



Introduction of Emoji scale

- Composing of five icons modelled after the five attribute levels of the HRQoL
 - The presented level was represented by an **enlarged, colourful** emoji positioned **within a scale of other smaller, colourless emojis** to reflect the level order
- Emojis were sourced from Apple Unicode emoji characters (Unicode, 2023)
- The emojis were chosen based on respondents' emotional interpretations from previous studies (Jaeger, 2019, Kutsuzawa, 2022)

Objectives

- To evaluate this novel visual aid in DCE, as an independent use (i.e. emoji only) or as a complement to text (i.e. emoji&text) compared with the standard text-only and the colour coding choice tasks
 - the resulting value set,
 - preference inversion,
 - quality of choice responses and
 - respondent perception of choice difficulty and preferences.

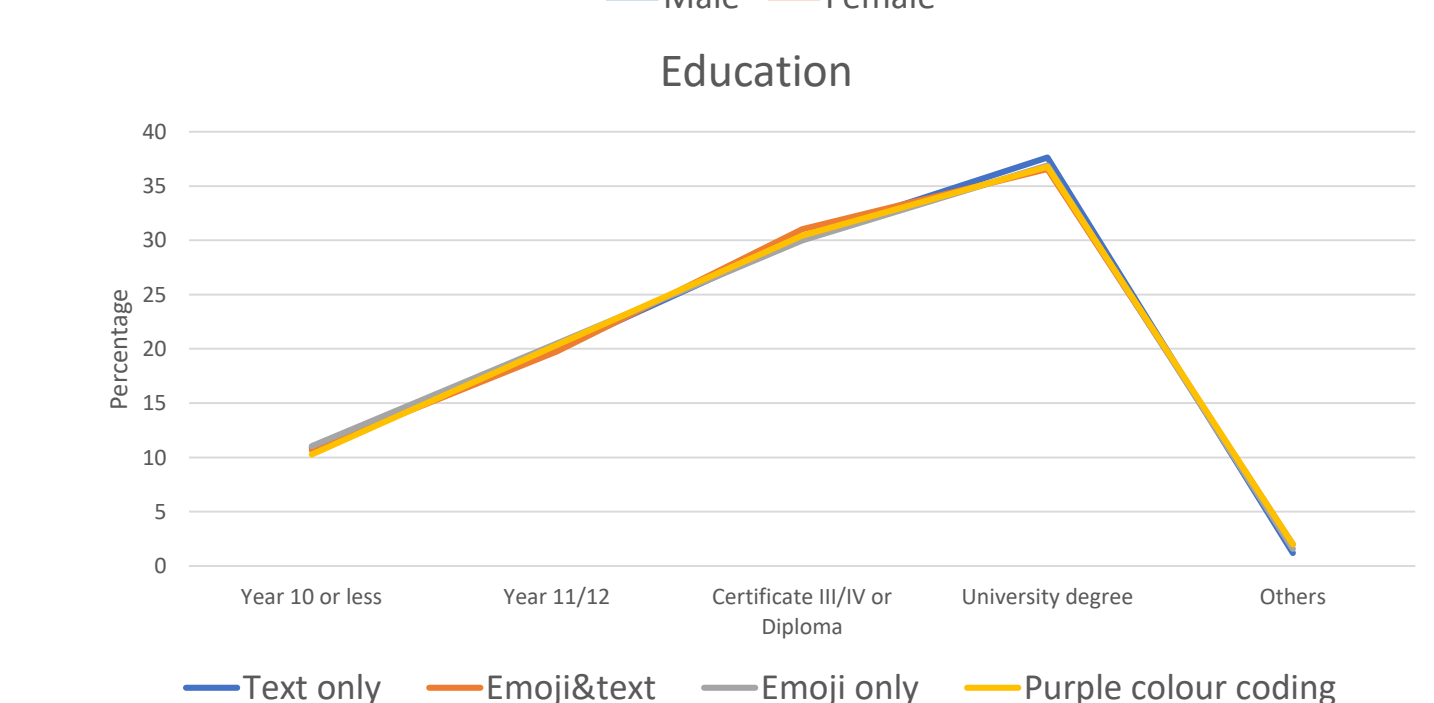
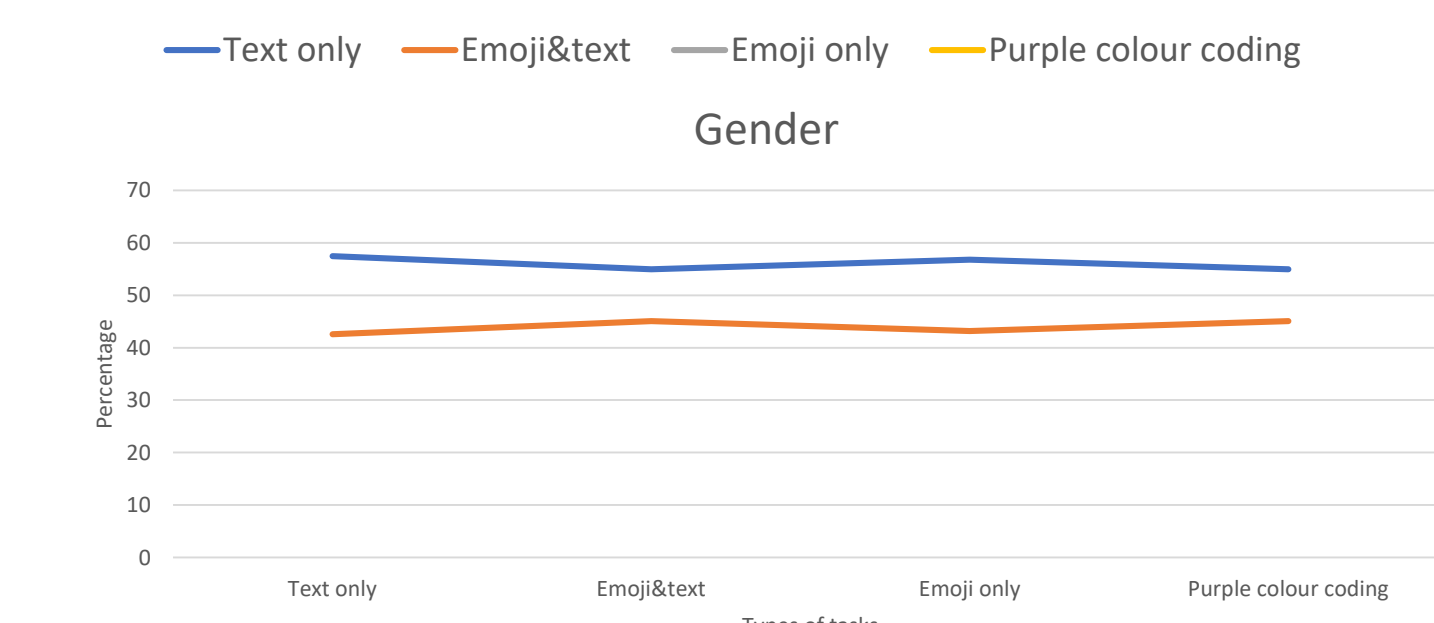
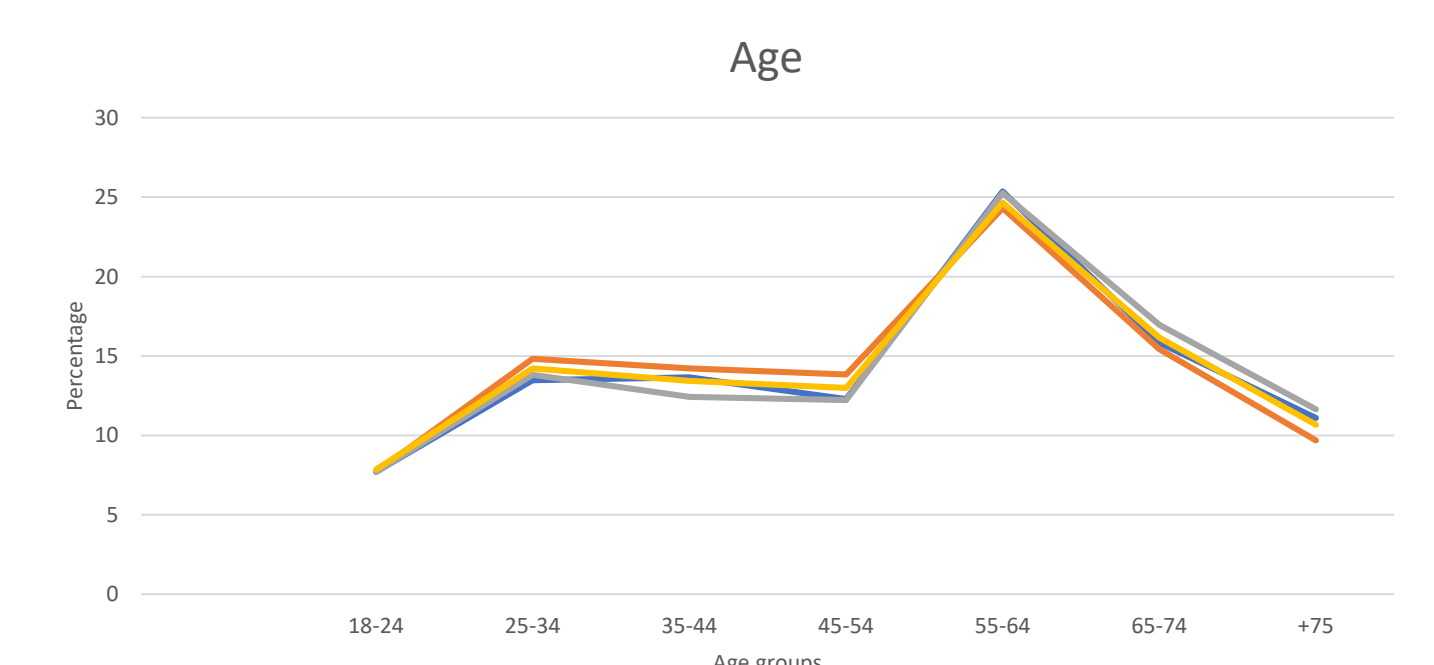
Methods

Study Design

- A **between-respondent comparison** was conducted where each respondent was randomly allocated to one of four arms
 - Emoji scale and Text
 - Emoji scale only
 - Text only
 - Colour coding (adopted from Jonker et al. 2018)
- The comparison was applied to the Recovering Quality of Life measures with both positively and negatively worded attributes
- Choice tasks from four arms were derived from the same 240 choice tasks assigned to 20 blocks of 12 choice tasks
- To minimise the order effect, we randomise
 - The choice task order within blocks
 - Blocks of choice tasks
 - Attribute order
 - The position of alternatives

Sample

Text only	505
Emoji&Text	506
Emoji only	507
Colour coding	506
Total	2024



Standard Text-only Choice tasks

	Health state A	Health state B
Number of years left to live before death	10 years	1 year
I enjoy what I do	Sometimes	
I feel confident in myself	Only occasionally	
I feel happy	Sometimes	Never
I feel lonely	Only occasionally	
I feel unable to cope	Never	Only occasionally
I think my life is not worth living	Most or all of the time	Only occasionally
My physical health: problems with pain, mobility, difficulties caring for myself, or feeling physically unwell	Moderate problems	Very severe problems
Which scenario do you think is better	☐	☐

Emoji&Text Choice tasks

	10 years 10	1 year 1
Number of years left to live before death		
I enjoy what I do	Often	
I feel confident in myself	Sometimes	
I feel happy	Never	Most or all of the time
I feel lonely	Often	Sometimes
I feel unable to cope	Often	Most or all of the time
I think my life is not worth living	Never	
My physical health: problems with pain, mobility, difficulties caring for myself, or feeling physically unwell	Very severe problems	No problems
Which scenario do you think is better	☐	☐

Emoji only Choice tasks

	Health state A	Health state B
Number of years left to live before death	10	1
I enjoy what I do		
I feel confident in myself		
I feel happy		
I feel lonely		
I feel unable to cope		
I think my life is not worth living		
My physical health: problems with pain, mobility, difficulties caring for myself, or feeling physically unwell		
Which scenario do you think is better	☐	☐

Purple colour coding Choice tasks

	Health state A	Health state B
Number of years left to live before death	1 year 1	10 years 10
I enjoy what I do	Most or all of the time	Only occasionally
I feel confident in myself		Often
I feel happy	Most or all of the time	Sometimes
I feel lonely	Often	Never
I feel unable to cope	Never	Most or all of the time
I think my life is not worth living		Sometimes
My physical health: problems with pain, mobility, difficulties caring for myself, or feeling physically unwell		Moderate problems
Which scenario do you think is better	☐	☐

Notes: Positive aspects are **light purple** and negative aspects are **darker purple**

Research question 1: Do emoji&text, emoji only and colour coding produce the same value sets as text only?

Methods used

- Utility estimates from CL models are used to separate preference parameters and scale parameters
- t-test is used for the difference of utility estimates for each presentation style and text-only.

Study arm	Compared to Text-only		
	Emoji&Text	Emoji only	Colour coding
enjoy2	-0.01	0.00	0.00
enjoy3	0.03	0.01	0.05 *
enjoy4	0.04	0.03	0.04
enjoy5	-0.01	0.01	0.01
confident2	0.00	-0.02	-0.02
confident3	-0.01	-0.04	-0.01
confident4	-0.01	-0.07 **	-0.01
confident5	-0.01	-0.18 ***	-0.01
happy2	-0.05	0.00	-0.05
happy3	-0.05	0.01	-0.03
happy4	-0.11 ***	-0.04	-0.08 **
happy5	-0.04	0.04	-0.01
lonely2	0.00	-0.06	-0.05
lonely3	-0.03	-0.01	-0.04
lonely4	0.02	0.01	-0.07 **
lonely5	-0.04	-0.06	-0.08 **
cope2	0.00	0.01	0.01
cope3	0.00	0.01	0.01
cope4	0.00	-0.13 ***	0.01
cope5	-0.05	-0.09 **	0.00
living2	0.03	0.03	0.03
living3	-0.01	0.00	-0.03
living4	0.01	0.03	-0.01
living5	-0.07	-0.02	-0.04
physical2	0.06	0.09 ***	0.06
physical3	0.08 *	0.05	-0.01
physical4	0.12 ***	0.20 ***	0.11 ***
physical5	0.06	0.20 ***	0.05

Notes: Comparisons are based on t-tests. * p<0.05, ** p<0.01, *** p<0.001

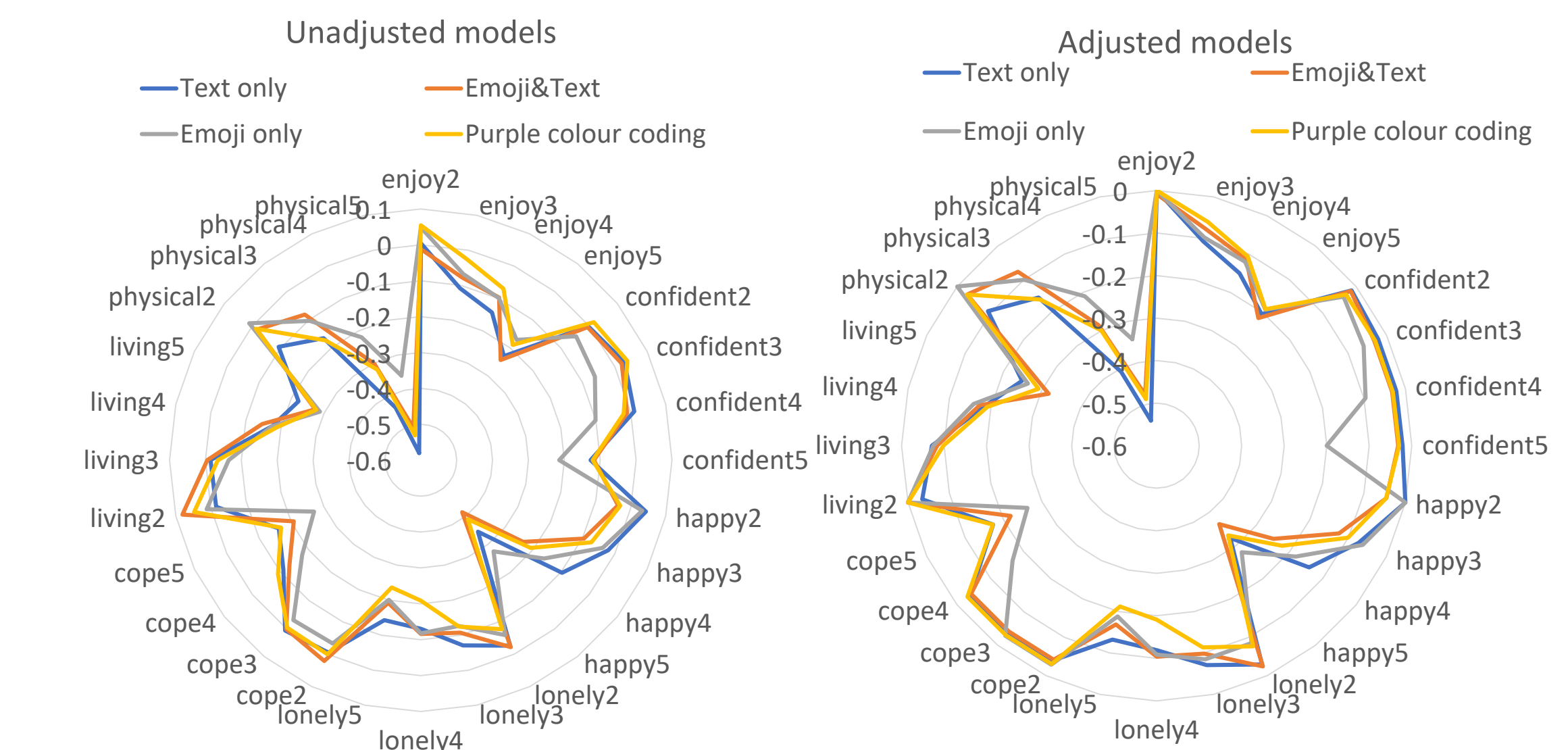
Research question 2: Which presentation style among text only, emoji&text, emoji only, and colour coding results in the lowest prevalence of preference inversion?

- Evaluate the **occurrence and frequency of preference inversion** in utility estimates resulting from each visual presentation based on CL models.
- To truly reflect the impact of choice presentations on preference inversion, we employed the smoothing-out technique to assess their ability to estimate logical values. If disordering existed, we combined the disordering levels with the adjacent levels to generate a consistent model (adjusted model).
- The performance of choice presentations was assessed based on the number of estimates they could produce without constraints.

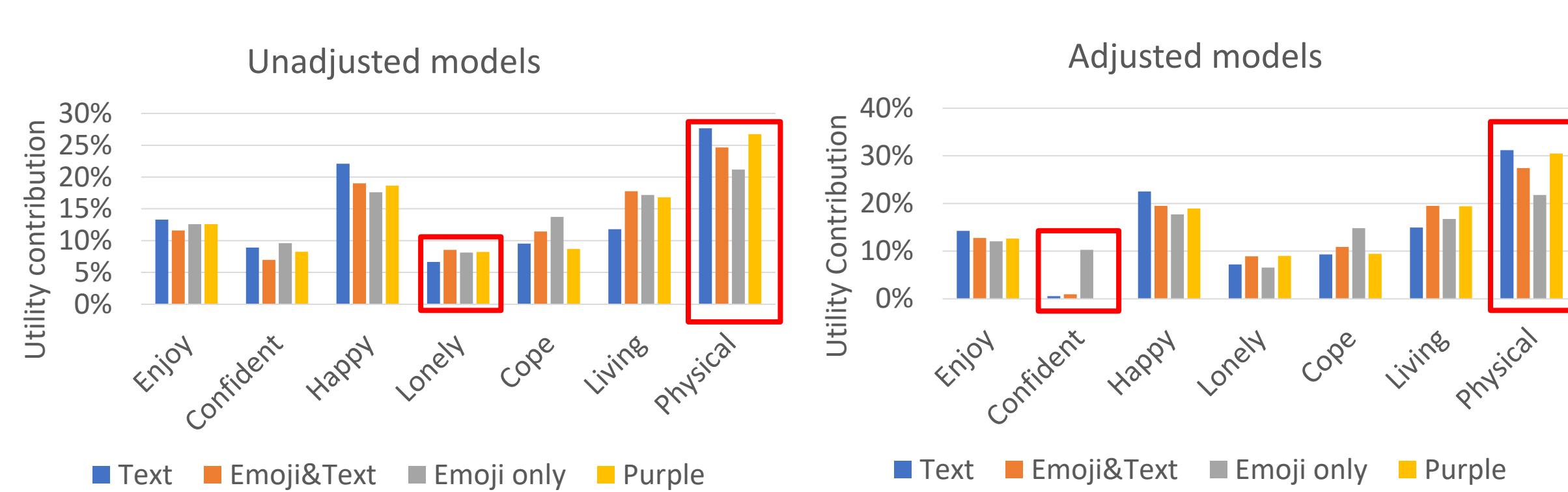
Study arm	Unadjusted model				Adjusted model			
	Text	Emoji&text	Emoji only	Colour coding	Text	Emoji&text	Emoji only	Colour coding
Number of utility decrements estimated	28	28	28	28	22	23	22	21
Total preference inversion	5	4	4	4	0	0	0	0

Notes: Unadjusted models are based on conditional logit model; Adjusted models were based on conditional logit model where disordering levels were combined with the adjacent levels to ensure monotonicity of utility decrements.

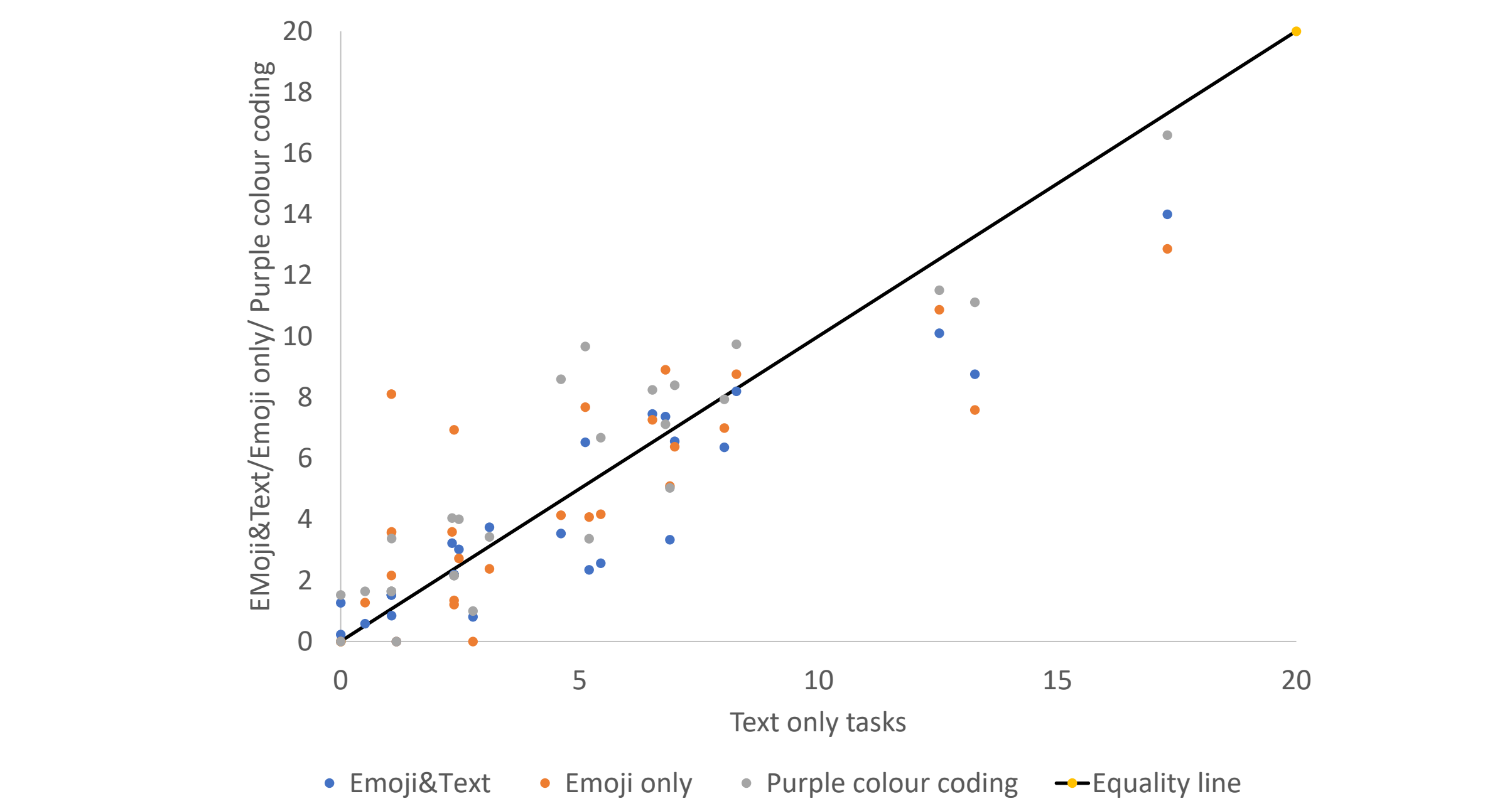
Comparison of utility decrements across four choice presentations



Relative Importance of Attributes from four choice presentations



Comparison of reliability of utility estimates across four choice presentations



Notes: Normalised standard errors were calculated by dividing the standard errors from the parameter estimates.

Research question 3: Did respondents find emoji&text, emoji only and colour coding tasks more difficult to complete than text only?

Methods used

- T-tests for the mean response scores for respondents' perceived difficulty between each presentation style and text-only

	How difficult was it to make a choice in these choice questions?	I found it difficult to imagine the health states	I found it difficult to see the difference between health states	I found it difficult to see the difference between health states	I found it difficult to consider all aspects when choosing between health states
Text only (reference)	3.07	2.55	2.12	2.71	2.63
Emoji & Text	2.97	2.47	2.14	2.54*	2.56
Emoji only	2.88**	2.53	2.21	2.60	2.67
Colour coding	3.14	2.61	2.20	2.71	2.71

Notes: All answers were provided on 5-point Likert response scales ranging from 1 (None of the time) to 5 (Most of the time) except for "How difficult was it to make a choice in these choice questions?" ranging from 1 (Very easy) to 5 (Very difficult).

*Null hypothesis of equal means is rejected with $p < 0.1$ (two-sided).

**Null hypothesis of equal means is rejected with $p < 0.05$ (two-sided).

***Null hypothesis of equal means is rejected with $p < 0.01$ (two-sided).

Research question 4: Do preference styles - emoji&text, emoji only and colour coding differ in poor-quality response indicators compared to text only?

Methods used

- T-tests for the differences in the number of respondents who **failed either of two dominant tests** or who consistently chose **either the left or right options** across all choice tasks in each presentation style
- T-tests to compare the differences in completion time used for each presentation styles and text-only

	Completion time	Left-right bias	Dominant test
Text only (reference)	14.92	0.01	0.07
Emoji & Text	8.36*	0.00	0.07
Emoji only	10.36	0.01	0.11*
Colour coding	10.86	0.00	0.09

Notes: Completion time is measured in minutes.

*Null hypothesis of equal means is rejected with $p < 0.1$ (two-sided).

**Null hypothesis of equal means is rejected with $p < 0.05$ (two-sided).

***Null hypothesis of equal means is rejected with $p < 0.01$ (two-sided).

Summary of findings

Criterion	Text-only	Emoji &Text	Emoji only	Purple colour coding
Convergent validity to standard text only	NA	✓	x	
Preference inversion		✓		x
Precision of estimates (i.e. magnitude of normalised standard errors	✓	✓	✓	✓
Perceived difficulty		✓	✓	
Response quality			x	
Completion time		✓		

Note: ✓ indicates which choice presentation performed best on a particular criterion, x indicates which choice presentation performed worst on a particular criterion, NA: Not applicable

Discussion

- Based on a carefully designed between-respondent comparison, we provide evidence that the emoji&text format
 - Produce a value set that is closely aligned with the standard text only
 - Reducing the prevalence of preference inversion
 - Decreased perceived difficulty of the choice tasks,
 - Maintained survey engagement.
- Our study supports the promising use of the emoji scale as a complement to text in DCEs with duration in health valuation studies.
- The emoji-only version yielded a distinct value set compared to the other three versions:
 - at least 7 out of 28 estimates are significantly different compared to text-only
 - It identified different least important dimensions.
 - It yielded smaller estimates for physical health but larger estimates for the confident and cope dimensions.
- However, despite the differences observed, the emoji-only version was able to differentiate utility decrements for the severity levels of the "confident" dimension, a capability not exhibited by the other choice presentations. Hence, the legitimacy of the emoji-only version in health valuation should not be dismissed and warrants further investigation.

Limitations

- The mental health-specific measure (i.e., the ReQoL-UI) with more emotion-related dimensions (e.g., "I feel happy" or "I feel lonely") which may align better with the emotions expressed by the chosen emojis in our emoji scale.

Conclusion

- Given the popularity and universality of emojis, we suggest that future research should investigate the potential use of emoji scales to make DCEs more inclusive for people with language barriers or limited literacy, as well as for children and adolescents.