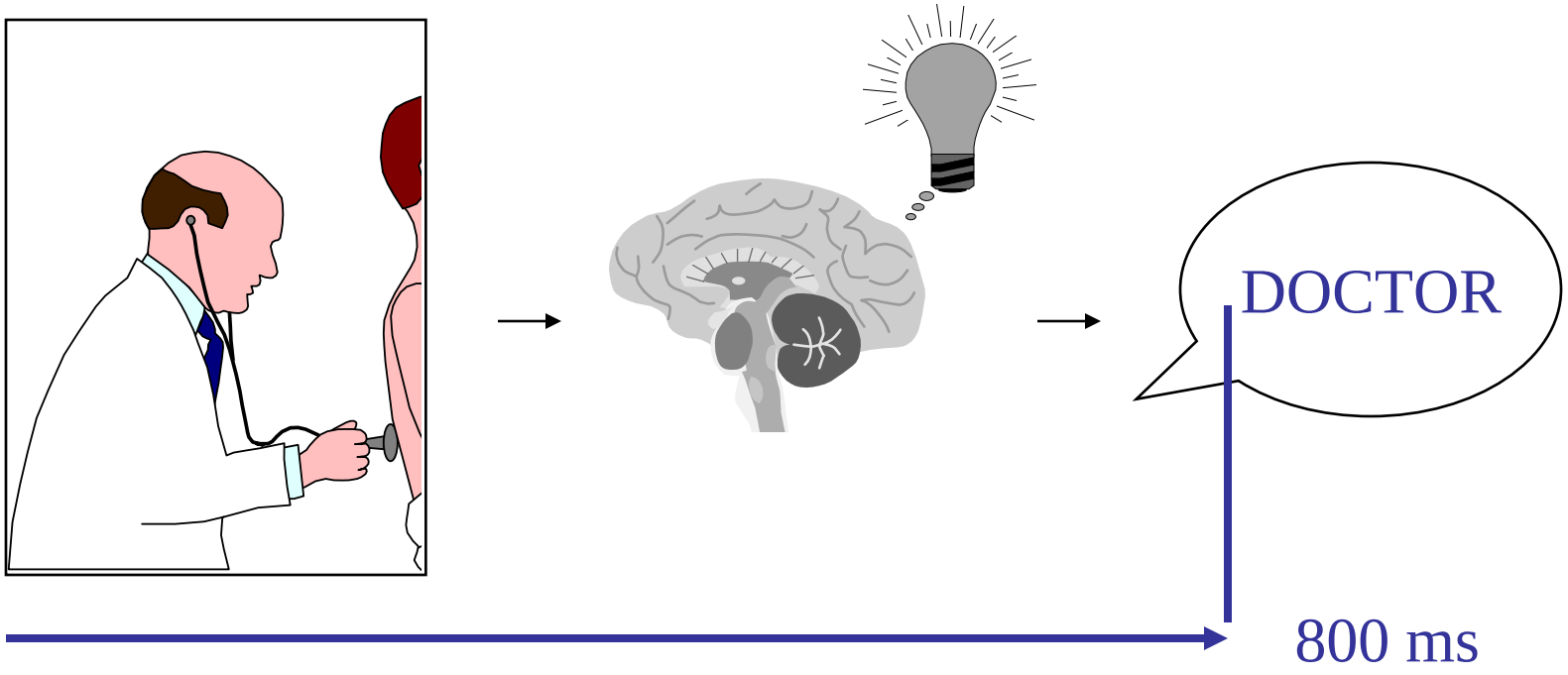
Speaking

- a picture -> speech planning -> a response



Speaking

- a picture -> speech planning -> a response



Manipulate meaning access

Picture-Word Interference Paradigm

- naming Doctor, hearing Nurse 880 ms
- naming Doctor, hearing Sun 830 ms

----

slow down 50 ms

semantic interference effect

Manipulate syntactic access

Picture-Word Interference Paradigm

- is Doctor a “de” or “het” word,
  seeing “het” 680 ms
- is Doctor a “de” or “het” word,
  seeing “de” 620 ms

  ----

  slow down 60 ms

  syntactic incongruency effect

Manipulate phonological access

Picture-Word Interference Paradigm

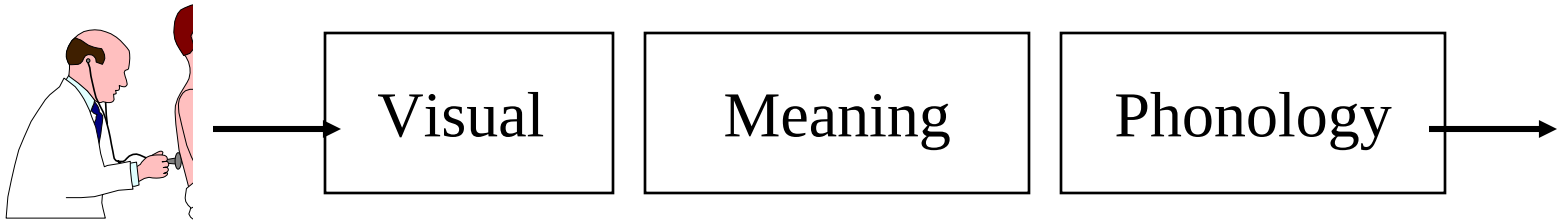
- naming Doctor, hearing Doll 800 ms
- naming Doctor, hearing Sun 830 ms

----

speed up 30 ms

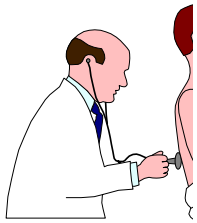
phonological facilitation effect

Time course



Levelt et al., 1991

Time course



Visual

Meaning

Phonology

word

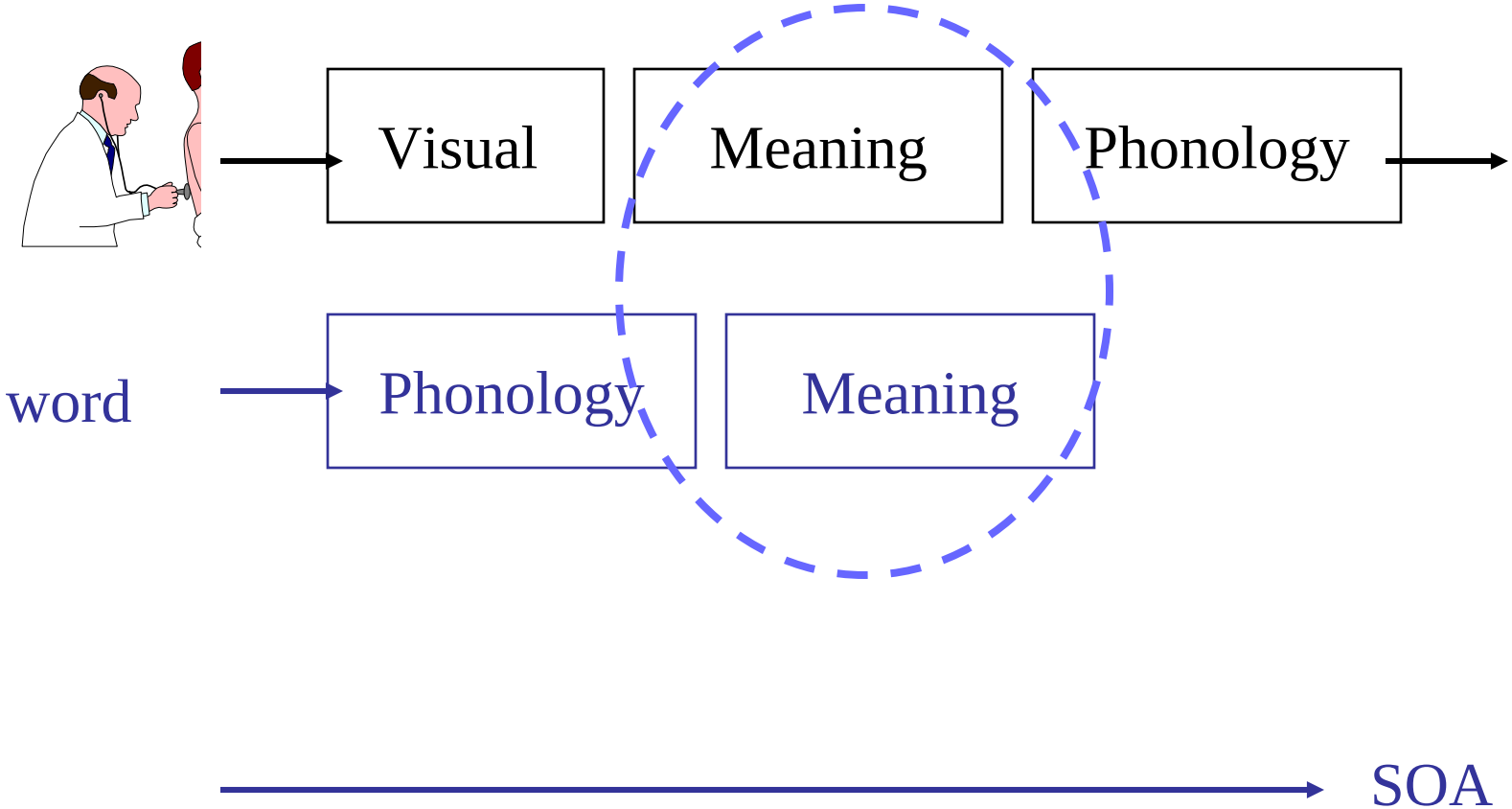
Phonology

Meaning

SOA

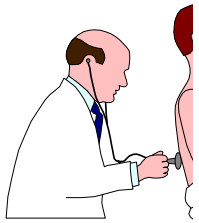
Levelt et al., 1991

Time course



Levelt al., 1991

Time course



Visual → Meaning → Phonology →

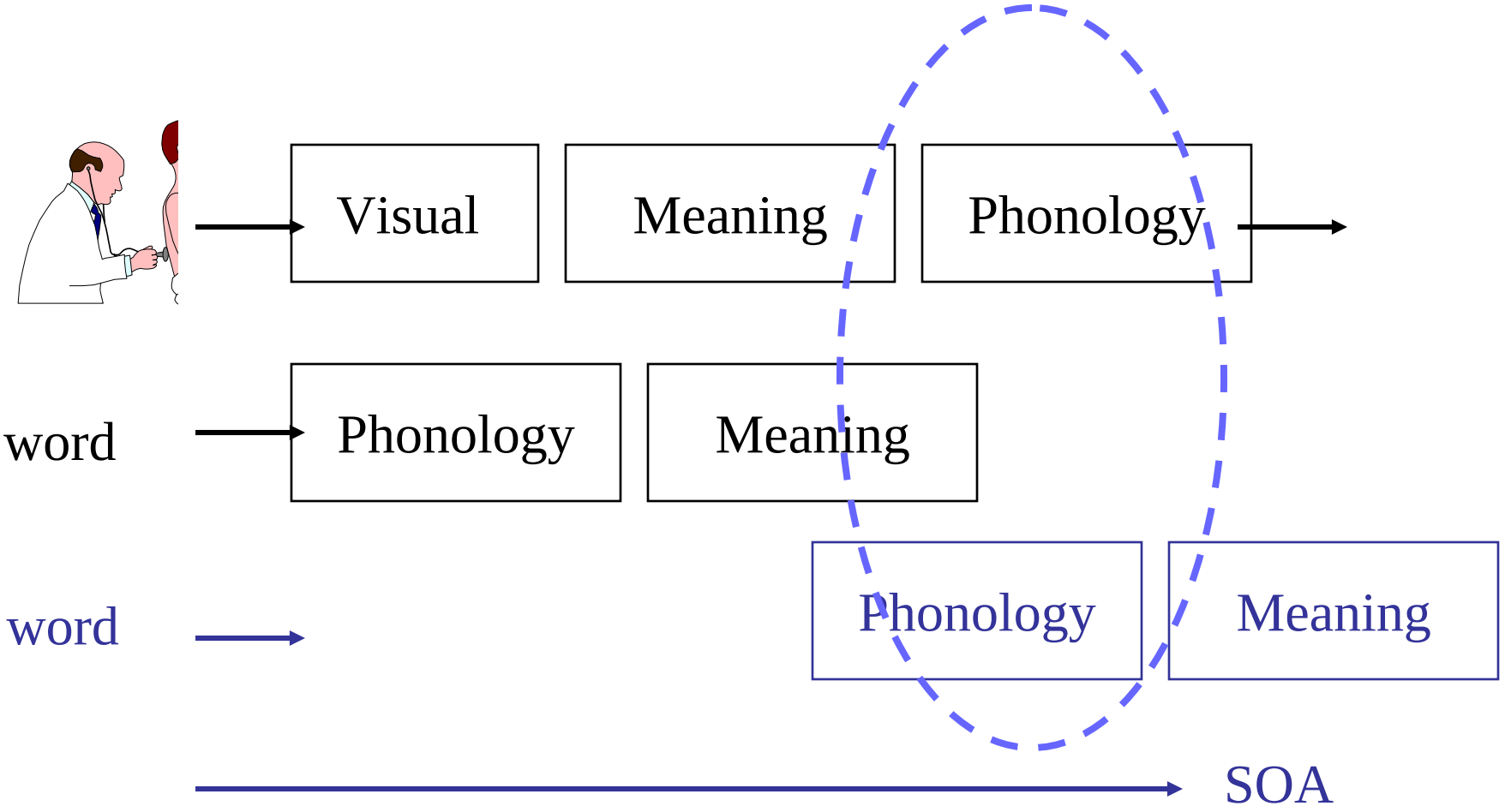
word → Phonology → Meaning

word → Phonology → Meaning

SOA

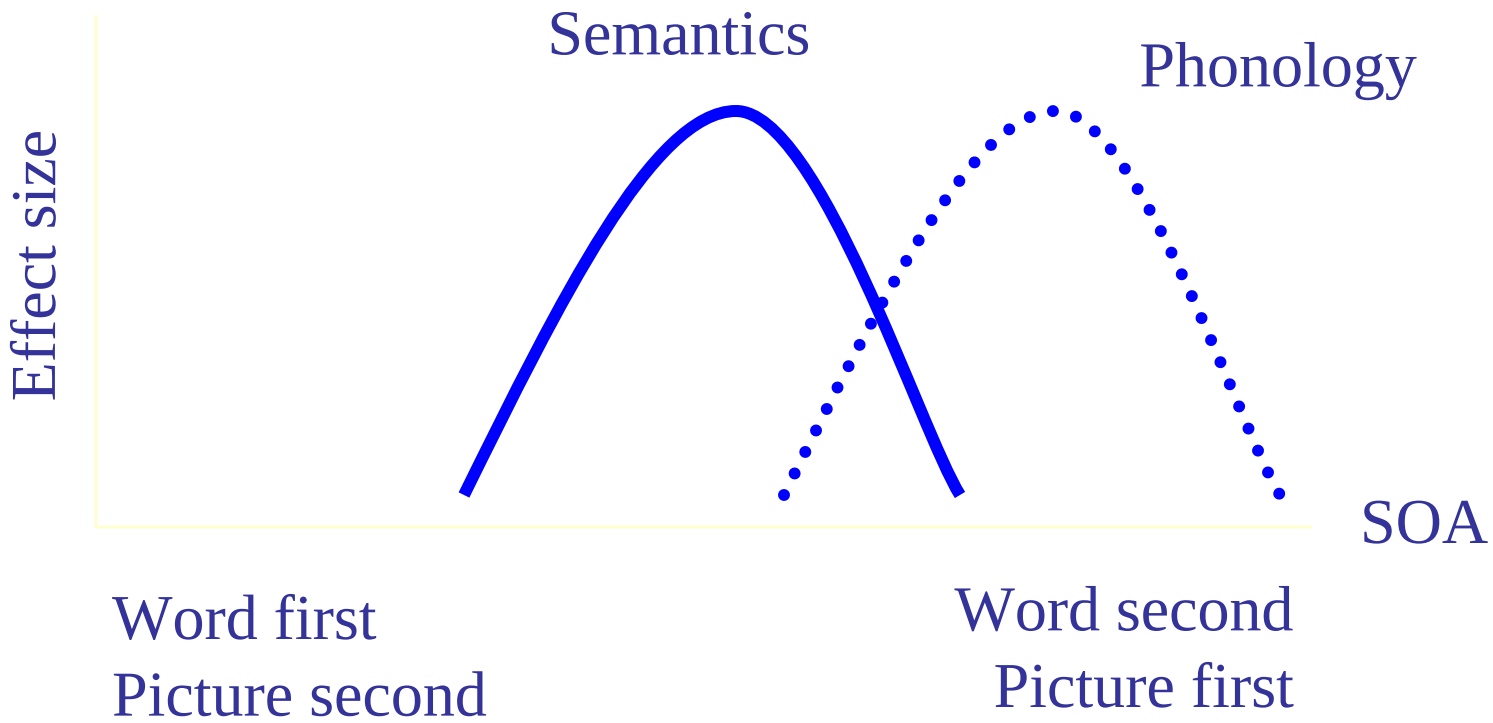
Levelt et al., 1991

Time course



Levelt et al., 1991

Time course



Schriefers et al., 1990

Dry cognitive theory

Test the model in reaction time experiments

Problem:

reaction times only show the end of the process

Other methods?

Look into the process during its run

- Event related potentials

Today’s ERP components

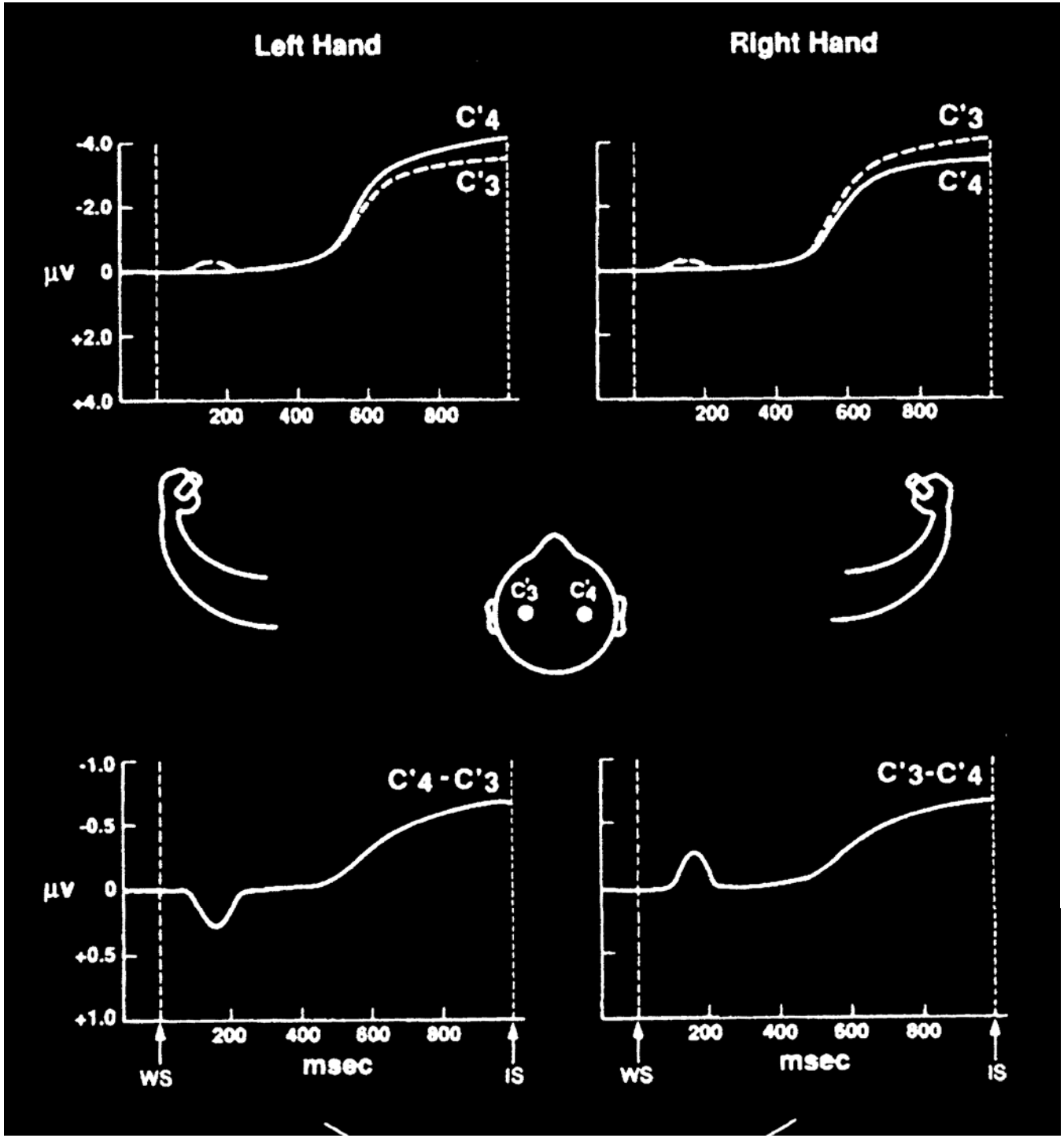
- LRP (lateralized readiness potential)
- (N200)

LRP

- derivative from the Bereitschaftspotential
- button press tasks
- ramp-shape activation above the motor cortex
- planning of movement (before actual movement)
- in go and nogo responses
- maximum contra lateral to movement
- maximum at electrode sites C3’ and C4’

Isolating LRP

- Obtain lateralized activity
  - Subtract potentials from left motor cortex from right (C3 & C4)
  - Separate difference waves for left hand trials and right hand trials
- Cancel out lateralized potentials not directly related to response prep
  - Subtract left hand difference waves from right hand difference waves
- LRP reflects lateralization occurring as a result of motor preparation


Left Hand
Right Hand
C'4
C'3
-4.0
-2.0
μv 0
+2.0
+4.0
200
400
600
800
C'3
C'4
C'4 - C'3
C'3-C'4
-1.0
-0.5
+0.5
+1.0
WS
msec
IS

LRP & Partial Information Transfer

- Can response preparation begin based on partial information?
- Two-choice go-nogo paradigm
- One choice indicates response hand
  - Letter shape
- One choice indicates whether to give response or withhold it
  - Letter size

Miller & Hackley (1992)

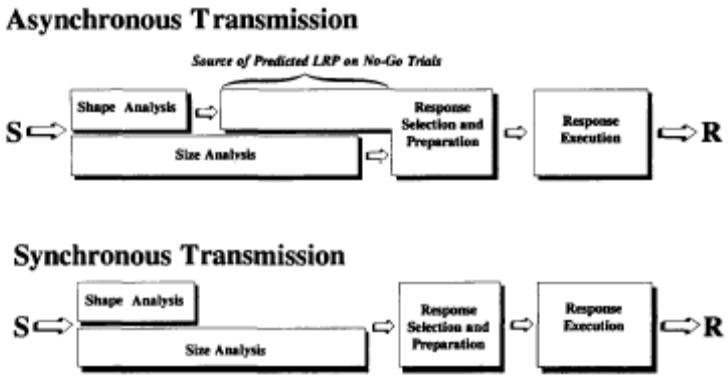


Figure 1. A schematic account of two competing models of interstage communication in human information processing. (The top panel illustrates the asynchronous discrete coding model, which assumes that perceptual-motor transmission occurs in a series of discrete pulses, one for each separable attribute of the stimulus. This model predicts that a lateralized readiness potential should be observed on no-go trials in Experiments 2 and 3. Fully continuous models of information processing would also make such a prediction. By contrast, fully discrete models, as illustrated in the bottom panel, assume that analyses of all task-relevant stimulus attributes must be completed before any perceptual-motor transmission takes place. Such models would not predict a lateralized readiness potential on no-go trials. LRP = lateralized readiness potential; S = stimulus; R = response.)

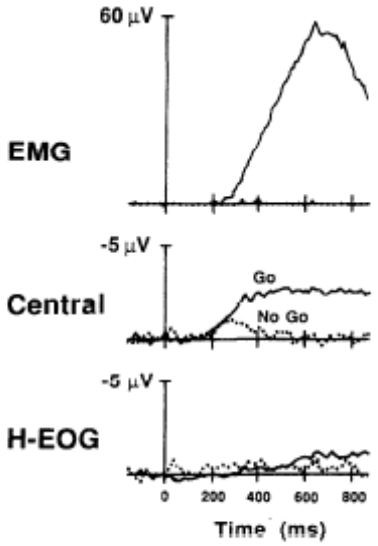


Figure 4. Grand average (N = 12) lateralized readiness potentials (Central), lateralized electromyograms (EMGs) and lateralized electro oculograms (H EOGs) on go and no-go trials of Experiment 2. (Lateralization of activity was calculated by subtracting, ms by ms, the waveform for trials on which the hand ipsilateral to the noninverting electrode was cued by letter shape from the waveform for trials on which the contralateral hand was cued. Note that significant lateralization of the motor readiness potential was obtained on no-go trials [dotted lines], and this lateralization was similar in onset latency to that observed on go trials [solid lines]. Each curve in this figure represents an average of roughly 7,600 responses for go trials or 660 responses for no-go trials.)

- Shape information available early (hand)
- Size information available late (go/nogo)
- LRP Present on no-go trials! Why?
- Partial stimulation activates response even before go/nogo decision is made

LRP

- Real time measure of response preparation
- Response selection can begin even before complete stimulus information available
- LRP provides index of time when different aspects of stimulus available for response selection

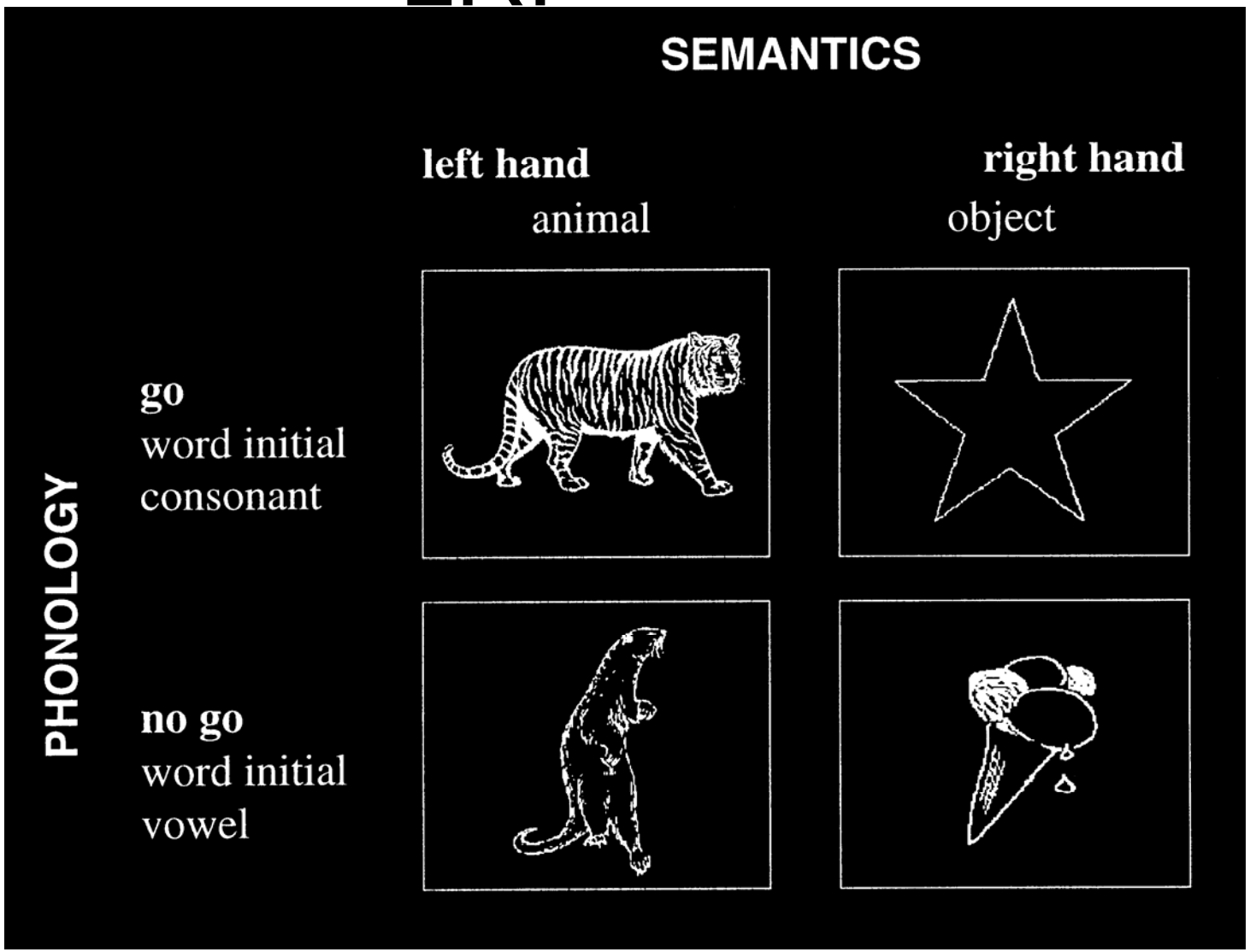
LRP in language production

- preparation to respond
- indicates when specific information becomes available
- dual choice go/nogo paradigm (Van Turennout et al., 1997, 1998)

- two decisions
- one is based on semantics
- one is based on phonology

LRP

design


SEMANTICS
left hand
animal
right hand
object
PHONOLOGY
go
word initial
consonant
no go
word initial
vowel

LRP: two major conditions

hand = semantics

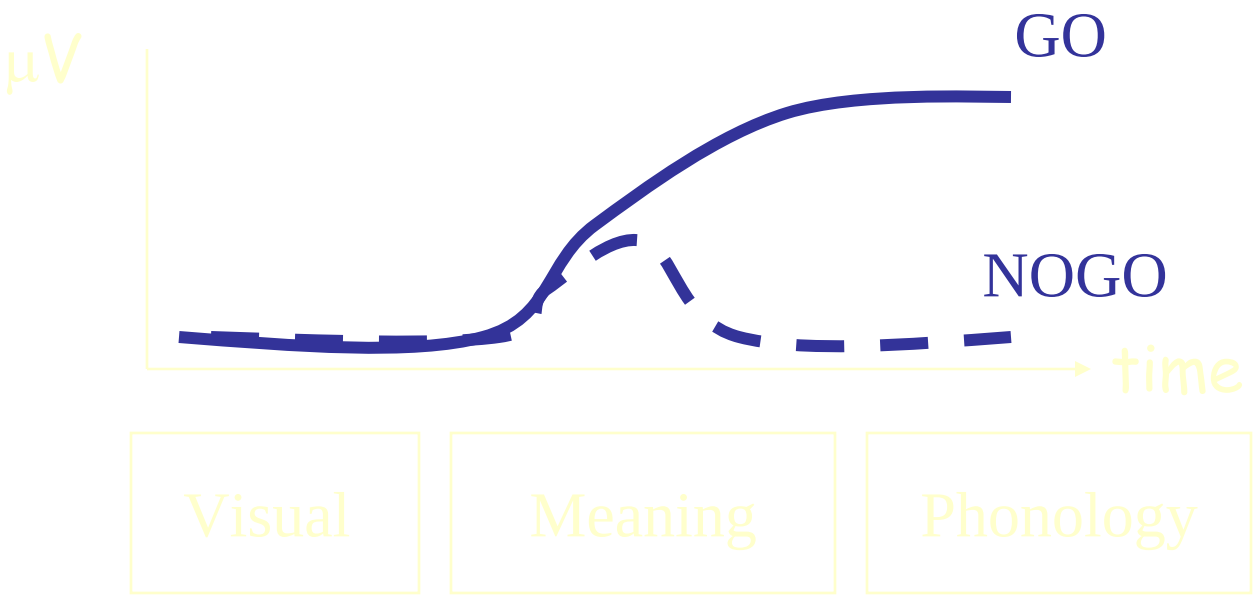
- left/right hand response preparation on semantics
- go/nogo decision contingent on phonology

hand = phonology

- left/right hand response preparation on phonology
- go/nogo decision contingent on semantics

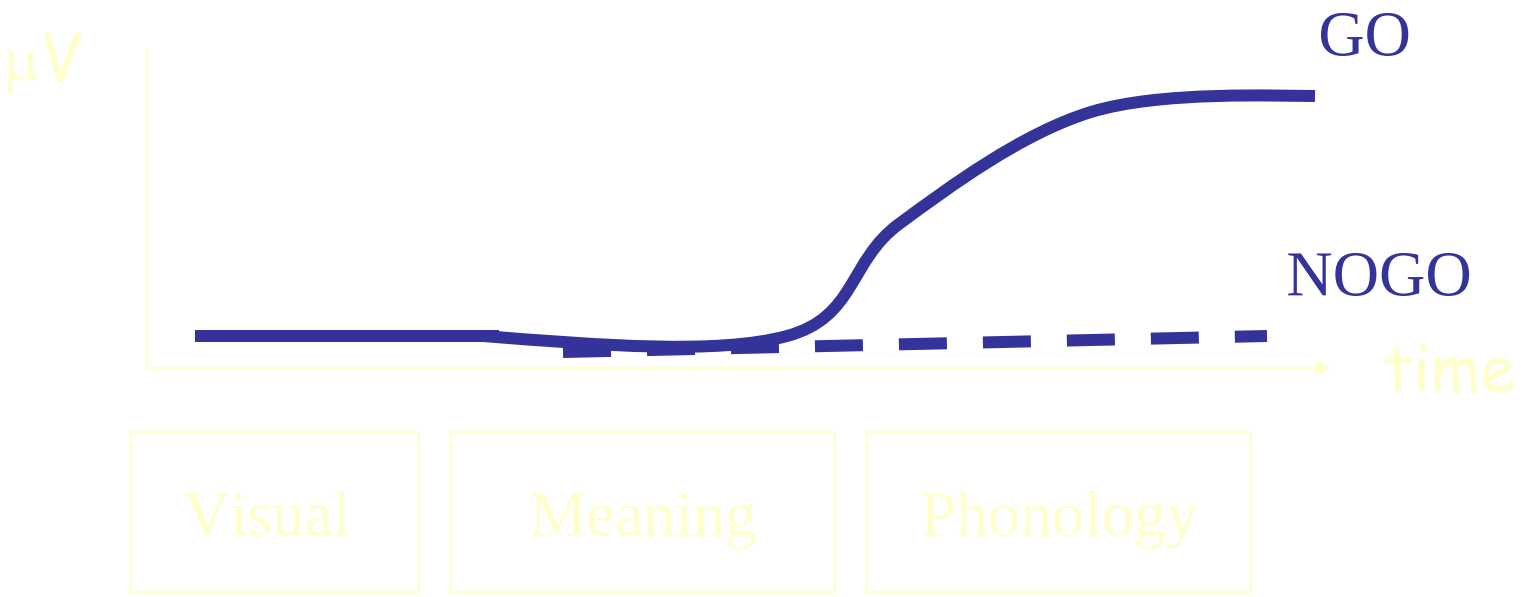
LRP Hypothesis

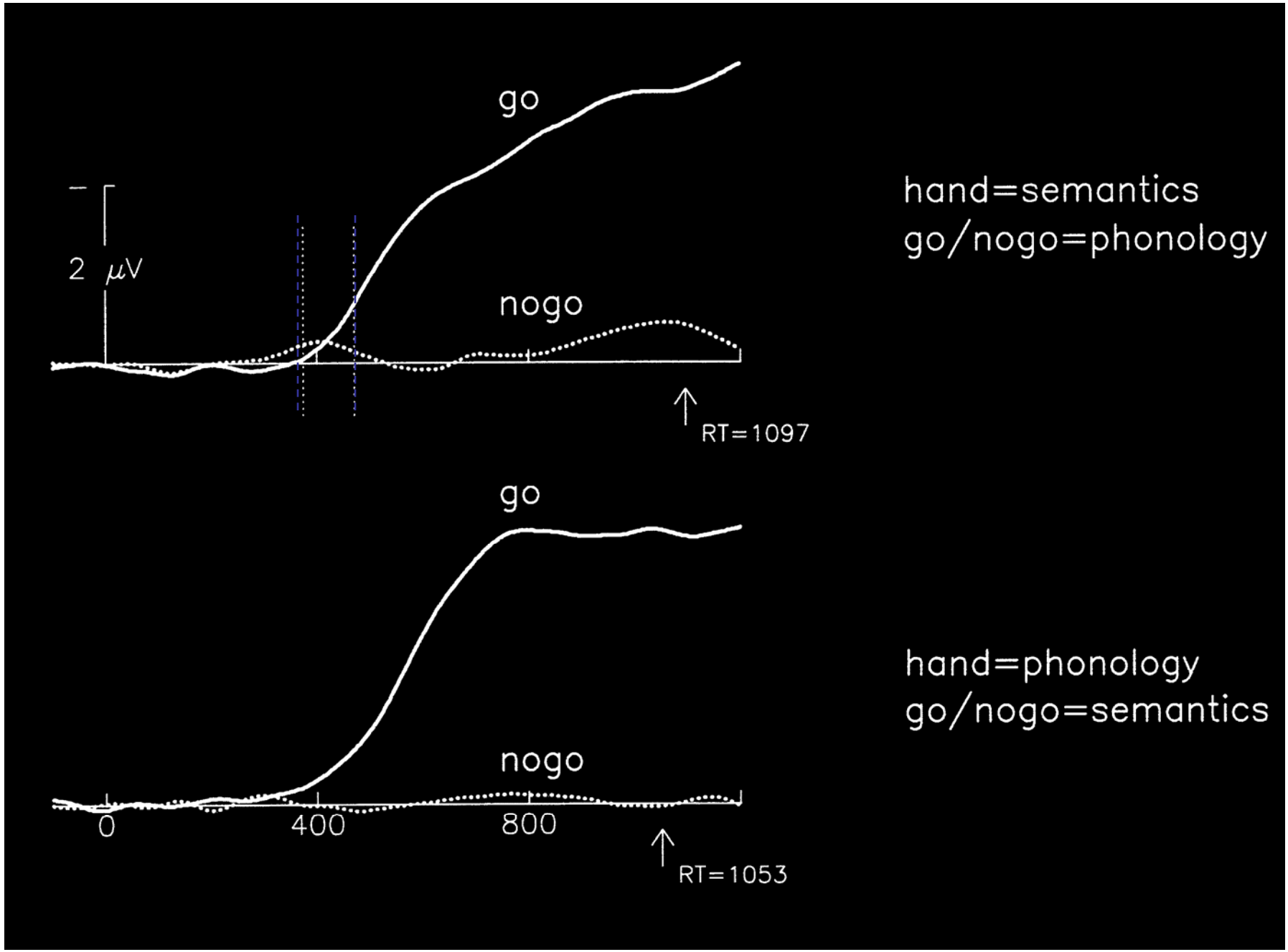
- hand = semantics
- if semantics precedes phonology LRP even on nogo trials



LRP Hypothesis

- hand = phonology
- if semantics precedes phonology LRP only on go trials




go
2 μV
nogo
RT=1097
go
nogo
0
400
800
RT=1053
hand=semantics
go/nogo=phonology
hand=phonology
go/nogo=semantics

LRP Conclusions

- nogo LRP in hand = semantics
- no nogo LRP in hand = phonology
- data fit hypothesis
- semantic encoding precedes phonological encoding