Older adults detect happy facial expressions less rapidly

Akie Saito, Wataru Sato and Sakiko Yoshikawa

Article citation details
R. Soc. open sci. 7: 191715.
http://dx.doi.org/10.1098/rsos.191715

Review timeline
Original submission: 30 September 2019
Revised submission: 6 January 2020
Final acceptance: 21 February 2020

Note: Reports are unedited and appear as submitted by the referee. The review history appears in chronological order.

Review History

RSOS-191715.R0 (Original submission)

Review form: Reviewer 1

Is the manuscript scientifically sound in its present form? No

Are the interpretations and conclusions justified by the results? Yes

Is the language acceptable? Yes

Do you have any ethical concerns with this paper? No

Have you any concerns about statistical analyses in this paper? No

Recommendation? Major revision is needed (please make suggestions in comments)
Comments to the Author(s)

The current paper aims to examine the detection of happy and angry emotions (controlling for visual properties) in young and old adults. Normal and anti-expression of angry and happy faces were presented as a target among neutral distractors in a visual search task. Both age groups were faster to detect faces with normal angry expression compared to faces with anti-angry expression. Young adults have also detected faces with a normal happy expression. However, older adults did not show the detection advantage for happy over anti-happy expression. This suggests that older adults may face difficulties in terms of quick detection and focusing attention toward smiling faces.

Overall, I liked the research question and methodology. However, I have a few concerns, which need to be resolved before publications.

1. Authors have claimed that older adults have difficulty in detecting happy faces when it is not directly appearing in front of them. It implies that they do not have problems to detect a happy face when presented directly in front of them. Since they have not compared the detection of happy faces presented at the periphery compared to faces presented at the center of the screen, therefore, the authors need to be cautious in making such a conclusion. Alternatively, authors should find the previous literature where emotional faces were presented at the center of the screen, and they found the same results just like the current study. Authors can compare their results with previous studies to make such a claim.

2. The introduction is quite weak. For example, the authors were interested in comparing happy and angry emotions. However, in the introduction section, they have not mentioned the basic cognitive processing differences in the processing of happy and angry emotions (Gupta, 2019; Gupta et al., 2016). Also, a lot of literature is missing concerning emotion processing, specifically positive and negative emotion in general (Srinivasan & Gupta, 2010, 2011; Gupta & Srinivasan, 2015; Gupta & Deak, 2015). Please add these studies and discuss them. Moreover, authors have not mentioned what could be the possible cognitive-affective mechanisms underlying the processing of happy and angry expressions that would have resulted in differences in young and old adults to process emotional stimuli. Many studies have shown that very little attention is required to process pleasant stimuli compared to unpleasant stimuli (see Gupta, 2019, 2016; Gupta et al., 2016; Srinivasan & Gupta, 2010, 2011; Gupta & Srinivasan, 2015).

3. Authors have suggested that using anti-expression is more controlled stimuli compared to neutral stimuli. It is not very clear.

4. Please add some example of real faces (e.g., normal happy vs. anti happy face) used in the study.

5. It would be interesting to examine the detection RT/accuracy of emotional faces in the left vs. right visual field. It has been suggested that emotional face processing are right-hemisphere biased (see Gupta & Raymond, 2012; Gupta et al., 2018). This will give an insight into how emotions processing are represented in the old and young brain.

6. G-power analysis is required to determine the sample size.

7. Please address the theoretical and clinical implications of these results.

Gupta, R. (2019). Positive emotions have a unique capacity to capture attention. Prog Brain Res, 247:23-46. doi: 10.1016/bs.pbr.2019.02.001.

Gupta, R., Hur, Y, & Lavie, N. (2016). Distracted by pleasure?: Effects of positive versus negative valence on emotional capture under load. Emotion, 16(3), 328-337.
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Gupta, R., & Déak, G. O. (2015). Disarming smiles: irrelevant happy faces slow post-error responses. Cognitive Processing, 16, 427-434.

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Gupta, R., Raymond, J. E., & Vuilleumier, P. (2018). Priming by motivationally salient distractors produces hemispheric asymmetries in visual processing. Psychological Research. doi: 10.1007/s00426-018-1028-1.

Gupta, R. (2016) Commentary: Neural Control of Vascular Reactions: Impact of Emotion and Attention. Front. Psychol. 7:1613. doi: 10.3389/fpsyg.2016.01613.

Review form: Reviewer 2

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
No

Is the language acceptable?
Yes

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No

Recommendation?
Major revision is needed (please make suggestions in comments)

Comments to the Author(s)
In this behavioral study, Saito and colleagues compared the detection of angry and happy facial expressions (relative to neutral ones) between younger and older adults using a visual search task. The main finding is that older adults exhibited similar detection performance compared to younger ones in case of angry faces. However, the performance on happy faces differed between groups where older adults exhibited reduced detection performance. In general, the manuscript is well written, and the findings would be of interest to the affective neuroscience community. However, the authors should address the concerns noted below to clarify the design and interpretational issues further.
1. It is unclear why the authors had used only two facial stimuli though the Ekman face database contains stimuli from multiple actors? Because of this design choice, as the same target stimuli were repeated multiple (36) times across the experiment, could potential adaptation to happy faces in older adults explain the observed pattern of results??

2. In the RT Results section, it was reported that the older adults exhibited better performance on anti-happy compared to anti-angry faces. Why should this be the case, especially when the authors stated earlier that the anti faces were typically perceived as neutral facial expressions?

3. In the Discussion section, the arguments of linking reduced social reward processing in older adults to the observed pattern of results are very speculative as no measures of social reward processing were collected and compared between the two groups. The authors should at least explicitly acknowledge that such a speculative hypothesis could be explicitly tested in future work.

4. In the Rating task, were the facial stimuli presented centrally or peripherally (as in the visual search task)? If presented centrally, how meaningful would be to relate them to the performance with peripherally presented faces in the visual search task (especially in the older adults)?

5. It is a bit confusing to see the ANOVA findings based on the accuracy data under the Data Analyses section (page 15). It would be better if the authors could move them appropriately into the Results section.

Decision letter (RSOS-191715.R0)

12-Dec-2019

Dear Dr Saito,

The editors assigned to your paper (“Older Adults Detect Happy Facial Expressions Less Rapidly”) have now received comments from reviewers. We would like you to revise your paper in accordance with the referee and Associate Editor suggestions which can be found below (not including confidential reports to the Editor). Please note this decision does not guarantee eventual acceptance.

Please submit a copy of your revised paper before 04-Jan-2020. Please note that the revision deadline will expire at 00.00am on this date. If we do not hear from you within this time then it will be assumed that the paper has been withdrawn. In exceptional circumstances, extensions may be possible if agreed with the Editorial Office in advance. We do not allow multiple rounds of revision so we urge you to make every effort to fully address all of the comments at this stage. If deemed necessary by the Editors, your manuscript will be sent back to one or more of the original reviewers for assessment. If the original reviewers are not available, we may invite new reviewers.

To revise your manuscript, log into http://mc.manuscriptcentral.com/rsos and enter your Author Centre, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision." Your manuscript number has been appended to denote a revision. Revise your manuscript and upload a new version through your Author Centre.

When submitting your revised manuscript, you must respond to the comments made by the referees and upload a file "Response to Referees" in "Section 6 - File Upload". Please use this to document how you have responded to the comments, and the adjustments you have made. In
order to expedite the processing of the revised manuscript, please be as specific as possible in your response.

In addition to addressing all of the reviewers' and editor's comments please also ensure that your revised manuscript contains the following sections as appropriate before the reference list:

• Ethics statement (if applicable)
  If your study uses humans or animals please include details of the ethical approval received, including the name of the committee that granted approval. For human studies please also detail whether informed consent was obtained. For field studies on animals please include details of all permissions, licences and/or approvals granted to carry out the fieldwork.

• Data accessibility
  It is a condition of publication that all supporting data are made available either as supplementary information or preferably in a suitable permanent repository. The data accessibility section should state where the article's supporting data can be accessed. This section should also include details, where possible of where to access other relevant research materials such as statistical tools, protocols, software etc can be accessed. If the data have been deposited in an external repository this section should list the database, accession number and link to the DOI for all data from the article that have been made publicly available. Data sets that have been deposited in an external repository and have a DOI should also be appropriately cited in the manuscript and included in the reference list.

  If you wish to submit your supporting data or code to Dryad (http://datadryad.org/), or modify your current submission to dryad, please use the following link:
  http://datadryad.org/submit?journalID=RSOS&manu=RSOS-191715

• Competing interests
  Please declare any financial or non-financial competing interests, or state that you have no competing interests.

• Authors’ contributions
  All submissions, other than those with a single author, must include an Authors’ Contributions section which individually lists the specific contribution of each author. The list of Authors should meet all of the following criteria; 1) substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; 2) drafting the article or revising it critically for important intellectual content; and 3) final approval of the version to be published.

  All contributors who do not meet all of these criteria should be included in the acknowledgements.

  We suggest the following format:
  AB carried out the molecular lab work, participated in data analysis, carried out sequence alignments, participated in the design of the study and drafted the manuscript; CD carried out the statistical analyses; EF collected field data; GH conceived of the study, designed the study, coordinated the study and helped draft the manuscript. All authors gave final approval for publication.

• Acknowledgements
  Please acknowledge anyone who contributed to the study but did not meet the authorship criteria.

• Funding statement
  Please list the source of funding for each author.
Once again, thank you for submitting your manuscript to Royal Society Open Science and I look forward to receiving your revision. If you have any questions at all, please do not hesitate to get in touch.

Kind regards,
Anita Kristiansen
Editorial Coordinator
Royal Society Open Science
openscience@royalsociety.org

on behalf of Dr Narayanan Srinivasan (Associate Editor) and Essi Viding (Subject Editor)
openscience@royalsociety.org

Associate Editor's comments (Dr Narayanan Srinivasan):
Two reviewers have now commented on the paper. Both find the paper interesting but have concerns. The authors need to address all the comments point by point in their revision.

Reviewers' Comments to Author:
Reviewer: 1

Comments to the Author(s)
The current paper aims to examine the detection of happy and angry emotions (controlling for visual properties) in young and old adults. Normal and anti-expression of angry and happy faces were presented as a target among neutral distractors in a visual search task. Both age groups were faster to detect faces with normal angry expression compared to faces with anti-angry expression. Young adults have also detected faces with a normal happy expression. However, older adults did not show the detection advantage for happy over anti-happy expression. This suggests that older adults may face difficulties in terms of quick detection and focusing attention toward smiling faces.

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7. Please address the theoretical and clinical implications of these results.

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Srinivasan, N., & Gupta, R. (2011). Global-local processing affects recognition of distractor emotional faces. Quarterly Journal of Experimental Psychology, 64, 425-433.

Gupta, R., & Déak, G. O. (2015). Disarming smiles: irrelevant happy faces slow post-error responses. Cognitive Processing, 16, 427-434.

Gupta, R., & Srinivasan, N. (2015). Only irrelevant sad but not happy faces are inhibited under high perceptual load. Cognition and Emotion, 29, 747–754.

Gupta, R. & Raymond, J. E. (2012). Emotional distraction unbalances visual processing. Psychonomic Bulletin and Review, 19, 184-189.

Gupta, R., Raymond, J. E., & Vuilleumier, P. (2018). Priming by motivationally salient distractors produces hemispheric asymmetries in visual processing. Psychological Research. doi: 10.1007/s00426-018-1028-1.

Gupta, R. (2016) Commentary: Neural Control of Vascular Reactions: Impact of Emotion and Attention. Front. Psychol. 7:1613. doi: 10.3389/fpsyg.2016.01613.

Reviewer: 2

Comments to the Author(s)
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1. It is unclear why the authors had used only two facial stimuli though the Ekman face database contains stimuli from multiple actors? Because of this design choice, as the same target stimuli were repeated multiple (36) times across the experiment, could potential adaptation to happy faces in older adults explain the observed pattern of results??

2. In the RT Results section, it was reported that the older adults exhibited better performance on anti-happy compared to anti-angry faces. Why should this be the case, especially when the authors stated earlier that the anti faces were typically perceived as neutral facial expressions?

3. In the Discussion section, the arguments of linking reduced social reward processing in older adults to the observed pattern of results are very speculative as no measures of social reward processing were collected and compared between the two groups. The authors should at least explicitly acknowledge that such a speculative hypothesis could be explicitly tested in future work.

4. In the Rating task, were the facial stimuli presented centrally or peripherally (as in the visual search task)? If presented centrally, how meaningful would be to relate them to the performance with peripherally presented faces in the visual search task (especially in the older adults)?

5. It is a bit confusing to see the ANOVA findings based on the accuracy data under the Data Analyses section (page 15). It would be better if the authors could move them appropriately into the Results section.

Author's Response to Decision Letter for (RSOS-191715.R0)

See Appendix A.

RSOS-191715.R1 (Revision)

Review form: Reviewer 1

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No
Recommendation?
Accept as is

Comments to the Author(s)
Authors have incorporated all comments.

Review form: Reviewer 2

Is the manuscript scientifically sound in its present form?
Yes

Are the interpretations and conclusions justified by the results?
Yes

Is the language acceptable?
Yes

Do you have any ethical concerns with this paper?
No

Have you any concerns about statistical analyses in this paper?
No

Recommendation?
Accept as is

Comments to the Author(s)
The authors have done a great job in addressing my previous comments. I do not have any additional comments or concerns.

Decision letter (RSOS-191715.R1)

21-Feb-2020

Dear Dr Saito,

It is a pleasure to accept your manuscript entitled "Older Adults Detect Happy Facial Expressions Less Rapidly" in its current form for publication in Royal Society Open Science. The comments of the reviewer(s) who reviewed your manuscript are included at the foot of this letter.

Please ensure that you send to the editorial office an editable version of your accepted manuscript, and individual files for each figure and table included in your manuscript. You can send these in a zip folder if more convenient. Failure to provide these files may delay the processing of your proof. You may disregard this request if you have already provided these files to the editorial office.

You can expect to receive a proof of your article in the near future. Please contact the editorial office (openscience_proofs@royalsociety.org) and the production office (openscience@royalsociety.org) to let us know if you are likely to be away from e-mail contact -- if
you are going to be away, please nominate a co-author (if available) to manage the proofing process, and ensure they are copied into your email to the journal.

Due to rapid publication and an extremely tight schedule, if comments are not received, your paper may experience a delay in publication.

Please see the Royal Society Publishing guidance on how you may share your accepted author manuscript at https://royalsociety.org/journals/ethics-policies/media-embargo/.

Thank you for your fine contribution. On behalf of the Editors of Royal Society Open Science, we look forward to your continued contributions to the Journal.

Kind regards,
Andrew Dunn
Royal Society Open Science Editorial Office
Royal Society Open Science
openscience@royalsociety.org

on behalf of Dr Narayanan Srinivasan (Associate Editor) and Essi Viding (Subject Editor)
openscience@royalsociety.org

Associate Editor Comments to Author (Dr Narayanan Srinivasan):
Associate Editor: 1
Comments to the Author:
Both reviewers are happy with the revisions. Congratulations and the paper is now accepted for publication in RSOS.

Reviewer comments to Author:
Reviewer: 1

Comments to the Author(s)
Authors have incorporated all comments.

Reviewer: 2

Comments to the Author(s)
The authors have done a great job in addressing my previous comments. I do not have any additional comments or concerns.

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https://www.facebook.com/RoyalSocietyPublishing.FanPage/
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Dear Dr. Narayanan Srinivasan and Essi Viding

We have uploaded the revised manuscript of “Older adults detect happy facial expressions less rapidly.” We would like to thank the Associate Editor and the reviewers for reviewing our manuscript and giving us invaluable comments. We have revised the manuscript following your comments and major changes are highlighted. Additionally, a professional English-language editing service made language-related changes, which are not highlighted unless the scientific content was altered.

We believe that the revised manuscript has improved thanks to your comments and suggestions. We would be grateful if you would consider this revised manuscript for publication in Royal Society Open Science.

Reviewer #1
Comment 1
Authors have claimed that older adults have difficulty in detecting happy faces when it is not directly appearing in front of them. It implies that they do not have problems to detect a happy face when presented directly in front of them. Since they have not compared the detection of happy faces presented at the periphery compared to faces presented at the center of the screen, therefore, the authors need to be cautious in making such a conclusion. Alternatively, authors should find the previous literature where emotional faces were presented at the center of the screen, and they found the same results just like the current study. Authors can compare their results with previous studies to make such a claim.

Response
We agree with the reviewer on this point. Our results suggest that older adults may have difficulty detecting happy faces peripherally, therefore we have denoted this result and deleted the speculative expressions (in Abstract, Discussion, and Conclusion).

Comment 2
The introduction is quite weak. For example, the authors were interested in comparing happy and angry emotions. However, in the introduction section, they have not mentioned the basic cognitive processing differences in the processing of happy and angry emotions (Gupta, 2019; Gupta et al., 2016). Also, a lot of literature is missing concerning emotion processing, specifically positive and negative emotion in general (Srinivasan & Gupta, 2010, 2011; Gupta & Srinivasan, 2015, Gupta & Deak, 2015). Please add these studies and discuss them. Moreover, authors have not mentioned what could be the possible cognitive-affective mechanisms underlying the processing of happy and angry expressions that would have resulted in differences in young and old adults to process emotional stimuli. Many studies have shown that very little attention is required to process pleasant stimuli compared to
unpleasant stimuli (see Gupta, 2019, 2016; Gupta et al., 2016; Srinivasan & Gupta, 2010, 2011; Gupta & Srinivasan, 2015).

Response
We have revised the Introduction section to cite studies that have examined the capturing power of positive (happy) stimuli (pages 5–6 in Introduction). Additionally, we have discussed the significance of positive stimuli on human beings and have interpreted our results as reflecting the decreased value of happy faces for older adults (page 18 in Discussion).

Comment 3
Authors have suggested that using anti-expression is more controlled stimuli compared to neutral stimuli. It is not very clear.

Response
Anti-expressions are not only generally rated as neutral expressions, but are also controlled stimuli for normal expressions in terms of visual (physical) characteristics of faces. In the previous version of the manuscript, we mentioned anti-expressions but failed to fully explain the term. In the revised manuscript, we have added the necessary explanation (page 3).

Comment 4
Please add some example of real faces (e.g., normal happy vs. anti happy face) used in the study.

Response
We cannot show real faces due to the lack of a license. Although all images published at Royal Society Open Science must be under the Creative Commons Attribution (CC BY) license (https://royalsociety.org/journals/authors/author-guidelines), the copyright for the images used in our study is held by The Paul Ekman Group, LLC and each reprint requires separate permission and payment. Therefore, we modified Figure 1 to show more realistic illustrations.

Comment 5
It would be interesting to examine the detection RT/accuracy of emotional faces in the left vs. right visual field. It has been suggested that emotional face processing are right-hemisphere biased (see Gupta & Raymond, 2012; Gupta et al., 2018). This will give an insight into how emotions processing are represented in the old and young brain.

Response
We conducted an ANOVA by adding the factor of visual field (right field versus left field). Because the result did not show a significant four-way interaction (F(1,60) = 1.431, p > .10), we reported it as the result of preliminary analysis in the Materials and Methods section (page 13).
Comment 6
G-power analysis is required to determine the sample size.
Response
We have performed G-power analysis and described it in the Materials and Method section (pages 7–8).

Comment 7
Please address the theoretical and clinical implications of these results.
Response
We have discussed the implications of our results (pages 19–20 in Discussion).

Reviewer #2
Comment 1
It is unclear why the authors had used only two facial stimuli though the Ekman face database contains stimuli from multiple actors? Because of this design choice, as the same target stimuli were repeated multiple (36) times across the experiment, could potential adaptation to happy faces in older adults explain the observed pattern of results??
Response
The main reason that we did not use faces from other models is because it was not possible to create corresponding anti-expressions of anger and happiness from other models, particularly those with open mouths. We have made a reference to this limitation (pages 20–21 in Discussion).

Regarding the issue of the potential adaptation to happy faces, we examined whether adaptation effects would be observed. We conducted an ANOVA by adding the factor of presentation block. Because there was no significant four-way interaction (F(3,180) = 1.175, p >.10), we reported it as the result of preliminary analysis in the Materials and Methods section (page 13).

Comment 2
In the RT Results section, it was reported that the older adults exhibited better performance on anti-happy compared to anti-angry faces. Why should this be the case, especially when the authors stated earlier that the anti faces were typically perceived as neutral facial expressions?
Response
We have discussed this pattern of results by comparing them to the rating performance of these stimuli (pages 18–19 in Discussion).

Comment 3
In the Discussion section, the arguments of linking reduced social reward processing in older adults to the observed pattern of results are very speculative as no measures of social reward
processing were collected and compared between the two groups. The authors should at least explicitly acknowledge that such a speculative hypothesis could be explicitly tested in future work.

**Response**

We did not conduct any tests related to social reward processing. Instead, we have attempted to explain our results using the hypotheses from studies that have examined the interaction between positive stimuli (including happy faces) and attention (page 18).

**Comment 4**

In the Rating task, were the facial stimuli presented centrally or peripherally (as in the visual search task)? If presented centrally, how meaningful would be to relate them to the performance with peripherally presented faces in the visual search task (especially in the older adults)?

**Response**

We have acknowledged that this is one of the limitations of our study and we have mentioned that presenting the faces in the same manner across the tasks would be necessary to examine the relationship between the performances of these tasks (page 20 in Discussion).

**Comment 5**

It is a bit confusing to see the ANOVA findings based on the accuracy data under the Data Analyses section (page 15). It would be better if the authors could move them appropriately into the Results section.

**Response**

We have updated the manuscript accordingly (page 15).