

**Effects of Audio-Video Asynchrony on
Viewer's Memory, Evaluation of Content and
Detection Ability**

Research Report Prepared for
Pixel Instruments

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Effects of Audio-Video Asynchrony on Viewer's Memory, Evaluation of Content and Detection Ability

Research Questions:

1. Does audio-video asynchrony change viewers' evaluation of television content, and memory for television content?
2. Can viewers detect audio-visual asynchrony in television programs?

Experimental Methods:

1. *Laboratory experiment:* conducted at Stanford University.
2. *Procedure:* People viewed three different versions (no asynch, 2.5 fields asynch, 5 fields asynch) of six television segments. After each segment, viewers evaluated the speakers in the segments. After viewing all segments, viewers were tested for memory of the segments, and they were asked if they could detect synchronization problems in the segments.
3. *Subjects:* 18 adults between the ages of 19 and 45; half men, half women.
4. *Equipment:* All video material was shown to single viewers on a rear-projection screen using a 3/4 in Sony U-Matic with an Eiki video projector. Subjects were seated 7 feet from the screen and viewed a 24 inch high picture.
5. *Manipulation of audio-video synchronization:*

Version #1 -- Perfect audio-video synchronization
Version #2 -- Audio preceded video by 2.5 video fields
Version #3 -- Audio preceded video by 5 fields

6. Description of stimuli:

- Message #1 -- Fitness Center ad (male and female announcers)
- Message #2 -- Jewelry store ad (*male* announcer)
- Message #3 -- News story about computers (*female* announcer)
- Message #4 -- Ad for radio station (female announcer)
- Message #5 -- News story with woman senator as featured speaker
- Message #6 -- News story about federal budget (female newscaster)

7. Measures of evaluation:

Eight 8-point scales evaluating main speaker (see questionnaire):

Effective	Ineffective
Understandable	Confusing
Pleasant	Unpleasant
Influential	Uninfluential
Bungling	Skillful
Aggravating	Soothing
Intelligible	Unintelligible
Agitated	Calm

Eight 8-point scales evaluating the overall presentation:

Well produced	Poorly produced
Unsuccessful	Successful
Fast	Slow
Likable	Unlikable
Unpersuasive	Persuasive
Rough	Smooth
Cast well	Cast poorly
Good	Bad

All evaluation scales (with the exception of slow/fast) summed for overall positive-negative index.

8. *Measures of memory:*

Three multiple-choice memory questions were asked for each of the six message segments. All memory questions (18) were then summed into an overall memory index for all information.

9. *Measures of detection ability:*

Two different types of questions asked viewers whether they noticed problems with audio-video synchronization:

Question 1: "Do you have any comments about the segments that you just viewed?" (No mention of possible synchronization problems.)

Question 2: "Please indicate in which of the segments you thought that the timing between audio and video may have been off. "

Viewers who mentioned synchronization problems voluntarily constituted a third level of detection.

Summary of Results:

1. When audio precedes video by 5 video fields, viewers evaluate people on television more negatively (e.g. less interesting, more unpleasant, less influential, more agitated, less successful). This difference is not large, but it is statistically significant. (Figures 1 and 2)
2. Audio-video asynchrony has no effect on viewer's memory for audio information. (Figure 3)
3. Viewers can accurately tell when a television segment is in perfect synch, and when it is 5 fields out of synch. Viewers

cannot accurately tell when the same segments are 2.5 fields out of synch. (Figure 4)

4. Even though detection is low when asynchrony is moderate (2.5 fields), viewer evaluations are still affected.

Implication of Results

1. *Audio-visual asynchrony does not inhibit memory for television material, it changes evaluations of television content.*

There are two competing theories about how audio-visual asynchrony could influence the psychological processing of television. One view is that asynchrony is confusing, and therefore it *interferes with thoughtful processing* of information. This interference could then preclude the mental rehearsal and elaboration necessary to remember material; hence, asynchrony causes poor memory.

A second view is that asynchrony is *unconsciously disturbing*. The experience of this disturbance (which is experienced as bad feelings) is then transferred to the primary content of the messages; hence, asynchrony causes negative evaluations of speakers and material with little or no conscious awareness of the effect.

The data in this experiment support the second theory. There were no effects of asynchrony on memory, and if anything memory was slightly better when the messages were maximally out of synch (perhaps because asynchrony attracts greater attention). But significant negative effects were found for the influence of asynchrony on evaluation of television segments and the people in them.

Based on this experiment, the following could be said about the necessity of correcting synchronization errors: *The presence of audio-video asynchrony will cause material to be negatively evaluated and remembered well -- perhaps the worst commercial outcome of a persuasive message.*

2. Awareness of audio-video asynchrony is not necessary for synchronization problems to have a psychological effect.

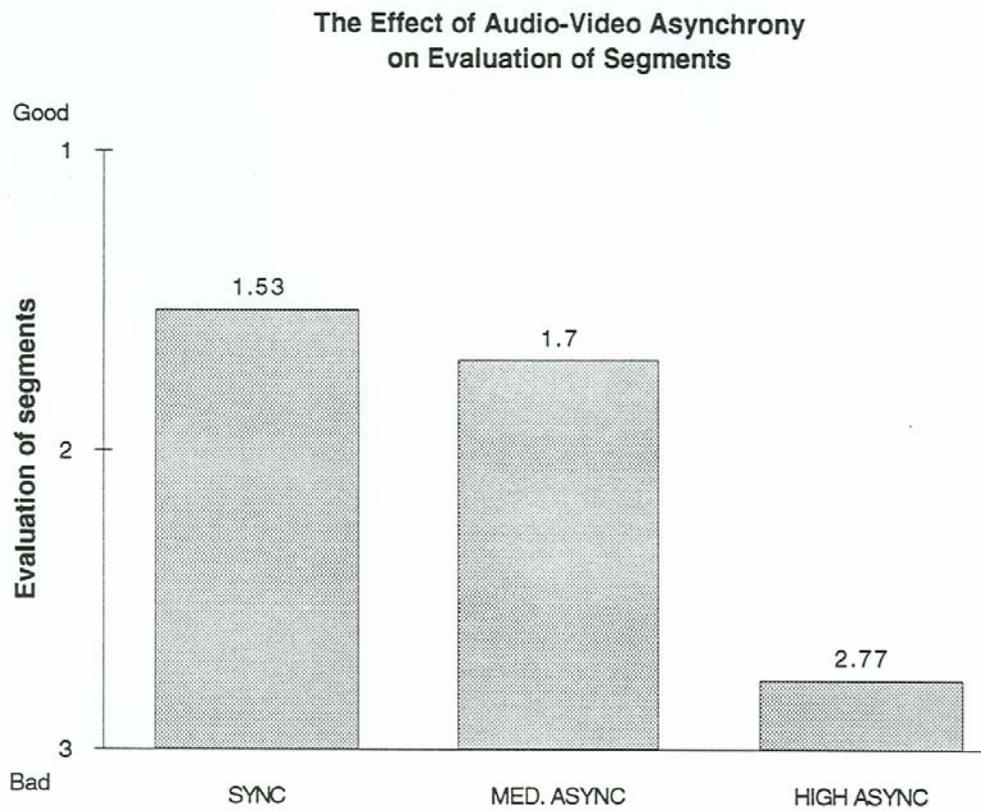
Half of the subjects could identify the synch problems and half could not, yet both groups were affected by the problem. Therefore, an appropriate criterion for judging the need for asynch correction is *not* the subjective awareness of average viewers or even technicians. Rather, the correction is justified because of his experiment which was able to demonstrate effects that viewers were unable to define or discuss.

3. The magnitude of the effect of audio-video asynchrony is statistically small but quite large relative to the cost of correction.

The size of differences in the experiment were small. Even though differences were not due to chance, the differences only accounted for small amount of the variation in evaluation of television content. So it's only fair to say that many other characteristics of television content, and methods of presenting content are more important than the degree of synchronization studied in this experiment.

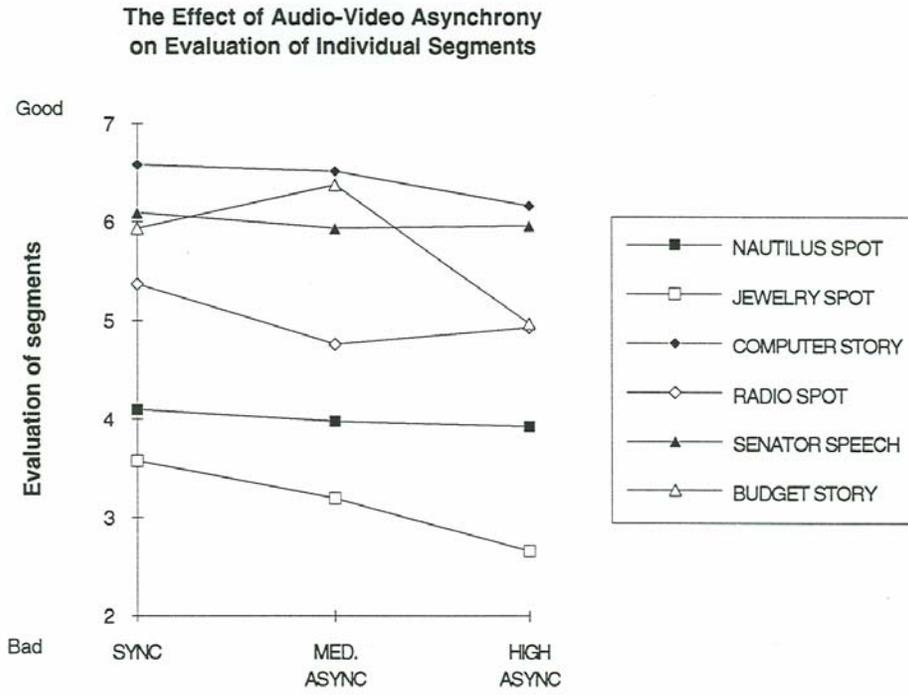
However, the *size of the synchronization effect is certainly large relative to the dollar cost of correcting the problem.* There are not many points in the post-production of television where significant negative effects can be precluded with an easy and relatively cheap intervention.

Figure 1



Friedman two-way analysis of variance by ranks test
Chi-square = 13.4 df = 2 p < .005

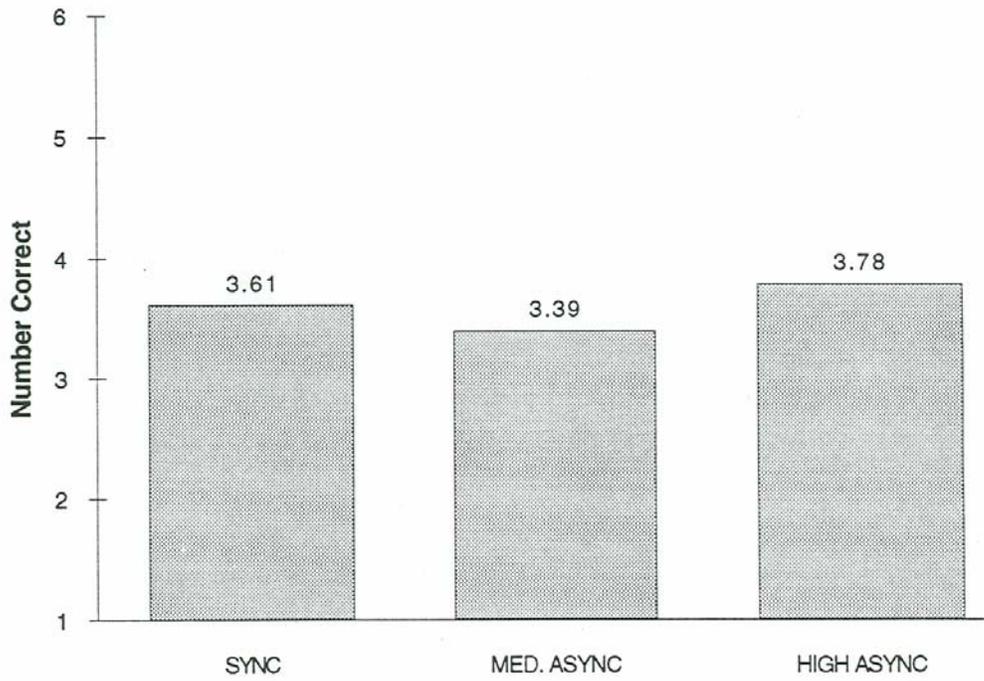
Figure 2



Friedman two-way analysis of variance
by ranks test
Chi-square = 7.0 df = 2 p < .05

Figure 3

The Effect of Audio-Video Asynchrony on Memory



Analysis of variance test $F = .55$ p not significant

Number of Correct Identifications of A/V Asynchrony by Individual Segments

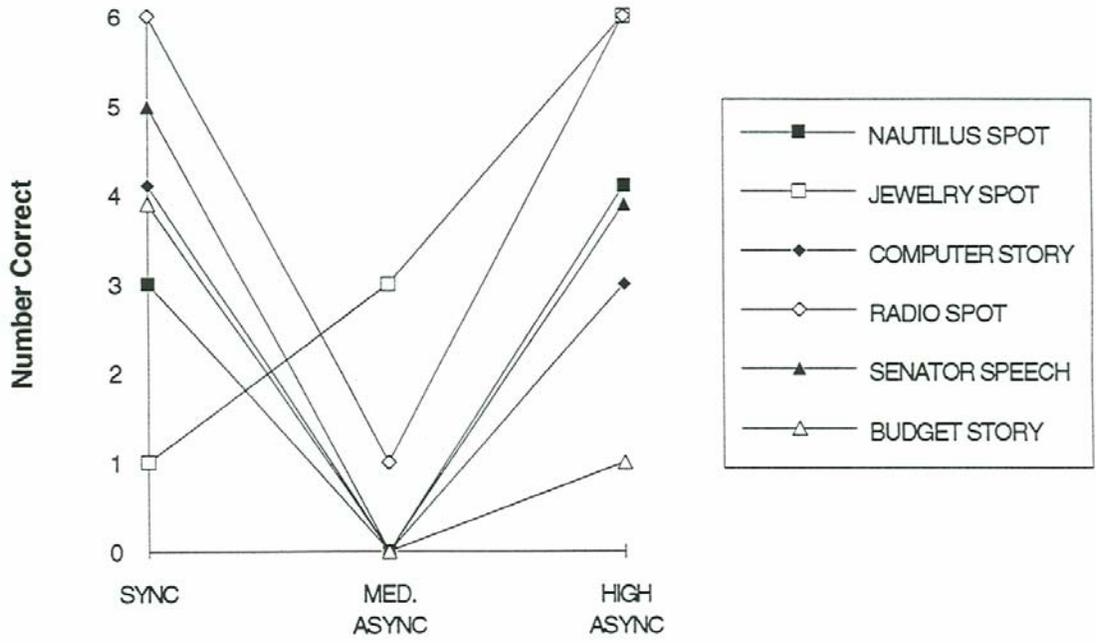
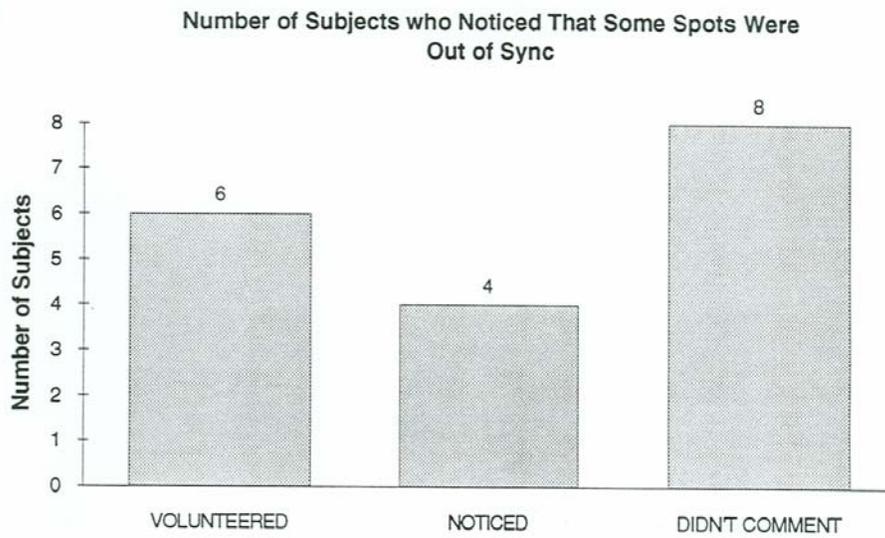


Figure 5



VOLUNTEERED: mentioned asynchrony unprompted during the session.
NOTICED: mentioned asynchrony when asked for general comments.

Television Study

Thank you for participating in this study. We're interested in how viewers evaluate people who have speaking roles on TV. I'm going to show you several brief segments of people talking. After each segment, we'll pause briefly so that you can answer a few written questions about the featured speaker.

Some of the segments have more than one person talking. We're most interested in the main person who is speaking in each segment, and that's the person we'll ask you to evaluate.

We'll do a practice segment first.

Practice segment

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the man who is the main speaker.

I thought the man was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 4. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 5. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 6. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |

Jewelry store commercial

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the man who is the main speaker.

I thought the man was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
| 4. influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | uninfluential |
| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
| 8. agitated | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | calm |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 9. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Budget news story

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the anchorperson.

I thought the anchorperson was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
| 4. influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | uninfluential |
| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
| 8. agitated | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | calm |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 9. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Radio station night out

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the woman who is the main speaker.

I thought the woman was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
| 4. influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | uninfluential |
| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
| 8. agitated | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | calm |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 9. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Woman senator speech

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the speaker.

I thought the speaker was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
| 4. influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | uninfluential |
| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
| 8. agitated | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | calm |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 9. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Fitness club commercial

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the woman in the commercial.

I thought the woman was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
| 4. influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | uninfluential |
| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
| 8. agitated | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | calm |
-

For each of the following word pairs, please circle the number that best corresponds to your opinion of the overall presentation.

I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
| 9. well produced | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | poorly produced |
| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Computer privacy story

Listed below are pairs of words that are opposite in meaning. For each word pair, please circle the number that best corresponds to your opinion of the anchorperson.

I thought the anchorperson was...

- | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|----------------|
| 1. understandable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | confusing |
| 2. ineffective | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | effective |
| 3. pleasant | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unpleasant |
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| 5. bungling | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | skillful |
| 6. aggravating | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | soothing |
| 7. intelligible | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unintelligible |
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-

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I thought the overall presentation was...

- | | | | | | | | | | |
|------------------|---|---|---|---|---|---|---|---|-----------------|
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| 10. unsuccessful | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | successful |
| 11. fast | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | slow |
| 12. likeable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | unlikeable |
| 13. unpersuasive | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | persuasive |
| 14. rough | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | smooth |
| 15. cast well | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | cast poorly |
| 16. good | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | bad |

Listed below are some lines of dialog from the segments you saw. Each line has four possible completing phrases. In each group, only one of the phrases was actually spoken in that position; the other three were not. Please circle the phrase that you think was actually spoken. Try to match the exact wording of the phrase that was spoken in the segment. If you can't remember exactly, please circle your best guess.

Fitness club commercial

1. "24-Hour Nautilus has a... **manager's once-in-a-lifetime miraculous heart-pumping** ...special happening now."
 2. "Now you can start working out... **to look your best." "to tone up and slim down." "to get in shape." "for less than you'd expect."**
 3. "A great **"The ideal** ...workout for the perfect price."
"The perfect
"The ultimate
-

Jewelry store commercial

4. "You could even win a... **diamond solitaire." "thousand-dollar watch." "Hawaiian vacation." "24-carat gold bracelet."**
5. "The Diamond Center's... **Easter egg win-a-prize anniversary holiday** ...extravaganza is underway."
6. "We've got credit, we've got prizes, and we have... **four convenient locations." "low, low prices." "beautiful jewelry." "lots of inventory."**

Computer privacy story

7. "Internal documents suggest the Resolution Trust Corporation's top lawyer approved..

**a committee's examination of an employee's records."
a secret check of an employee's computer."
an anonymous inquiry into employee bank accounts."
a secret study of employee computer files."**

8. "The RTC claimed it wanted to see if... **Brian Patterson
Bruce Peterson
Bruce Patterson
Brian Peterson** ...violated policy by

using government computers for personal business."

9. "Federal law allows such checks only... **with permission of the user."
when authorized by federal court."
in theft or espionage cases."
in felony cases."**

Radio station night out

10. "We're partying tonight with Bay Area Night Out here at the... **Oasis Cafe."
Mile High Club."
Cadillac Club."
Hot Rod Cafe."**

11. "Wanna give it up for my main man... **revvin' it up tonight..."
who's spinning the discs tonight..."
puttin' us in the mix tonight..."
waxing the tracks tonight..."**

12. "KMEL power mixer Billy Vidal is... **mixing music tonight."
in the house."
manning the booth."
your host tonight."**

Woman senator speech

13. "What I worry most about today is engaging people in a way...

that provides a sense of fulfillment."
in which they're willing to participate."
that makes them feel government is responsive to them."
that maximizes their personal involvement."

14. "They're willing to...
go door-to-door."
pound the pavement."
give up something in order to get something."
work long hours at phone banks."

15. "It's hard to engender that kind of...
motivation and drive
personal excitement ...for a moderate position."
principled commitment
spark and enthusiasm

Budget news story

16. "The Clinton administration has abandoned plans for a...
BTU tax"
natural gas tax"
broad-based energy tax"
comprehensive gas tax"

17. "The...
Senate's budget bill
Republican alternative ...substitutes a 4.3-cent increase
National Energy Council's proposal in the gas levy."
Energy secretary's recommendation

18. "The Washington Post
"President Clinton
"Press secretary Dee Dee Myers
"Budget Director Leon Panetta

...says the administration will favor a compromise closer to the Senate version"

PLEASE DO NOT TURN THE PAGE UNTIL REQUESTED

In some of the segments you saw, the timing of the audio with the video may have been off. Please indicate in which of the segments, if any, you think the timing was off (or "out of sync"). The segments may be listed in an order different from the order in which you saw them.

Circle one for each:

Jewelry store commercial:	in sync	out of sync	don't know
Budget news story:	in sync	out of sync	don't know
Radio station night out:	in sync	out of sync	don't know
Woman senator speech:	in sync	out of sync	don't know
Fitness club commercial:	in sync	out of sync	don't know
Computer privacy story:	in sync	out of sync	don't know