

Visual masking reveals two qualitatively different levels of unconscious cognition

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Note: The reproduced slides from the presentation do not contain quite enough information to be easily understandable.
This version therefore contains amplification in the form of notes in this red font.

A few preliminaries

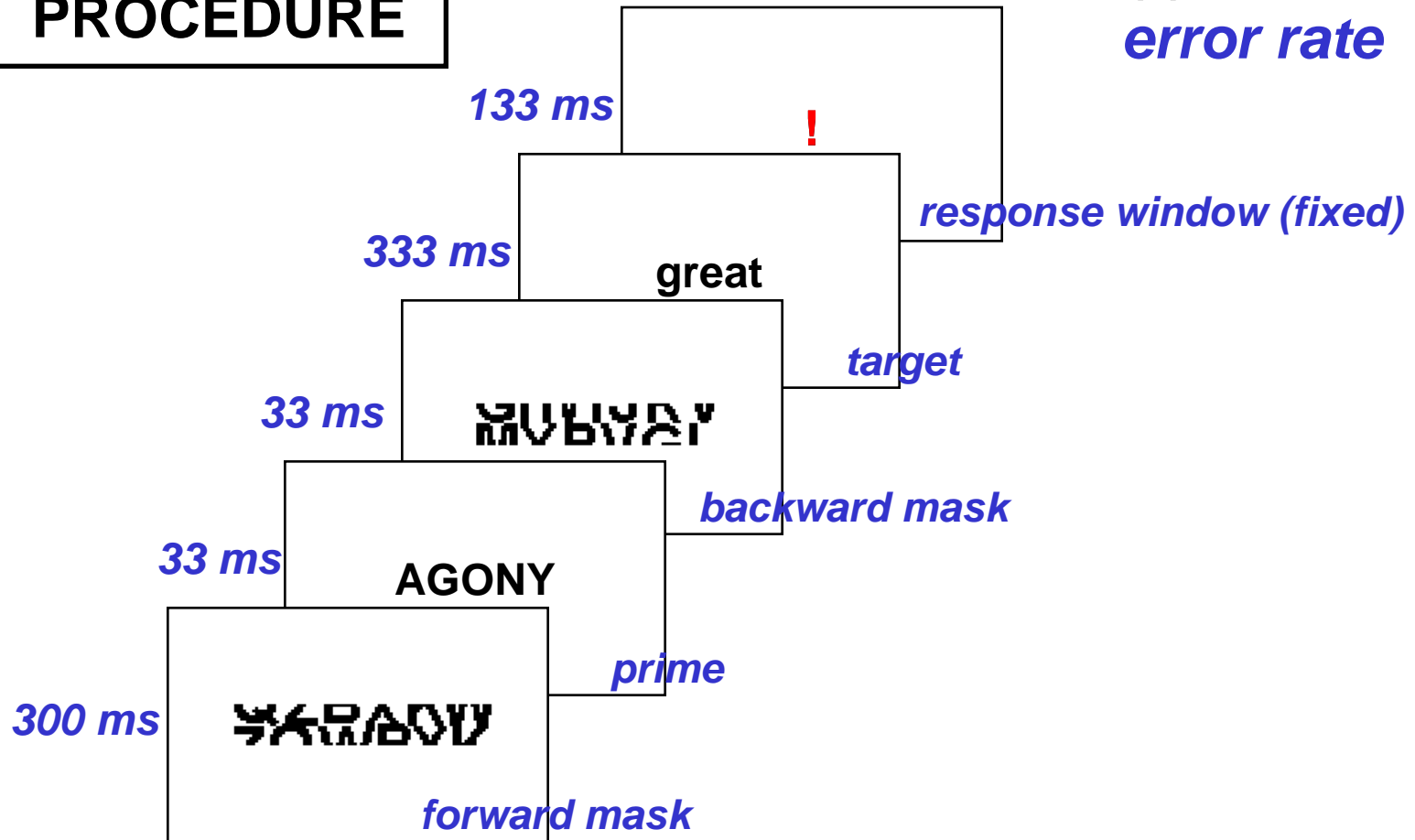
- The subliminal priming effects to be described are **easily producible**
- They depend on **practice** in classifying target words
- Most of these effects are produced by **subword letter strings** that have acquired meaning during an initial practice period of the experiment
- The effects do **not** show retrieval of meanings of whole words

Instructions for the valence classification task

- **Press the right key if the word is pleasant in meaning**
- **Press the left key if the word is unpleasant in meaning**
- **Respond while the exclamation point is on the screen**

RESPONSE WINDOW PROCEDURE

Priming effect appears on **error rate**



Note: This illustration of procedure is for a valence classification task. The trial shown is one with an incongruent prime-target combination. The opposite-valence prime tends to select a response opposite to that selected by the target. Under time pressure of the response window, this will produce noticeably more errors than with congruent priming.

Inquisit

The response window procedure and the procedure used to test for visibility of the masked prime stimuli were demonstrated at this point.

To cover a lot, experiments will be summarized by showing only

- **examples of stimuli used as targets**
- **examples of stimuli used as primes**
- **priming effects, measured as sensitivity (d') of the target response to the prime stimulus**

Except for the most recent results, data from visibility tests will not be shown.

However, careful visibility tests were done in each experiment.

'STANDARD' FINDING

unpleasant pleasant

*practice &
test target
stimuli:*

anger
blind
grief
jail

home
kiss
ocean
happy

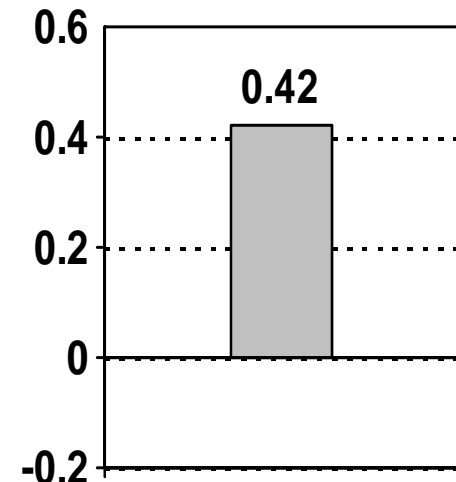
unpleasant pleasant

*test
(masked)
primes:*

ANGER
BLIND
GRIEF
JAIL

HOME
KISS
OCEAN
HAPPY

*priming
effect (d')*



N = 12, $p = .0002$

Note: Primes are from the same set that the subject had initially practiced classifying as targets. Targets are always presented lower case; primes upper case

*This priming effect is obtained with words that subject has **practiced** classifying*

NONWORD 'HYBRID' PRIMES

unpleasant pleasant

*practice &
test target
stimuli:*

sm**ut**
b**ile**
d**read**
s**cream**

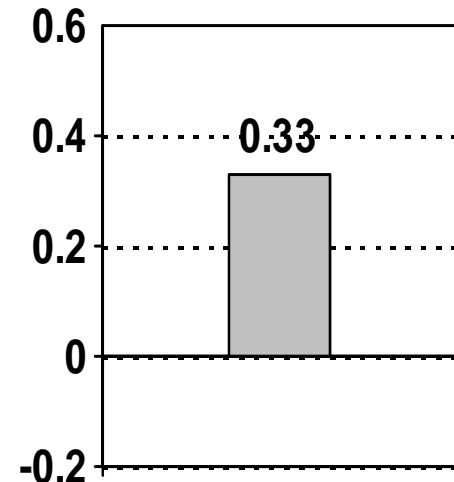
tul**ip**
h**umor**
ang**el**
ch**eer**

*test
(masked)
primes:*

BIUT
SCREAD

HULIP
CHEEL

*priming
effect (d')*



N = 12, $p = .0002$

Note: Primes are constructed as combinations of parts of practiced target words. (Colors show 'parent' practiced target words and the 'hybrids' produced from them. All stimuli were presented in black font.)

*This effect depends on **practice** classifying the words that contain the recombined pieces that compose primes*

Abrams & Greenwald, *Psychological Science*, 2000.

CONCLUSIONS (1)

- **Nonword hybrid primes act subliminally as if they had the valence of their ‘parent’ words**
- **Subliminal priming is capable of analyzing information from **subword** units**
- **These effects depend on **practice** classifying the ‘parent’ target words**

NONWORD (REARRANGED-WORD) PRIMES

unpleasant pleasant

*practice &
test target
stimuli:*

harm
debt
jerk
ugly

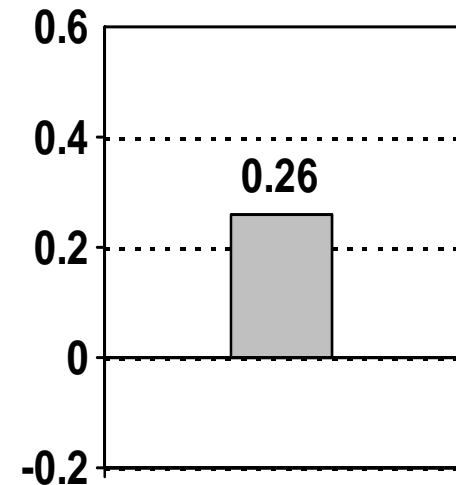
mint
silk
posh
cozy

*test
(masked)
primes:*

AHMR
EDTB
KREJ
GUYL

TNIM
ISKL
HSOP
OCYZ

*priming
effect (d')*



N = 5, p = .01

Note: Primes are constructed as non-pronounceable non-word anagrams from the practiced target words.
(Colors show 'parent' words and descendant anagram primes. All stimuli were presented in black font.)

'FRANKENSTEIN' PRIMES

unpleasant pleasant

*practice &
test target
stimuli:*

bleed
mice
geek

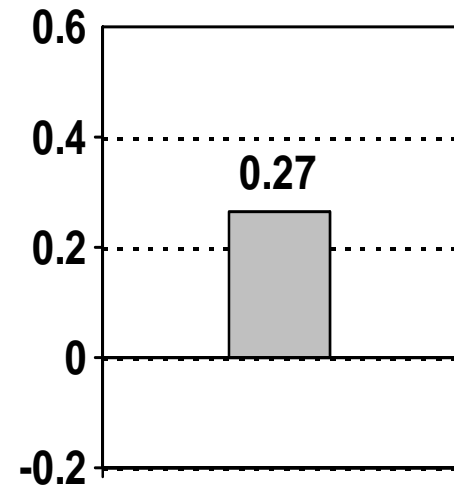
swan
toy
purr

*test
(masked)
primes:*

MBLD
GKCB
CMLG

STPW
TYSR
PNYR

*priming
effect (d')*



N = 11, $p = .002$

Note: Primes are constructed from ill-fitting pieces from multiple parent words. (Again, colors show the relation between practiced 'parent' target words and the primes created from their consonants.)

REPEATED-CONSONANT PRIMES

unpleasant pleasant

*practice &
test target
stimuli:*

puny
war
soot

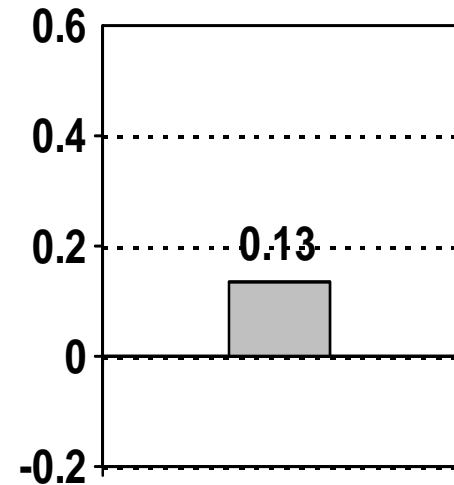
medic
big
like

*test
(masked)
primes:*

NNNN
RRRR
YYYY

DDDD
GGGG
KKKK

*priming
effect (d')*



N = 16, $p = .01$

Note: Even single consonants from practiced words were found to function as subliminal primes, although the priming effect was weaker than in preceding experiments.

CONCLUSIONS (2)

Subliminal priming is achieved easily by letter strings composed of ill-fitting parts such as:

- **nonword anagrams of *practiced* target words**
- **consonants from multiple *practiced* target words**
- **repeated single consonants from *practiced* target words suffice to produce subliminal priming**

UNPRACTICED ('ORPHAN') PRIMES

unpleasant pleasant

*practice &
test target
stimuli:*

dumb
menace
victim
waste

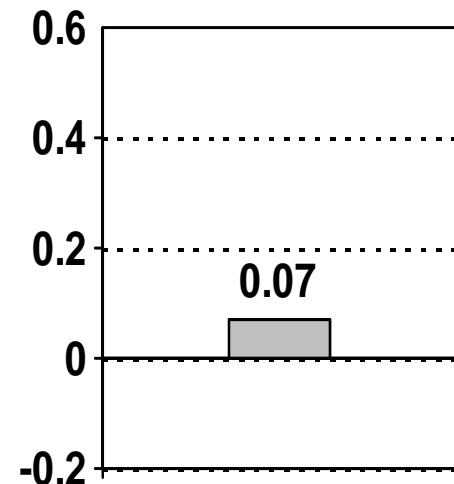
dance
nature
rich
warmth

*test
(masked)
primes:*

ANGER
BLIND
GRIEF
JAIL

HOME
KISS
OCEAN
HAPPY

*priming
effect (d')*



$N = 12, p = .14$

Note: Unlike previous experiments, primes were words that had **not** previously been practice-classified as targets. This did not produce a significant priming effect, although the d' priming measure was above zero.

Abrams & Greenwald, *Psychological Science*, 2000.

TOTAL 'ORPHAN' PRIMES

unpleasant pleasant

<i>practice & test target stimuli:</i>	barf	food
<i>letter set:</i>	damp	posh
abdfhmoprsw	doom	prom
	drab	shop

<i>test (masked) primes:</i>	EVIL	CUTE
<i>letter set:</i>	GEEK	GLEE
cegi klnqtuvy	JUNK	LIVE
	QUIT	LUCK



Note: Primes in this experiment were 'total' orphans, which contained no parts (letters) from previously practiced target words. The priming effect was nil.

PARADOXICAL 'HYBRID' WORD PRIMES

unpleasant pleasant

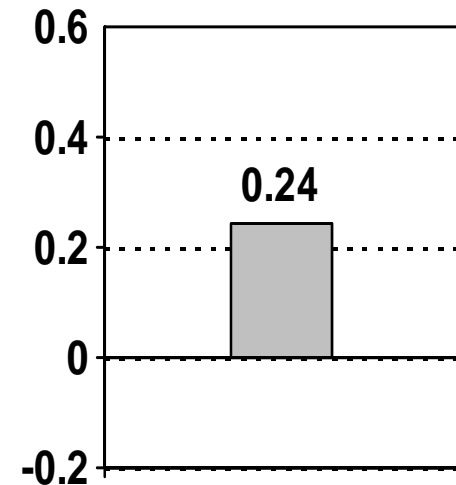
*practice &
test target
stimuli:*

smut	tulip
bile	humor
dread	angel
scream	cheer

*test
(masked)
primes:*

SMILE	TUMOR
DREAM	ANGER

*priming
effect (d')*



N = 34, $p = 10^{-9}$

Note: These primes are constructed like the hybrid primes in Slide 8. Now, the primes are words that have evaluative meaning opposed to that of the practiced parent words from which their (recombined) parts came.

These primes functioned subliminally (and paradoxically) with the valence of their parent words.

Abrams & Greenwald, *Psychological Science*, 2000.

CONCLUSIONS (3)

- Paradoxical hybrid word primes (just like nonword hybrids) act subliminally as if they had the valence of their **practiced** ‘parent’ words
- ‘Orphan’ words (**not practiced** as targets) act weakly (if at all) as subliminal primes
- These results give **no indication** that subliminal priming has access to long-term memory of word meaning

SOME INTERESTING QUESTIONS

- **How much additional prime exposure would it take to find that subliminal primes were able to activate word meanings?**
- **Would it have to be long enough so that the primes would become visible?**

The following four slides show stimulus materials and results for a new experiment that was designed to answer these questions by using prime duration as a between-subjects variable. There were four levels of prime duration: 17, 33, 50, and 67 ms (prime-target SOA = 83 ms; a backward mask filled the interval between end of prime and start of target).

The experiment was conducted separately with name-gender (shown first) and word valence classification tasks.

These words were initially practiced targets, and also later used as primes

Practiced Male Name Primes

DIRK
SHANE
JOE
EDDIE
JULIUS
RUDY
BERTRAM
KEITH
PAUL
ADAM

These words were used as primes, but without any previous practice classification

Unpracticed Male Name Primes

MATT
MIKE
NICK
AARON
OSCAR
PETER
THAD
ERIC
ANDY
SCOTT

These nonsense hybrids (derived from the practiced targets) were used as primes

Nonsense Male Hybrid Primes

SHIRK = shane + dirk
EDOE = eddie + joe
RUIUS = rudy + julius
KEIRAM = keith + bertram
ADAUL = adam + paul

Practiced Female Name Primes

LOUANN
DORIS
EVELYN
FRAN
ALICE
ELLEN
NELL
GAIL
CLAIRE
FLORENCE

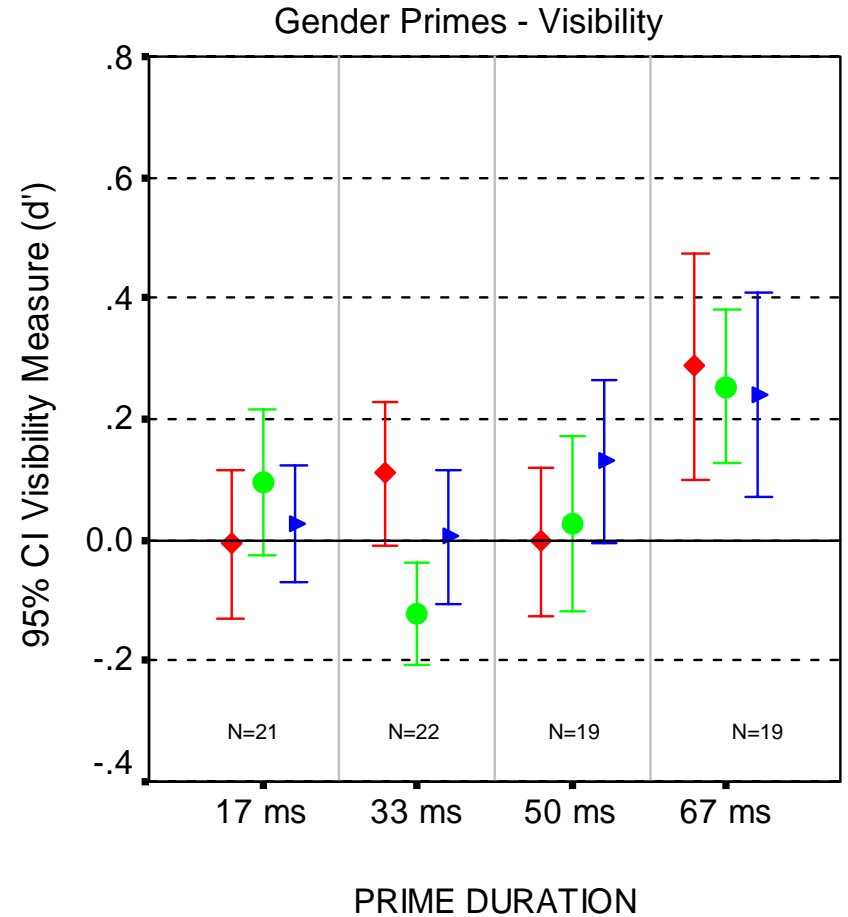
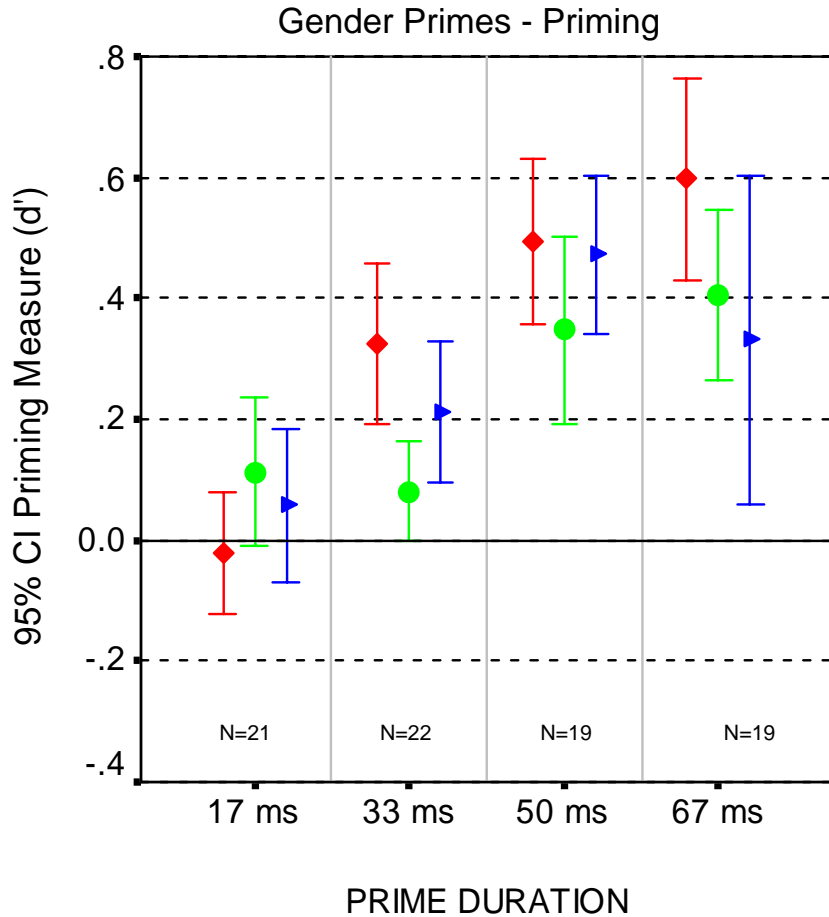
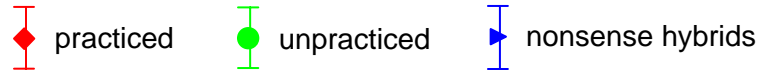
Unpracticed Female Name Primes

KATE
LINDA
PEGGY
HEIDI
FAYE
ETHEL
ERIN
NICOLE
PHOEBE
AUDREY

Nonsense Female Hybrid Primes

DORNN = doris + louann
FRAVE = fran + evelyn
ELLCE = ellen + alice
GALL = gail + nell
FLOIRE = florence + claire

PRIME TYPE



Results to notice: (a) Visibility tests (right panel) showed lack of visibility (d' near zero) up to 50 ms prime duration. (b) unpracticed words (green bars) were effective primes (left panel) at 50 ms, but not at shorter durations. (c) Practiced and nonsense hybrid primes were effective at a shorter subliminal duration (33 ms). I.e., effects were qualitatively different at 33 ms and 50 ms, but these two different effects were both subliminal, as shown by the visibility test.

These words were initially practiced targets, and also later used as primes

Practiced Negative Valence Primes

FRAIL
FLEE
POOR
PHONY
GOON
CLOD
CHEAT
DANGER
BLEMISH
MESS

These words were used as primes, but without any previous practice classification

Unpracticed Negative Valence Primes

RAPE
AFRAID
BOMB
UGLY
WRONG
TRAP
STINK
FIGHT
PAIN
HELL

These nonsense hybrids (derived from the practiced targets) were used as primes

Nonsense Negative Hybrid Primes

FLIL = flee + frail
PHOR = phony + poor
CLON = clod + goon
DANAT = danger + cheat
MEMISH = mess + blemish

Practiced Positive Valence Primes

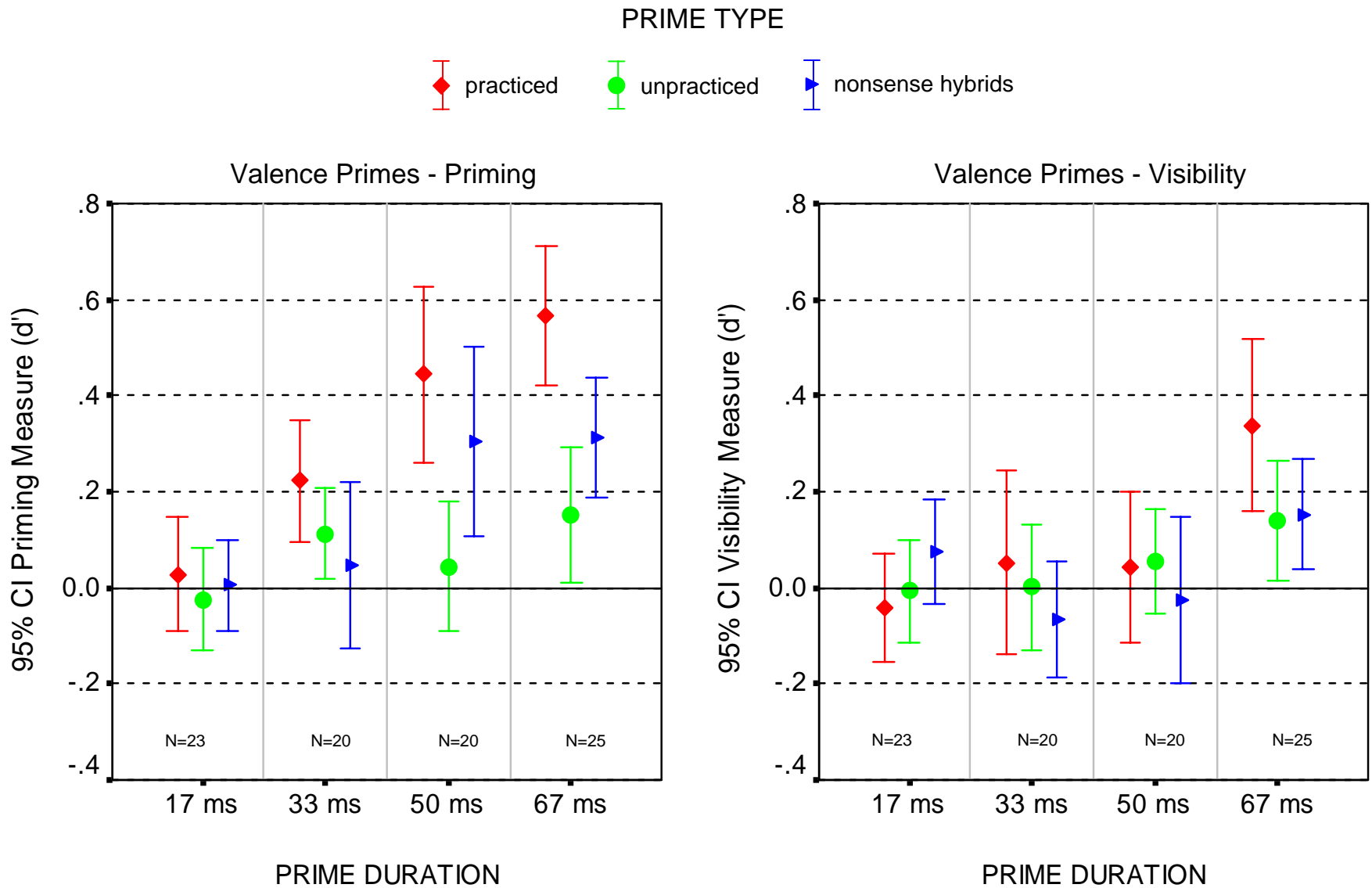
BIG
SMILE
SCIENCE
DREAM
FAME
SAVE
SLED
LAKE
WARM
DEAR

Unpracticed Positive Valence Primes

HEALTH
PEACH
THANK
FIRST
KIND
STRONG
TRUE
CUTE
RICH
ABLE

Nonsense Positive Hybrid Primes

SMIG = smile + big
DRENCE = dream + science
FAVE = fame + save
SLKE = sled + lake
DERM = dear + warm



Results to notice: (a) Visibility tests (right panel) showed lack of visibility (d' near zero) up to 50 ms prime duration. (b) Practiced and nonsense hybrid primes were effective at 50-ms duration (left panel) but unpracticed primes were not effective at that duration (this was like the name-gender primes at the shorter duration of 33 ms). (c) Somewhat puzzlingly, unpracticed words (green bars) were effective as subliminal primes (but barely) at the 33-ms duration.

CONCLUSIONS (4)

- **There is a level of stimulus exposure (prime duration?) at which (a) words are not visible and (b) parts of words, but not whole words, are analyzed**
- **There is a level of greater exposure at which (a) words are still not visible and (b) long-term semantic memory of word meaning is accessed.**
- **These appear to be two qualitatively different levels of unconscious cognition**
- **The results, alas, do not show this quite as cleanly (for the valence primes) as is desirable**

MOST INTERESTING **UNANSWERED QUESTION**

Why was word meaning accessible for name gender (but not word valence) with prime duration = 50 ms?

- **Gender is the only dimension of meaning for names (valence is only one of many dimensions of word meaning)**
- **Gender meanings of names don't change (valences associated words often do)**
- **Languages have classes of words based on male-female gender (not valence)**

Whether higher-level visual processing of visual objects can occur without awareness remains controversial. Here, the sandwich masking procedure and event-related potential (ERP) were applied to investigate the unconscious processing of visual objects. The behavioral results indicated that sandwich masking successfully eliminated visual awareness of the masked images. The ERP results revealed that early visual processing, which was reflected by the N/P100 effect, was preserved in the absence of visual awareness. However, higher-level visual processing was eliminated by sandwich masking. The present study suggests that the unconscious processing of visual objects is limited to early visual processing.

View. Show abstract. Visual masking is a phenomenon of visual perception. It occurs when the visibility of one image, called a target, is reduced by the presence of another image, called a mask. [1] The target might be invisible or appear to have reduced contrast or lightness. There are three different timing arrangements for masking: forward masking, backward masking, and simultaneous masking. There are two different spatial arrangements for masking: pattern masking and metacontrast. Pattern masking occurs when the target and mask locations overlap. Metacontrast masking occurs when the mask does not overlap with the target location.

"Neural Compensation Mechanisms of Siblings of Schizophrenia Patients as Revealed by High-Density EEG". *Schizophrenia Bulletin*. Unconscious Cognition Reclaimed. Anthony G. Greenwald University of Washington. Recent research has established several empirical results that are widely agreed to merit description in terms of unconscious cognition. A familiar theme in academic psychology has been that psychoanalytic conceptions of unconscious cognition lack empirical confirmation. This skeptical view-which partly explains the omission of the topic of unconscious cognition from many textbooks, and even the omission of the word unconscious from the vocabularies of many psychologists-was prevalent in the 1950s, when concerted empirical research (the New Look, starting with Bruner & Postman, 1947) ultimately subsided with much achieved, but without any convincing evidence for.

Two means of suppressing visual awareness: A direct comparison of visual masking and transcranial magnetic stimulation. *Cortex*, 48, 333-343. Do unconscious and conscious modes of processing depend on different neural pathways? The objective is to find out the minimal neuronal mechanisms jointly sufficient for any one specific conscious percept (Crick & Koch, 2003, p. 119). There are multiple different methods for manipulating visual consciousness (Kim & Blacke, 2005), but the present thesis focuses on two methods: metacontrast masking and TMS. As discussed later in detail, in metacontrast masking a visual mask stimulus prevents the conscious perception of another, preceding visual stimulus.