



Anna Jenčová &lt;jencaster@gmail.com&gt;

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**IEEE Transactions on Information Theory - Decision on Manuscript ID  
IT-20-0155**

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**IEEE Transactions on Information Theory** <onbehalf@manuscriptcentral.com>Mon, Aug 17, 2020 at  
6:52 AMReply-To: marco.tomamichel@nus.edu.sg  
To: jenca@mat.savba.sk  
Cc: jenca@mat.savba.sk

17-Aug-2020

Dear Prof. Jencova:

Manuscript ID IT-20-0155 titled "A general theory of comparison of quantum channels (and beyond)" which you submitted to the IEEE Transactions on Information Theory, has been reviewed. The comments of the reviewer(s) are included at the bottom of this letter. There may be additional comments as separate files available through your Author Center on the ScholarOne Manuscripts web site, so please check there also to make sure you have received all reviewer comments.

Based on my own detailed reading of the paper and the reviewers' comments, I recommend that you revise and resubmit your manuscript. Both referees and I agree that this manuscript contains significant new connections and results that are interesting to a subset of the readership of the Transactions. However, as currently written, the manuscript does not seem to target them sufficiently. The referees suggest some means how this could be improved. I would particularly encourage you to add a short summary presentation of the main results concerning quantum channels in the introduction, as those are rather hidden away in the bulk of the paper right now. Additionally it would be helpful to add a paragraph explaining the structure of the paper. The readership will not necessarily be familiar with the GPT framework as this is a toy model used mostly in the quantum foundations community, and not often seen in information theory. Its use should be motivated and Section 2 might need to be expanded slightly. On the other hand, the information theory community would very much be interested in a discussion of asymptotic discrimination, which is only briefly mentioned in the conclusions as an open problem currently.

Hence, while this paper certainly deserves publication and I will recommend publication in the Transactions if the improvements suggested by the referees and myself are implemented adequately, I am not fully convinced that the IEEE Transactions on Information Theory is the best venue for this work to be disseminated to the researchers most interested in the topic. Journals whose readership might be more in tune with this research direction include the Journal of Mathematical Physics or Quantum.

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Comments by the reviewers:

Reviewer: 1

Comments to the Author

In this paper the author develops a theory for comparison of quantum channels. The author starts with general considerations, within the framework of GPT, and then focus on its applications to quantum channels. The paper is well written, although the presentation can be improved a bit (see suggestions below). As I see

it, the main result of the paper is Theorem 3 (or Theorem 2 in the GPT setting). I think the theorem is interesting and timely given the recent activity on resource theories of quantum channels. I therefore recommend publication provided the author consider the following suggestions.

Theorem 3 is missing, to my taste, some motivation or explanation of the meaning of these three equivalent characterizations. The author gives some operational meaning in terms of guessing games for several special cases (e.g. only post-processing, etc), but can you say something in the general case? What is the significance of these equivalent characterizations of the F-deficiency?

On page 8, it is not clear to me why the author introduce  $C_{\Delta}$ ? Also, for classical wires, it is common (by the QI community) to use double lines for classical systems. This can simplify a bit notations instead of the "cl".

On page 11, what is the significance of Lemma 3? How tight is the inequality?

The paper is full of notations that some of them are only used in this paper. Therefore, when that author write on page 12 "see Section 3.1.5 for the definition of  $\alpha p$ " it makes it hard on the reader to find the definition in the in the section.

The terminology of the F-deficiency is less familiar for the QI community. I recommend the author use the more common name of "conversion distance".

The case  $\epsilon=0$  of Theorem 3 had been studied in Ref.[9]. Therefore, I recommend adding couple of sentences comparing with the earlier work.

The convex subcategory  $F$  (particularly if it is a symmetric monoidal category) has been studied under the name "convex resource theory". I recommend the author consider using this terminology. See for example: "A mathematical theory of resources", Information and Computation 250 (2016), 59--86

A general comment about the guessing games: It will be extremely helpful for the reader if the author add some figures to describe the different games considered in this paper.

Typo: P.13, "that involve the use the channel  $\Phi_1$  or  $\Phi_2$ "

Typo: On page 6, "The randomization theorem tells us that  $\delta F(M||N)$  if and only if,...."

Reviewer: 2

Comments to the Author

(There are no comments. Please check to see if comments were included as a file attachment with this e-mail or as an attachment in your Author Center.)

My own comments:

I noticed some inconsistent notation, as mathematical operations labels like "int", "min", "guess" are sometimes written in normal and sometimes in the italic font reserved for variables.

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As always the submission of the revised manuscript should be accompanied by a detailed response to the reviewers' and to my comments. In preparing this response, please pay particular attention to the points

mentioned above.

To revise your manuscript, log into <https://mc.manuscriptcentral.com/t-it> and enter your Author Center, where you will find your manuscript title listed under "Manuscripts with Decisions." Under "Actions," click on "Create a Revision."

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Because we are trying to facilitate timely publication of manuscripts submitted to the IEEE Transactions on Information Theory, your revised manuscript should be uploaded within 90 days. The revised manuscript must be submitted by the deadline. Please note that extensions will not be considered by the Editor-in-Chief except under extenuating circumstances, as a part of our drive to reduce sub-to-pub delays. For extensions up to one week, please contact Kristen Cignavitch at [t-it-admin@ieee.org](mailto:t-it-admin@ieee.org). For an extension longer than one week, please provide your reason for the extension and contact Eic Igal Sason at [sason-ittrans@ee.technion.ac.il](mailto:sason-ittrans@ee.technion.ac.il) and copy [t-it-admin@ieee.org](mailto:t-it-admin@ieee.org) and [marco.tomamichel@nus.edu.sg](mailto:marco.tomamichel@nus.edu.sg).

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Once again, thank you for submitting your manuscript to the IEEE Transactions on Information Theory and I look forward to receiving your revision.

Sincerely,  
Dr. Marco Tomamichel  
Associate Editor, IEEE Transactions on Information Theory  
[marco.tomamichel@nus.edu.sg](mailto:marco.tomamichel@nus.edu.sg)



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