LEAD-ME

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Fully automatic vs. human subtitling: comprehension, user experience and perception

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Eye tracking in media accessibility research - methods, technologies and data analyses

Introduction & Background

Fully automatic subtitling = Speech Translation + Auto-spotting + Automatic segmentation

Automatic subtitling is here to stay

- Chrome (Scharff, E. and Kompalli, M. 2021)
- Youtube (Alberti, C. and Bacchiani M. 2009)
- ST integration in subtitling tools: MateSub

Some studies on productivity of MT for subtitles (Bywood et al 2017, Matusov et al. 2019, Koponen et al. 2020)

But is fully automatic subtitling good enough to be used raw?

Research question & hypotheses

RQ1: Do fully automatic subtitles require more processing effort on the part of viewers than human subtitles?

H1: Users spend more time looking at the subtitles instead of the image when the subtitles are produced automatically.

RQ2: What is the impact of fully automatic subtitles on perception and comprehension?

H2: The perception and comprehension scores of the participants in the fully automatic condition are lower compared to the participants in the human condition.

Study design

Independent variables

- fully automatic subtitles vs. human subtitles

Dependent variables

- comprehension > questionnaire
- user experience > fixation duration (subtitle vs image) > questionnaire
- perception > questionnaire

Confounding variables

- level of proficiency in source language
- level of proficiency in target language
- preferred audiovisual translation methods

Method

Procedure

- between-subject design
- 2 studies, one clip
  - Fully automatic subtitles > generated with Matesub
  - Human subtitles > produced by professionals following a three-step QA process
- random assignment of one condition per participant via randomized link

Research materials

- TED talk (0:00-2:44) - German original with English subtitles
  - Stadtlücken - Wem gehört die Stadt? | Christine von Raven | TEDxStuttgart
- Questionnaire
  - 5 general questions
  - 4 comprehension questions
  - 3 attention questions
  - 5 perception questions (1-5 rating scale)

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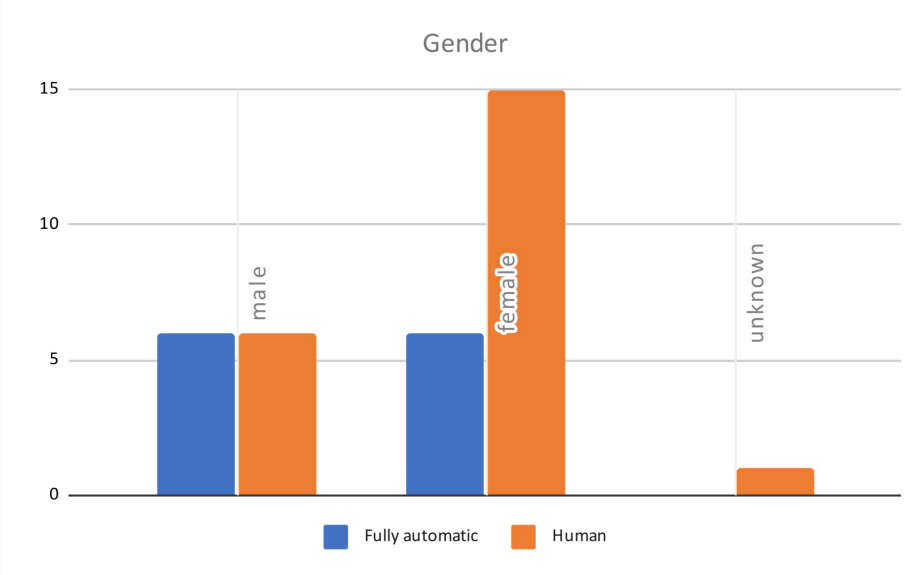
Method

Eye tracking equipment

- experiment conducted in RealEye from 7 July - 8 July 2021
- Subtitle AOI: 1 AOI occupying 14% of the screen, starting from the time the first subtitle appears

Participants

- 12 participants for fully automatic condition
- 22 participants for human condition



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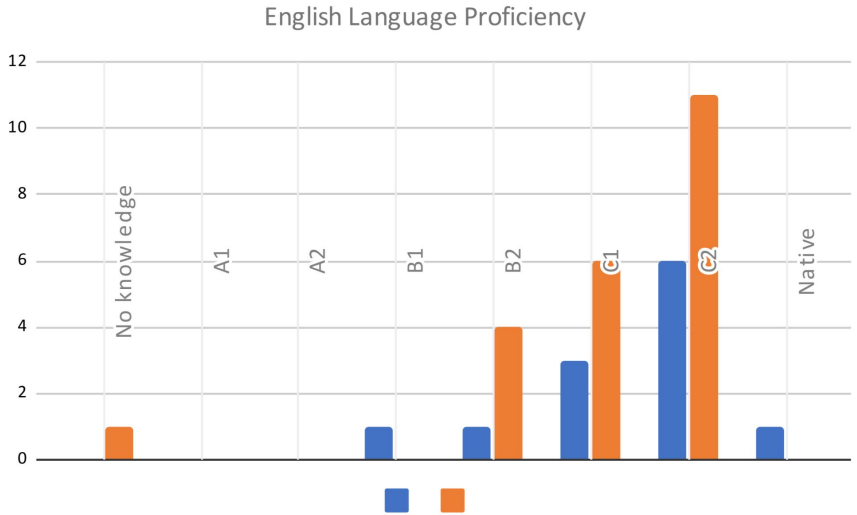
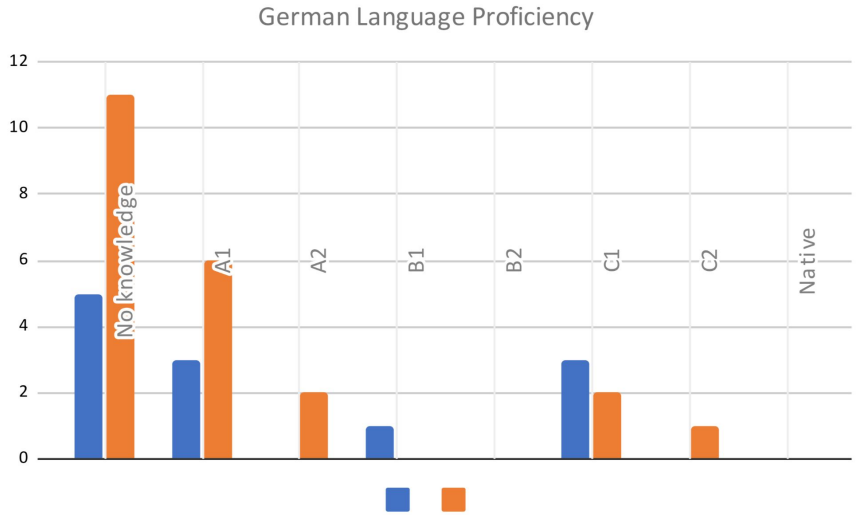


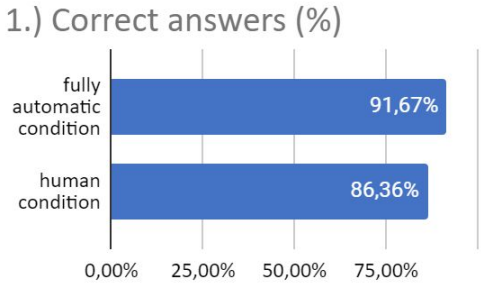


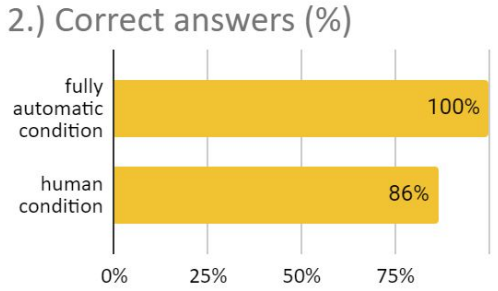
Questions on attention

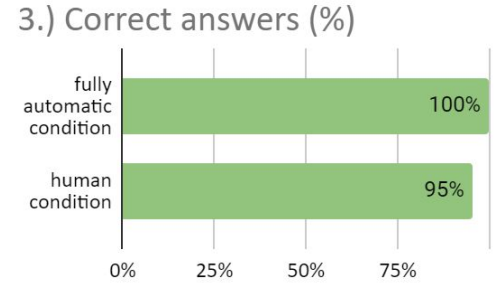
1.) What colour was the speaker's shirt?
a. Red.
b. Blue.
c. Green.
d. I don't know.

2.) What was the speaker's hair colour?
a. Brown.
b. Black.
c. Blonde.
d. I don't know.

3.) Which picture did the speaker use at the beginning of the talk?
a. A picture of a parking lot.
b. A picture of a highway.
c. A picture of a building.
d. I don't know.

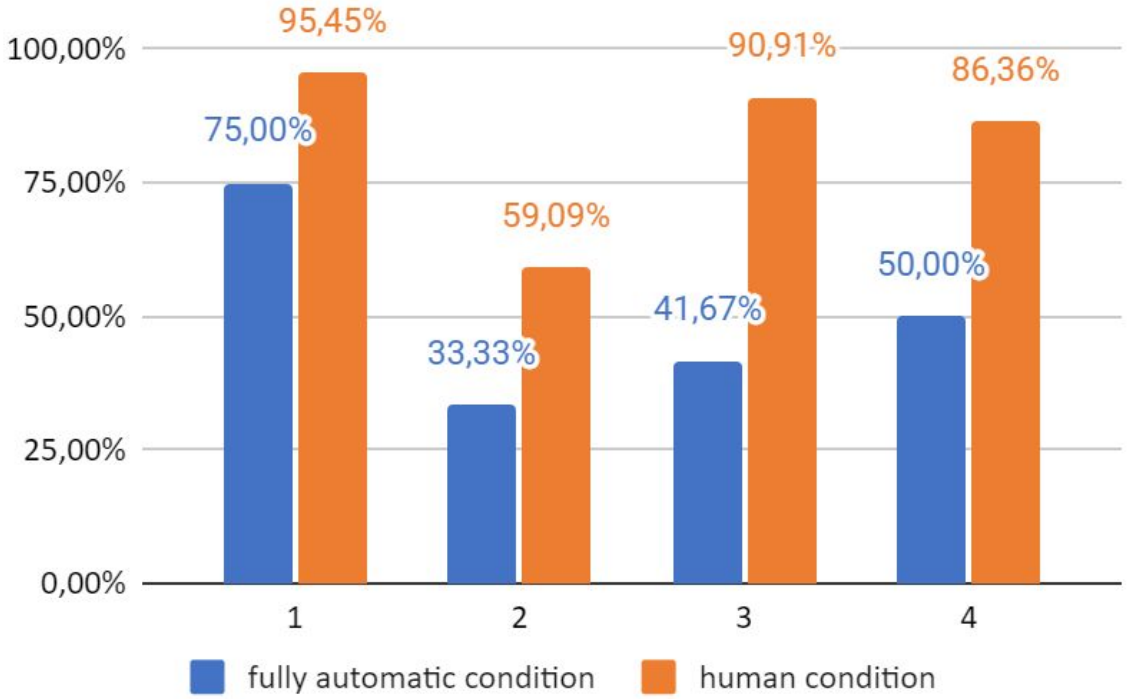






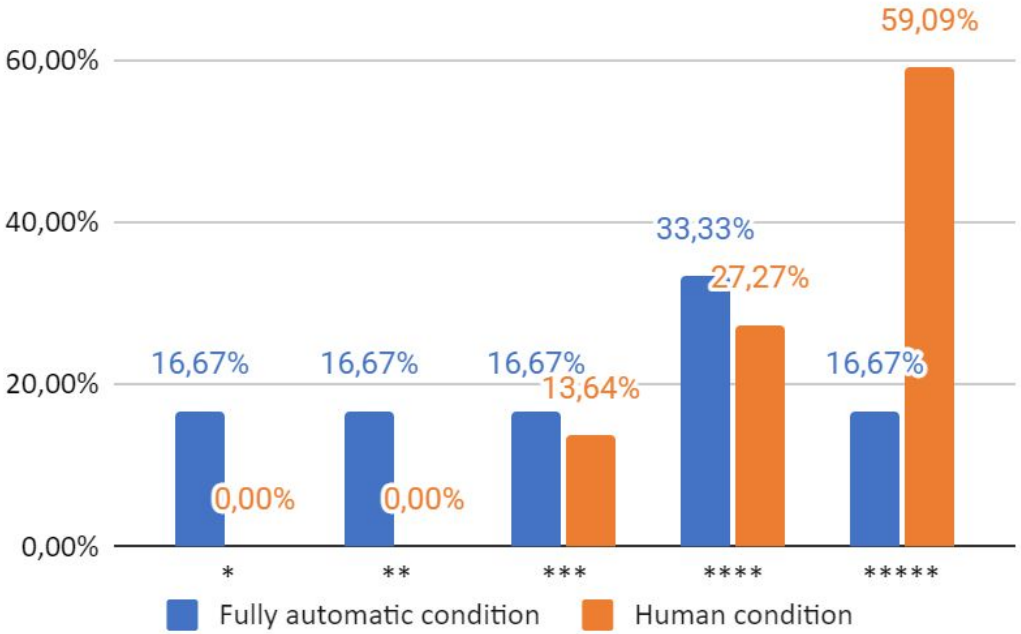
Questions on comprehension (% of correct answers)

1.) What is the topic of this talk?
2.) What is the problem in cities nowadays?
3.) Why is the parking lot not being used?
4.) According to the speaker, what is an activity that might take place at the unused parking lot?



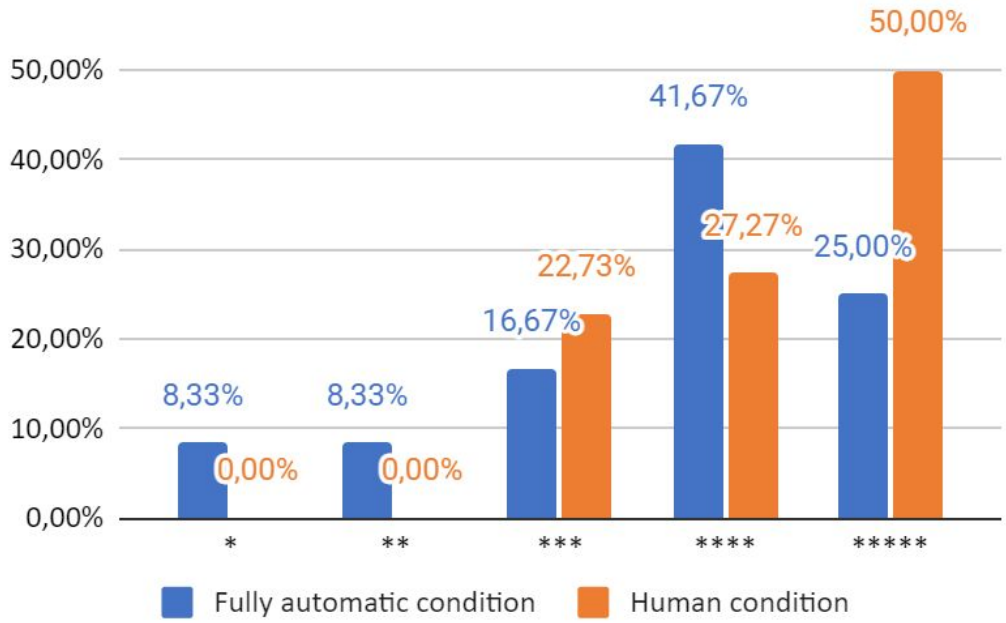
Questions on perception

1.) How would you rate the quality of the subtitles? From 1 (Terrible) to 5 (Excellent).



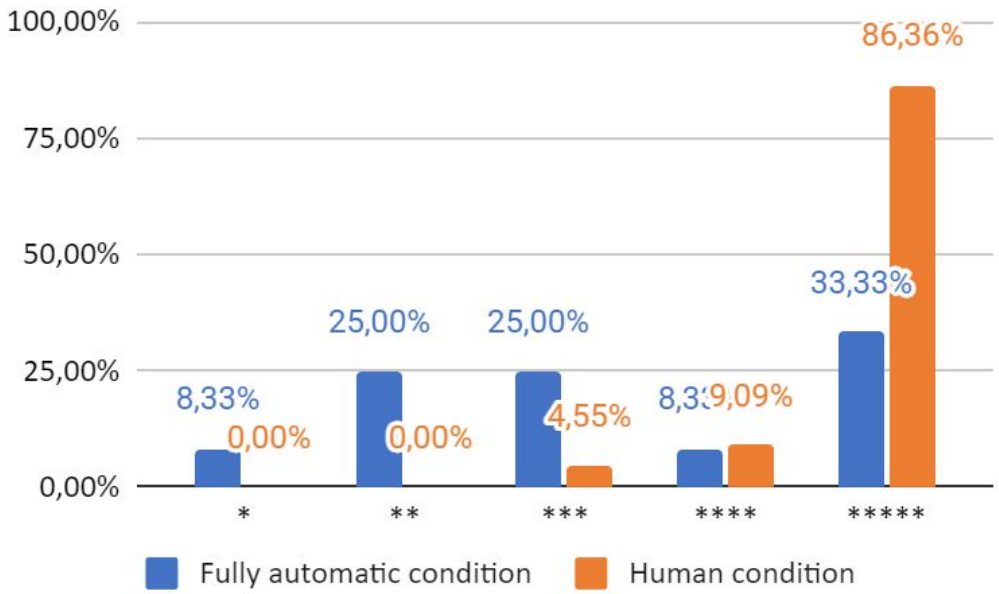
Questions on perception

2.) How would you rate the time available to read the subtitles? From 1 (Insufficient) to 5 (Sufficient).



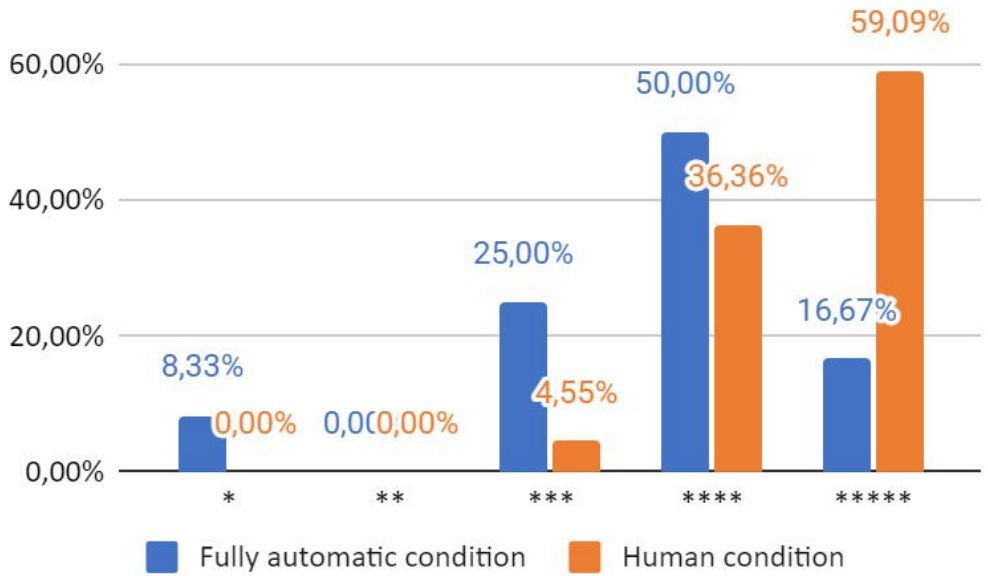
Questions on perception

3.) How comprehensible were the subtitles? From 1 (totally incomprehensible) to 5 (totally comprehensible).



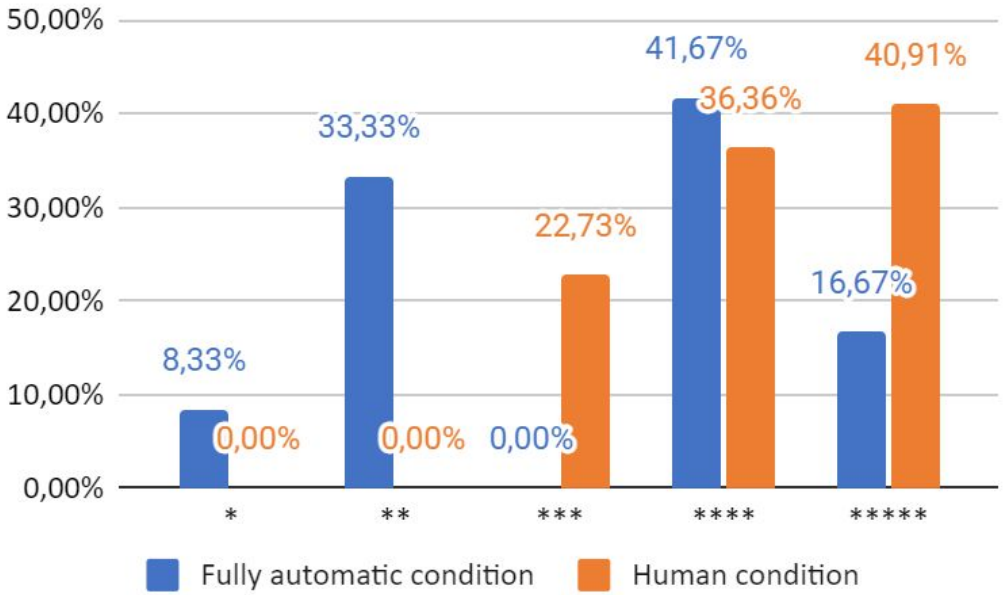
Questions on perception

4.) How synchronised were the subtitles? From 1 (completely unsynchronised) to 5 (completely synchronised).



Questions on perception

5.) How easy were the subtitles to read? From 1 (not easy at all) to 5 (very easy).



Results - RQ1

H1: Users spend more time looking at the subtitles instead of the image when the subtitles are produced automatically.

Results:
In general, participants spend slightly less time looking at the subtitles compared to the image (47%)

Participants spend the same time looking at the subtitles regardless of method of production

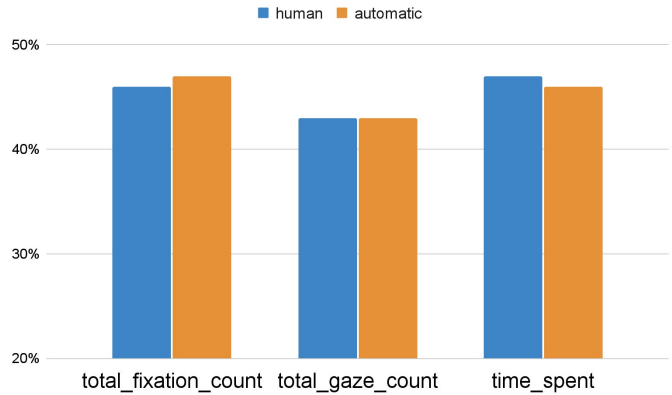


Figure: Percentage of fixations, gazes and time spent on subtitles compared to image

Results - RQ1

H1: Users spend more time looking at the subtitles instead of the image when the subtitles are produced automatically.

Human condition

Automatic condition

Results - RQ2

H2: The perception and comprehension scores of the participants in the fully automatic condition are lower compared to the participants in the human condition.

Results:

Rating:

- Excellent/very good quality
  - Human subtitles: 86.3% of users
  - Fully automatic subtitles: 50 % of users
- Sufficiently/well timed
  - Human subtitles: 77.3% of users
  - Fully automatic subtitles: 66.7% of users
- Totally/very comprehensible
  - Human subtitles: 95.5% of users
  - Fully automatic subtitles; 41.6%
- Not easy at all/not very easy
  - Human subtitles: 0% of users
  - Fully automatic subtitles: 41.7% of users
- Fully/very much synchronised
  - Human subtitles: 96% of users
  - Fully automatic subtitles: 66% of users

The hypothesis appears to be confirmed.

Comprehension questions:

The comprehension scores are higher in the human condition for all four of the comprehension questions.

Discussion & Limitations

Discussion

Automatic subtitles do not distract viewers more from the image than human subtitles.

It seems that viewers ignore subtitles when their quality is very low.

Limitations

- different number of participants in the two conditions
- 1 AOI for all subtitles

Conclusion & Future work

Conclusion

Fully automatic subtitling performed better than expected but is still not ready to be used raw.

Future work

More detailed analysis of eye-tracking data

Correlation of eye-tracking data with

- User profiles
- Translation quality (BLEU, TER)

Analysis of crisis points (translation errors, synchronisation, segmentation, reading speed)

References list

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