



HUMANE Paper Review

# **HearHere: Mitigating Echo Chambers in News Consumption through an AI-based Web System**

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CSCW

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# Background

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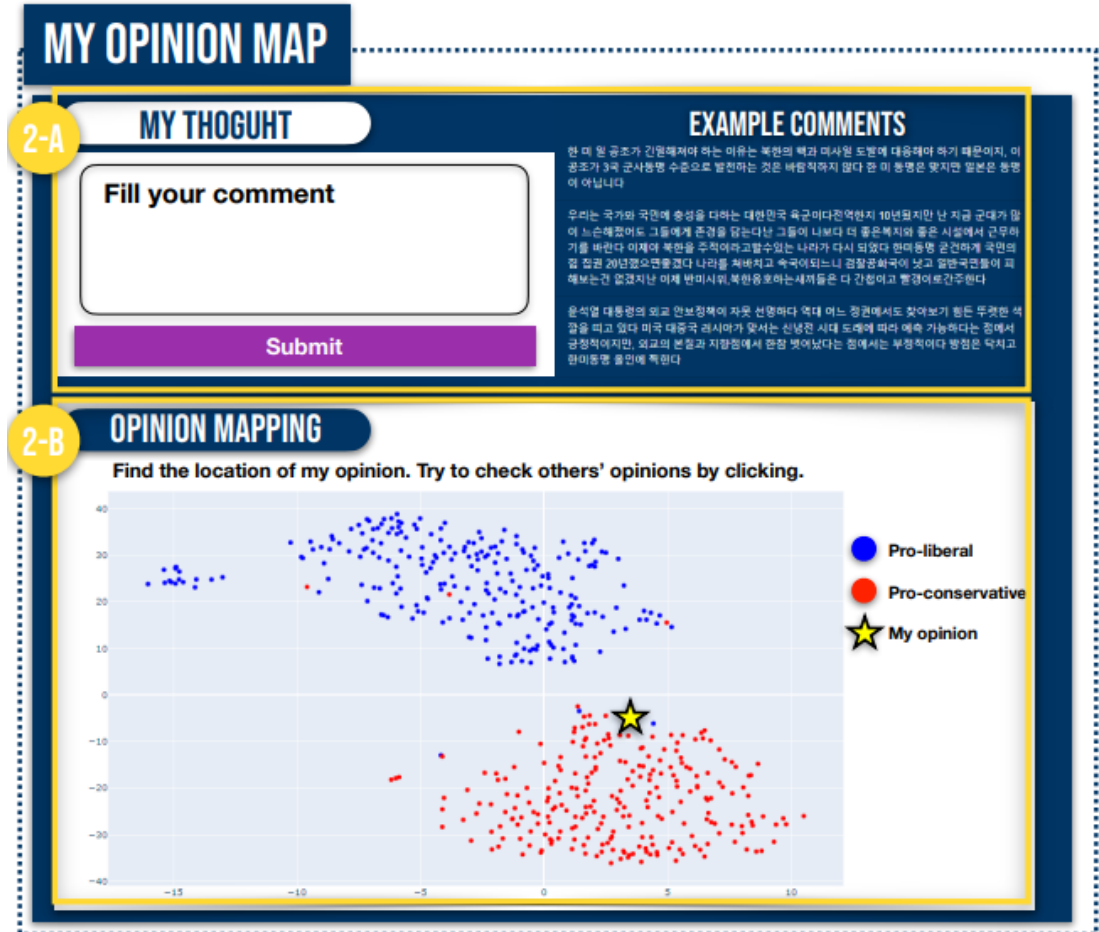
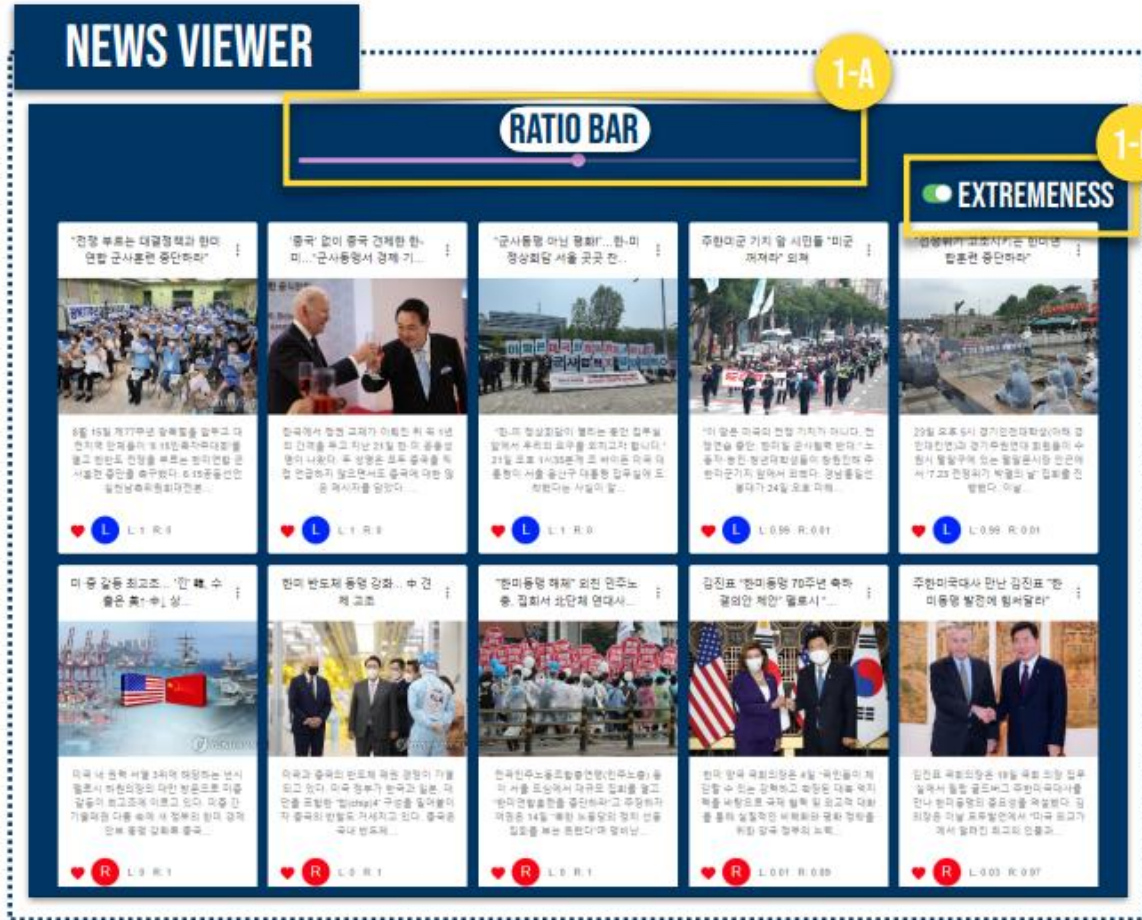
- Helping people consume and share information from diverse perspectives is necessary but challenging
- Echo chamber
  - Phenomenon where individuals are exposed primarily to the like-minded groups or information, leading to a reinforcement of shared narratives
- Negative outcomes
  - Creation and dissemination of biased information
  - Increased susceptibility to fake news
  - Resistance towards accepting scientific evidence
  - Adoption of unbalanced perspectives

# However

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- Many studies have proposed the use of computer-based tools designed to present information from diverse perspectives
  - Focused on only one aspect of the information consumption process
  - Limited quantitative approaches to AI-based computer-supported tool
- Digital literacy: one's ability to find, evaluate, and communicate information on digital platforms
  1. Information understanding
  2. Opinion comparison/confirmation

# HearHere



# Research Question

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- **RQ1:** How can we incorporate key components of information consumption in the context of digital literacy into the design of HearHere?
- **RQ2:** Does HearHere help the participants realize the importance of information diversity?
- **RQ3:** How do changes in perception differ according to the user characteristics?

# Propose

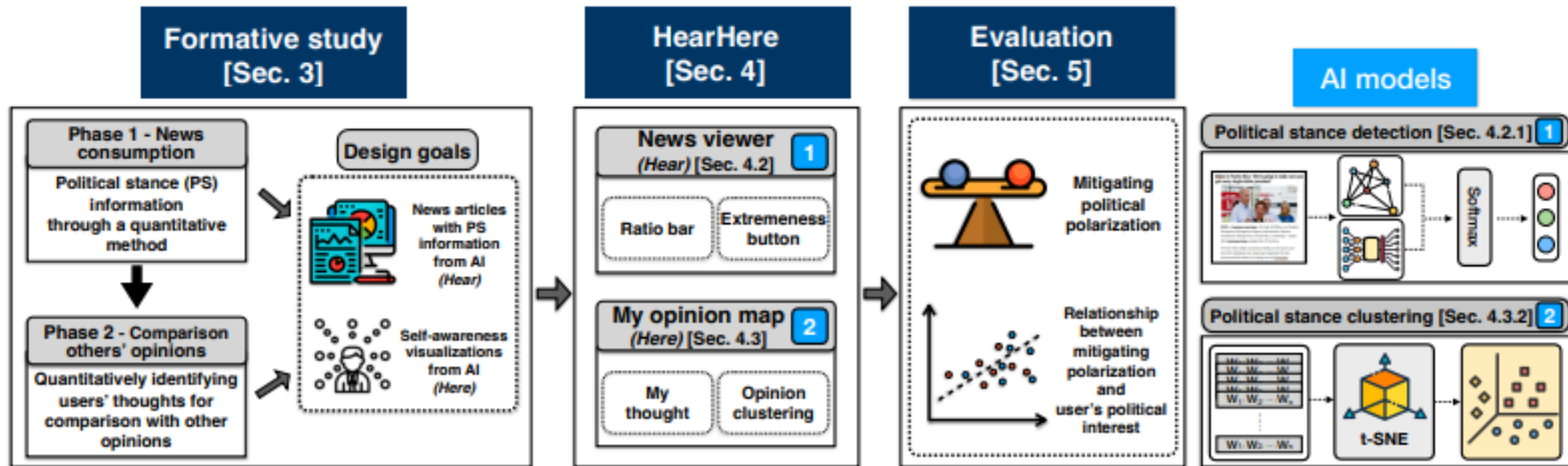


Fig. 1. The overview of our research procedure.

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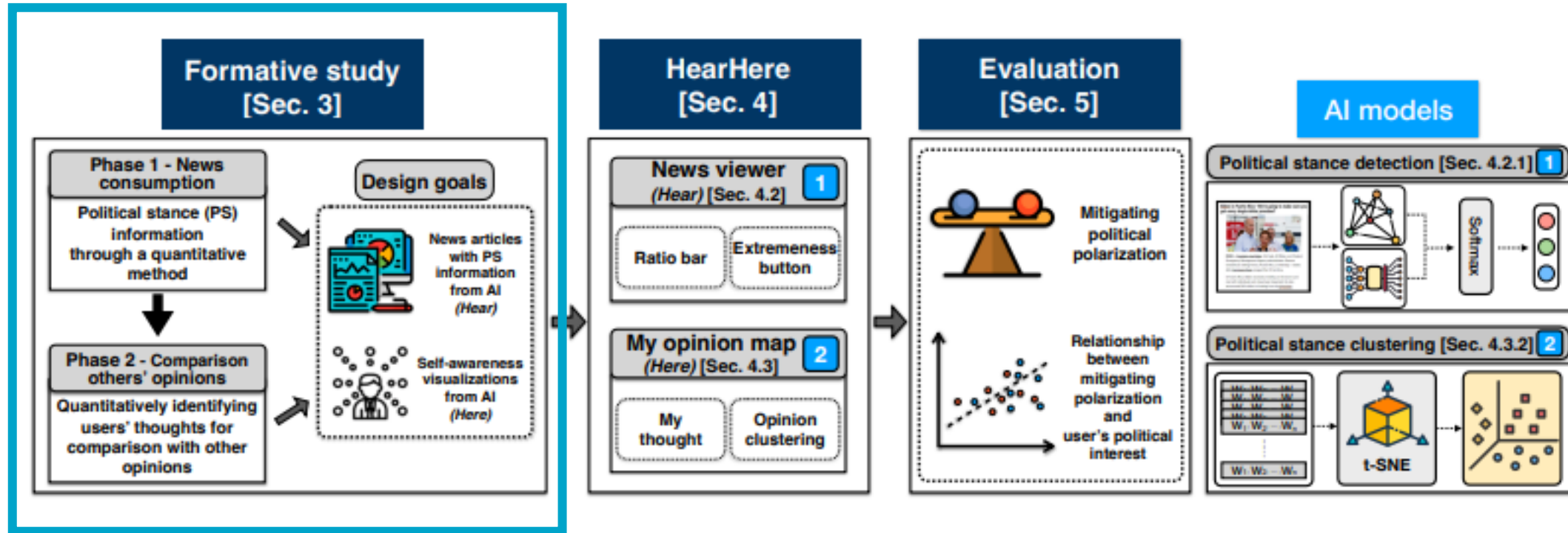


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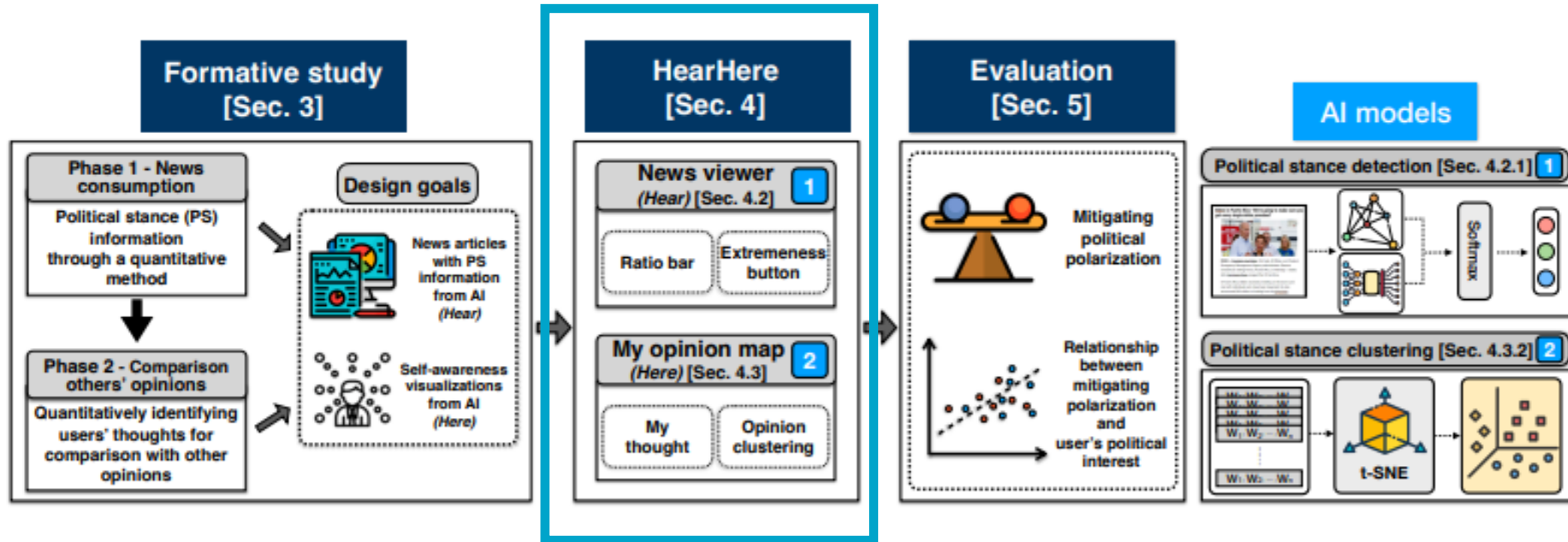


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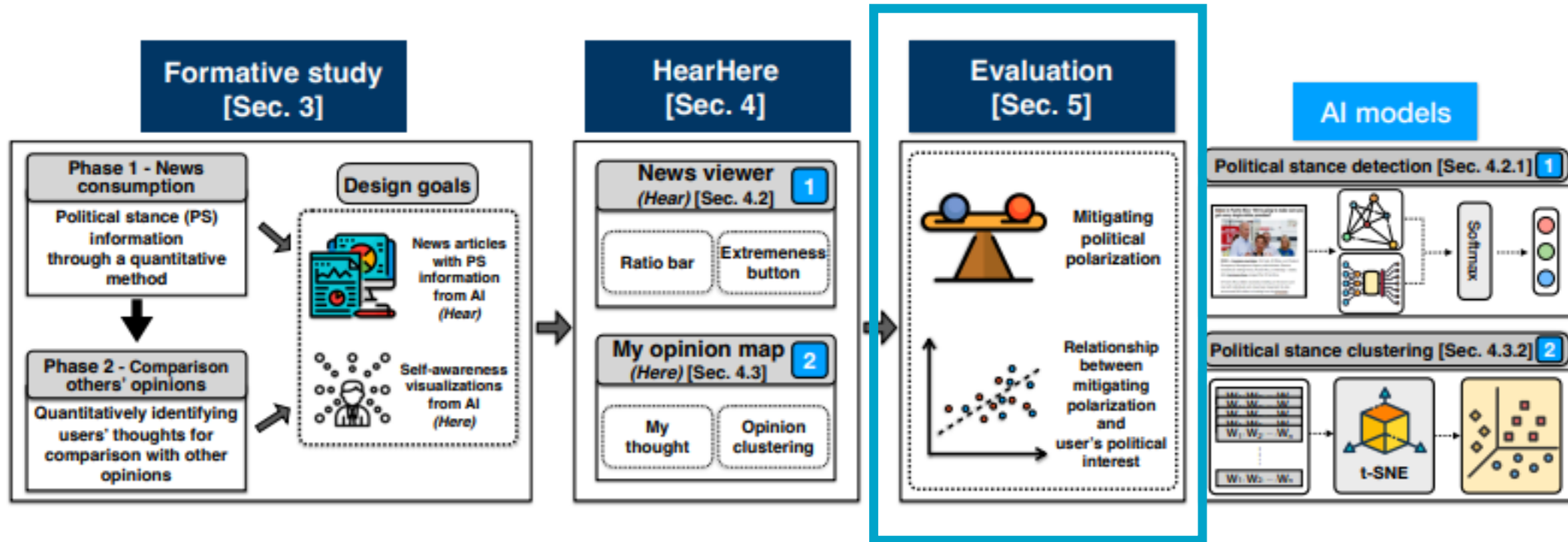


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# Formative Study

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1. Process of political news information consumption
2. The challenges in the existing news interface for balanced information consumption
3. Possible solutions for those challenges

Table 1. Demographic information of formative study participants and the average daily time they spent on reading political news. We used  $P_f^X$  to denote participant number X in the formative study in the ID column.

ID	Gender	Age	Political stance	Minutes Reading News Online (daily)
$P_f^1$	Male	28	Conservative	30-45
$P_f^2$	Female	36	Conservative	35
$P_f^3$	Male	43	Conservative	30-45
$P_f^4$	Male	42	Liberal	30-40
$P_f^5$	Female	28	Liberal	30-45
$P_f^6$	Male	36	Liberal	40-60

# Formative Study

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Table 2. Results of formative studies.

Questions in the formative study	Responses	Insight
Q1. How do you consume news online? (current practices of news consumption)	Two phases of news consumption: 1) news information consumption phase 2) opinion comparison phase	To support users' political news consumption in the real world, the interface needs to cover the whole process (i.e. two phases).
Q2. What are the barriers and challenges in balanced news information consumption?	1) In the news information consumption phase, participants mentioned that it is difficult to consume information from a different standpoint. 2) In the comparison of others' opinions phase, they mentioned that it is difficult to consume opposing opinions for balanced information consumption.	For the issue in each phase, we need to develop AI to 1) quantitatively define political stances of news and 2) quantitatively define their thoughts based on others' thoughts.
Q3. What are the potential solutions and coping strategies to address these challenges?	1) In the news information consumption phase, people should receive quantitative information about political stances, defined by a quantitative method. 2) In the opinion comparison phase, people should quantitatively identify their thoughts for comparison with others' opinions.	

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# System Development: HearHere

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- System Design Goals

Table 3. Design goals of the balanced news consumption considered in *HearHere*.

News consumption phase	Requirement	Goal	Interface visualization
Information understanding	Political stance information defined by a quantitative methodology	Provides <b>news articles with their political stance information through AI</b> (e.g., political stance and extremeness)	<i>News viewer - Hear (Sec. 4.2)</i>
Opinion comparison/confirmation	Quantitatively identifying users' thoughts for comparison with other opinions	Provides <b>self-awareness visualizations through AI</b> for comparing between user's thoughts and both opinions supporting particular political sides (conservative or liberal)	<i>My opinion map - Here (Sec. 4.3)</i>



# System Development: HearHere

- Visualization 1: News Viewer



Fig. 3. The visual example of News viewer (Visualization 1). This visualization presents the title-image-news content (summary) section in thumbnail format. When users click on some news, this visualization provides users with a full article.



# System Development: HearHere

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- Selected six topic
  - extent to which particular news articles receive public attention

Table 4. Paired policy dimension [56] and the news themes of *HearHere*.

Policy dimension	New theme of <i>HearHere</i>
Labor policy	1. Illegal strike of confederation of unions 2. Minimum wage increase
Political corruption	3. Impeachment of the Minister of Justice 4. Thesis plagiarism of the first lady
Human rights	5. Right of the disabled
Military	6. U.S. military alliance

# System Development: HearHere

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- AI to predict a political stance
  - Graph-based political classification model
  - Figured out five main factors when identifying the political stance of a news article
    - context, tone, frequently used words, person, and keyword
  - Knowledge-aware approach
    1. Hierarchical Attention Networks
      - word-level, sentence-level, and title-level
    2. Knowledge Encoding
      - incorporate external knowledge(both common and political) for real-world entities

# System Development: HearHere

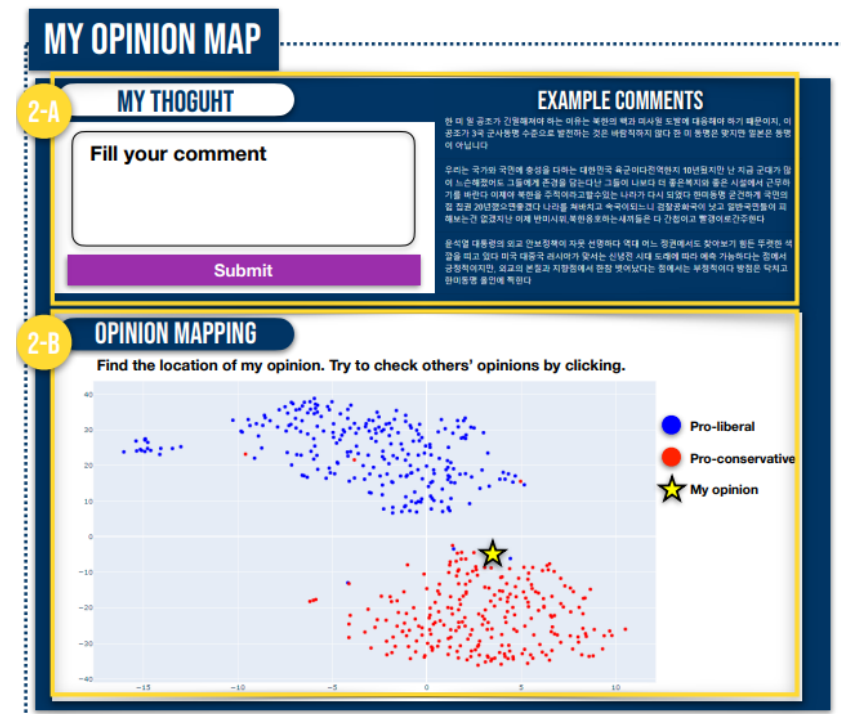
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- AI to predict a political stance
  - Higher performance(92.26% accuracy) than other existing state-of-the-art models

Method	Dataset		
	SemEval	AllSides-S	AllSides-L
Word2Vec [58]	0.7027	0.4858	0.4851
GloVe [68]	0.8071	0.7101	0.6354
ELMo [69]	0.8678	0.8197	0.7483
BERT [44]	0.8692	0.8246	0.7812
RoBERTa [55]	0.8708	0.8535	0.8222
KGAP [20]	0.8956	0.8602	N/A
KCD [91]	0.9087	0.8738	N/A
Ours-RotatE	0.9426	0.9151	0.8584
Ours-HAKE	0.9395	0.9216	0.8563
Ours-ModE	<b>0.9521</b>	<b>0.9256</b>	<b>0.8617</b>

# System Development: HearHere

- Visualization 2: My Opinion Map
  - Submit their opinions about a specific political issue in the comment form
  - Confirm the position of their own opinions



# System Development: HearHere

- Visualization 2: My Opinion Map
  - Used NLP AI model trained with about 180 million sentences of news comments
  - Collected additional sets of comments on six topics from two online communities (total of 14,148)
  - Achieved 94.46% accuracy
  - 768-dimensional vectors
  - visualized as a 2D map(t-SNE algorithm)

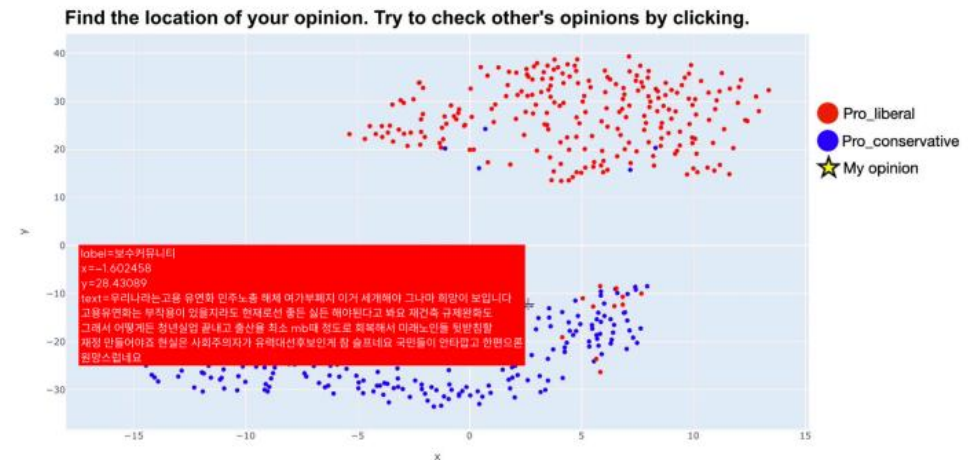


Fig. 4. The visual example of My opinion (Visualization 2). This visualization presents the location of users' own opinions between pro-liberal and pro-conservative comments on a map interface. In addition, if users click comments, they can explore and examine the opinions of others.

# Evaluation

- User study with 94 participants
  - Participants realize the importance of information diversity after using HearHere? (RQ2)
  - Degree of acceptance of information having diverse perspectives after using HearHere differs from the user characteristics? (RQ3)

Table 5. Demographic information of the participants in user studies and in-depth interviews (total: 94 participants, 10 interviewees).

Demographic group		User study		Interview	
		N	%	N	%
Gender	Female	46	49%	5	50%
	Male	48	51%	5	50%
Age	19 29	39	41%	4	40%
	30 39	25	27%	3	30%
	40 49	30	32%	3	30%
Political Interest	High	17	18%	4	40%
	Middle	48	51%	3	30%
	Low	29	29%	3	30%
Political Stance	Conservative	19	20%	3	30%
	Moderate	57	61%	4	40%
	Liberal	18	19%	3	30%

# Evaluation

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- Procedures
  - Asked to complete the pre-survey, use HearHere once a day for about 15 minutes (for three days), and complete post-survey
  - Read news topics about two topics per day



# Evaluation

- Echo chambers breaking score (EC breaking score)

Table 6. The EC breaking questions [15] based on the features of an echo chamber effect (Disagree, Different, Confirm, Offline, and Changed). In the pre-survey, we asked about the participants’ current behaviors. In the post-survey, we asked about their willingness to adopt behaviors that could prevent the echo chamber phenomenon.

Question	Pre-survey	Post-survey
Q1	How often do you read something you <b>DISAGREE</b> with?	How often will you read something you <b>DISAGREE</b> with?
Q2	Have you ever checked a news source that is <b>DIFFERENT</b> from what you normally read?	Will you check a news source that is <b>DIFFERENT</b> from what you normally read?
Q3	Do you try to <b>CONFIRM</b> information you find by searching online for another source?	Will you try to <b>CONFIRM</b> information you find by searching online for another source?
Q4	Do you try to confirm information by checking a major <b>OFFLINE</b> news medium?	Will you try to confirm information by checking a major <b>OFFLINE</b> news medium?
Q5	Thinking about recent searches you have performed online using a search engine, how often have you discovered something that <b>CHANGED</b> your opinion on an issue?	How often will you discover something that <b>CHANGES</b> your opinion on an issue?

# Results

- Significant increases in all questions

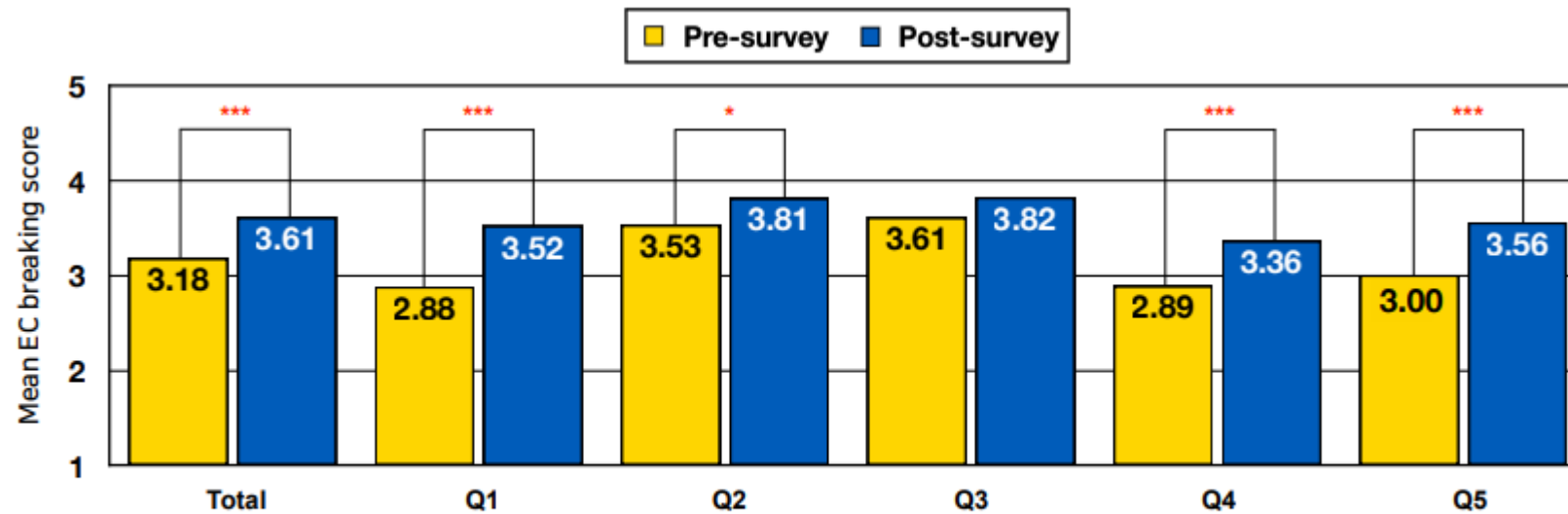


Fig. 5. Bar plots showing the differences in the EC breaking scores between the pre- and post-surveys (\*\*\* $p < .00016$ , \*\* $p < .00166$ , \* $p < .00833$ ). All groups showed significant differences between the pre- and post-surveys.

# Results

- EC breaking score by demographic

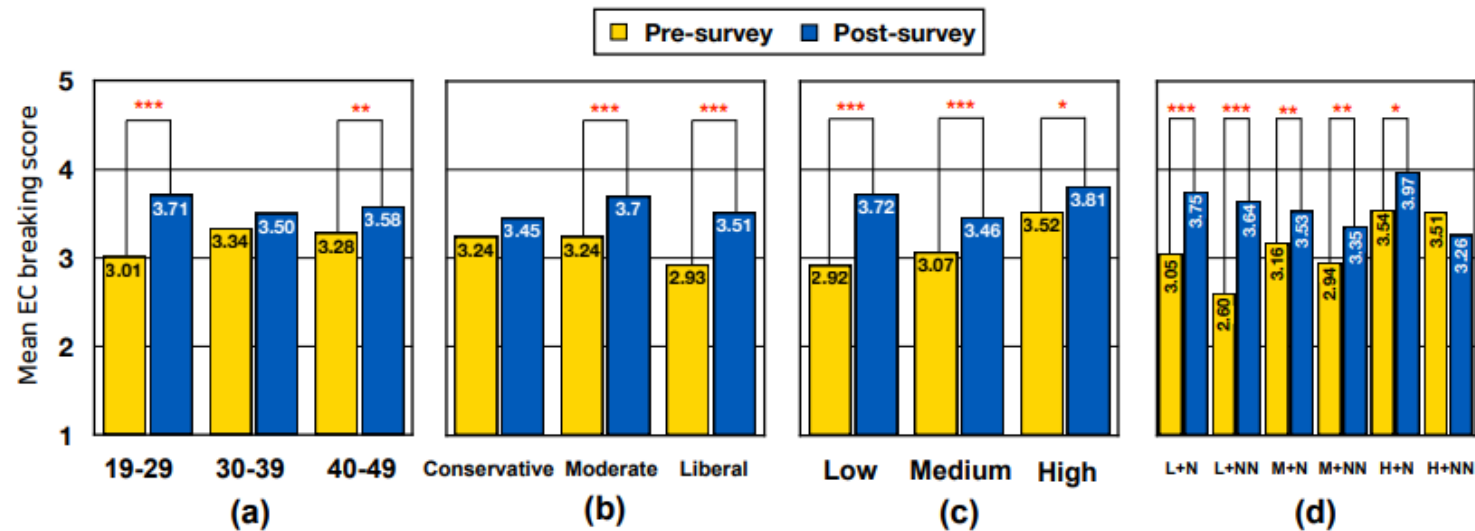


Fig. 6. Bar plots showing the differences in the EC breaking scores between the pre- and post-surveys according to (a) age (\*\* $p < .00025$ , \* $p < .0025$ ,  $p < .0125$ ), (b) political stance (PS) (\*\* $p < .00025$ , \* $p < .0025$ ,  $p < .0125$ ), (c) political interest (PI) (\*\* $p < .00025$ , \* $p < .0025$ ,  $p < .0125$ ), (d) PI x PS (L+N: Low+Neutral, L+NN: Low+Non-neutral, M+N: Middle+Neutral, M+NN: Middle+Non-neutral, H+N: High+Neutral, H+NN: High+Non-neutral) (\*\* $p < .00014$ , \* $p < .00142$ ,  $p < .00714$ ).

# Results

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- User Interview Analysis

All participants answered ... ..

- Sufficient support for having a balanced perspective in consuming information
- Highlighted the need for diverse, personalized options that reflect users' thoughts and enable AI interaction.

Those with high political interest ... ..

- Difficulty in comprehending news articles presenting an opposing political stance, which sometimes made them uncomfortable
- Decreased echo chamber breaking scores

Those with low political interest ... ..

- Effective in accepting diverse perspectives

# Conclusion

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- Highlight the importance of political stance info and quantifying user's political status to reduce polarization
- Propose design implications including demographics consideration and user initiatives

# Opinion

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- 한계점

- 6개의 이슈에 대해서만 진행해서 다른 이슈/새로운 이슈에 대해서는 적용이 될지 검증 안됨
- 언론사 단위로 political stance에 대한 라벨을 부여한 점
- 정치적 입장이 강경한 사람에게 관점 다양성의 중요성을 인식시키는게 더 중요한데, 해당 부분에서는 크게 효과적이지 않았음

- 돋보이는 점

- 처음으로 뉴스 소비 과정 전체를 포괄하는 균형 잡힌 관점을 위한 시스템 설계
- 설계 단계부터 평가까지 User study 내용이 유기적으로 연결됨(HCI에서 좋아할듯)

# Open Question

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- 뉴스의 관점을 예측하는 것이 정치 분야에서만 의미가 있을까? 경제, 사회, 연예 등 다른 분야에서도 의미가 있을까?
- 의미가 있다면 해당 분야에서도 언론사 단위로 예측이 가능할까?