1. For the restricted variant of mean proximity rules studied by the authors, the set of rules that one can capture are, in essence, the MLERIV rules (as studied by Conitzer and Sandholm). The authors argue that they seek a family of voting rules that would be less general than DR or MLE rules... yet they seem to find exactly the rules that are interesting in the MLE framework. Further, they claim that MLE/DR frameworks did not yield general results about, say, manipulability of MLE/DR rules, but they do not provide such results for their family of rules either.

2. The set of interesting (known) rules that fits the proposed framework seems to be limited to scoring rules and the Kemeny rule. Is there any other interesting rule that is in the class?

3. What benefits do we have from the provided characterization? Why is it useful? (I understand and appreciate the fact that the results are interesting in themselves, but since this is an electronic commerce conference and not a social choice one, then I think there should be some better motivation/justification for the work, especially that the proposed class does not seem to be giving us any family of rules that we did not already have).

4. The paper is based on the work of Zwicker, whose title is: "Consistency without neutrality in voting rules". Bringing back neutrality, in effect, is going somewhat against the spirit of Zwicker's work and, not too suprisingly, leads to a class of rules that is quite limited.

More detailed remarks:

p. 1: "these approaches have been rather unfruitful" <--- given the number of work on MLE and DR frameworks, one really cannot write such things. If MLE/DR were unfruitful, one should specify in what sense. Further, especially for the MLE class, it seems that---at least for MLERIV and MLEWIV classes of Conitzer and Sandholm---the set of expressible voting rules is quite limited, so the comment that too many voting rules are expressible does not seem right.

~~p. 3: "low-dimensional embeddings" -> "low-dimensionality embeddings"~~

**[SL: don’t need to correct this, it’s not wrong]**

~~p. 4: "for every profiles" -> "for every two profiles"~~

~~p. 5: the description of Kemeny is quite unclear and it would be nice to explicitly define the several positional scoring rules mentioned.~~

~~p. 5, def 4.1: does ||.|| mean Euclidean norm?~~

p. 5: The term "scoring rules" in social choice is very deeply connection to positional scoring rules, so one should not use it for Zwicker's generalized scroing rules (indeed, because of the confusion it was unclear for me how it is possible to have both Proposition 4.4 and 4.5)

~~p. 6: "is a broad family" -> "are a broad family"~~

~~p. 6: "Note that all embeddings" -> "Note that not all embeddings" (?)~~

p. 7: If we have Observation 4.7 then what is the point of bothering with rank distinguishability?

~~p. 8: "In the next section, characterize" -> "In the next section, we characterize"~~

p. 11, last paragraph: "R\_{tau^{-1}}" -> "R(tau^{-1})"

p. 15: "This succict representation has many advantages [...]" <--- well, but for this comment to make sense, the authors should convince us that there indeed is any rule aside from positional scoring rules and Kemeny's rule that is worth looking at in this family (and, indeed, that there is so many of them that we cannot have specific representation for each of them).

p. 16: Pointing a reader to a table of results in the appendix seems very inappropriate. A summary of results is important and it certainly is worth spending some space on it...

~~p. 16: "Edith et al." -> "Elkind et al."~~

~~general: cite command seems to give names of the authors, so one should probably use something like shortcite to avoid text such as "Meskanen and Nurmi [Meskanen and Numie 2008]" in the paper.~~

In the intro it may seem like you consider the purpose of a voting rule to uncover some ground truth (e.g. where you say that DR methods have been "unfruitful").

When first mentioning DR better also reference Meskanen and Nurmi.

In Fig 1(a): is this a neutral mapping? I guess not since it seems that the order of permutations on the cycle matters.

Saying that almost all voting rules are DR (in the negative sense) is a bit unfair, since this is no longer true once you add reasonable restrictions (like you do for MPRs).

Year missing in [Crisman]

Section 2: "...Borda count similar" (missing "is")

In Def. 4.1 please emphasize that the outcome is a set, and || is the Euclidian norm (L2).

The term "scoring rules" is still problematic since one may get confused with positional scoring rules. How about "matrix scoring rules" ?

You can add that Prop. 4.3 (from Zwicker) is just the simple observation that the average minimizes the sum of distances to all points.

~~bottom of page 6: "note that all... not..." you mean "not all"~~

~~end of 4.1: "this has no cost" is a bit exaggerated. it has some cost but well known rules can still be represented.~~

~~bottom of page 7: why three representation?~~

top of page 8: note that in the more common interpretation od voting rules where ties are not allowed, then most standard rules are \*not\* neutral (e.g., break ties lexicographically).

the comment on the dimension of phi^NT (after proof of Lemma 5.5) should come before the Lemma. This would make the lemma and proof easier to follow.

you can emphasize in the text what the main results are (e.g., before Thm. 5.9)

~~in eq (4) the third expression is redundant.~~

**[SL: I don’t agree]**

The proof of 5.15 is very nice and well explained. I was missing one bit: you show properties (2) and (3) of the linear embedding phi^f. I understand that (4) follows from (3). What about (1)? I did not see where you show that R\_{tau^{-1}} = R^T\_{tau}

discussion in page 15: I understand that representation is poly in the dimension k. However it seems that there is no evidence that neutral "reasonable" rules have a low dimension mapping. The straight-forward way you suggest to construct a neutral mapping (Lemma 5.5) has k exponential in m. Scoring rules for m=3 have only one parameter so it is not so surprising they can be embedded in two dimensions (although the equivalence is nice).

I guess my question is: is there an example of a natural voting rule (SWF) that can be embedded in k=poly(m) for any m? maybe Borda? If none is known, this can be stated as an open question.

-- Comments to the author(s):

This paper characterizes neutrality of mean proximity voting rules by the existence of a linear representation of the embedding function, using a theorem in group representation theory. While I feel that the paper is interesting from a theoretical point of view and may potentially lead to a new direction, in its current form I do not think it fits EC well. My impression is that the paper is more or less marginal (but it can be improved, probably not easily). I have two main suggestions on improvement.

1. The paper lacks a clear illustration and justification of the benefit of the group representation approach (i.e. why it is important to know that neutrality is equivalent to the existence of a linear embedding function? Does it help design a better voting system? Does it provide a different angle to view previous social choice approaches?). It would be a strong paper if the authors can show how results in group representation theory can help us from a social choice or mechanism design point of view (because this is EC). The benefit was very briefly explained in the paper as arguing that the linear representation gives a easier and more understandable way to design the embedding function. If this is the biggest selling point please elaborate on it and give examples (of designing new mean proximity rules).

2. This suggestion is still more or less along the direction of the first suggestion above, but is more technical, focusing on the importance of the obtained results. In general I am not sure if it is super exciting to understand only the neutrality of a certain type of voting rules since there are many other axiomatic properties that are arguably more interesting/important than neutrality. It would be great if the authors could build a closer connection between mean proximity rules and group representation theory by characterizing a significantly larger set of axioms (monotonicity, consistency, participation, IIA, Condorcet, etc), or give an axiomatic characterization of mean proximity rules.

Detailed comments (mostly on the motivation and references):

P1 references to manipulability look strange. Papers by Gibbard, Satterthwaite are much better choices.

P1 last sentence of the first paragraph: not clear what does a "theoretical justification" mean. GSRs have an axiomatic characterization by Xia and Conitzer in an IJCAI-09 paper. The same paper also gave a geometric interpretation which was rediscovered by By Elchanan Mossel, Ariel D. Procaccia, and Miklos Z. Racz in a recent JAIR-13 paper (as hyperplane rules). I am not sure about PM-c and PD-c rules---theoretical justification might be hard since it is a model selection problem and highly depend on the problem domain.

P1 paragraph 2: some earlier papers discussed distance rationalizability e.g. T. Meskanen and H. Nurmi. Closeness counts in social choice. Also for the MLE approach, a much better set of references are Condorcet's 1785 paper,Young's 1988 paper, and Conitzer and Sandholm 05 paper (but not Conitzer et al. 09)

P2 second paragraph. Theoretical justification was mentioned again, but still it is not clear what does it mean. Certainly "theoretical justification" should not mean "being a mean proximity rule", and the geometric viewpoint of voting rules was discovered and explored in depth (to the best of my knowledge) by Young in 1975. Social choice theory often justifies class of voting rules by axiomatic properties and there is usually no golden standard to compare two voting rules. Maybe a better way to motivate the paper is to say that mean proximity rule takes a different angle towards the aggregation process, which is already quite interesting.