

Response to reviewers for AMIA 2016  
**Analyzing SNOMED CT's Historical Data: Pitfalls and Possibilities**  
*W. Ceusters & Jonathan P. Bona*

Dear Prof. Werner Ceusters:

Thank you for submitting your research to the AMIA 2016 Annual Symposium.

Congratulations! Your submission was accepted. We look forward to seeing you in Chicago.

Your presentation will take place on November 14, 2016 from 10:30 AM to 12:00 PM. The exact session title will be announced in the Itinerary Planner in late July.

It is critically important that you read the following text in its entirety as it contains important information about the resubmission process. Most questions you will have are addressed below.

If you (the authors) adequately address the reviewers' comments during the resubmission phase, your work will be published in the Annual Symposium Proceedings at <https://knowledge.amia.org>. Publication applies to all content with the exception of Tutorials and Working Group Pre-symposia. Papers and student papers will be archived in PubMed Central. The resubmission phase is your final opportunity to edit your work. Failure to resubmit and respond to the reviewers' comments may result in removing your work from the Proceedings.

For podium abstracts, student papers, and papers, the resubmission phase is an additional step in the process that will help ensure the scientific validity of the papers and other submissions confirming AMIA submissions as fully peer-reviewed. Authors, whose papers have been accepted for presentation at the symposium, are required to address carefully the comments of the reviewers and the SPC, and to submit a revised version of their manuscript for publication in the Proceedings. Authors are not required to accept all suggestions; but when submitting their revised manuscripts, authors should explain why they did and did not respond to specific comments. Space will be provided for this explanation within the final submission area of the website. The SPC reserves the right to review authors' revisions and their rationale, and may change the decision of accept to reject and thus remove from the program papers of authors, whose changes are not responsive to the comments or who otherwise do not comply with this final submission procedure.

We encourage you to begin work on your resubmission as soon as possible. The resubmission deadline is Thursday, July 7th and it will not be extended.

Thank you again for your contribution to the AMIA 2016 Annual Symposium. Please contact Dasha Cohen by e-mail at [dasha@amia.org](mailto:dasha@amia.org) if you have any questions about any aspect of this process.

Sincerely,

Wanda Pratt, PhD, FACMI

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Professor, Information School, University of Washington

Chair, 2016 Scientific Program Committee

Member, AMIA Board of Directors

Reviewer Comments (Please note that your submission was reviewed by at least two reviewers and an SPC member. Numbers 1, 2, 3., etc. below represent different reviewers):

### **Review 1**

The reviewers generally agree in finding this paper interesting and this exploration worth reporting to the AMIA community. However, the reviewers all have significant concerns about the amount of technical details in this paper, compared to substantive practical recommendations.

To make this good paper more accessible and more interesting to a wide AMIA audience, the authors should:

1a) limit the technical details to a minimum -- Technical aspects belong to a more technical journal or venue

**R1→ This paper is submitted as a research paper for the AMIA 2016 theme Terminology and Standards Ontologies which is described on the AMIA 2016 website as intended to cover 'complex issues surrounding standard syntax, semantics, and pragmatics of design, development and use of various application-specific and general-purpose clinical terminologies and ontologies'. Complex issues typically require non-trivial methods to detect root causes and explaining such methods. Reproducibility of results by other groups requires disclosure of the methods whereby technicality cannot be avoided. In any case, we provided more explanations and examples for items specifically requested by the reviewers.**

1b) provide a gentle introduction to the remaining technical aspects -- There is currently no overview of the methods, nor do the authors provide any examples for some aspects of the methods (e.g., attribute implication)

**R2→ We added a subsection 'Overview' to the methodology section.**

**R3→ examples have been provided. See responses R11 and R13**

2a) provide more results, especially for the patterns extracted from the data

**R4→ 285 patterns were extracted, as explicitly noted in the paper. It is obvious that they cannot all be listed and discussed in a 10-page paper. We will however make these patterns available as additional data on our website.**

2b) emphasize the practical significance alluded to in the introduction -- any wisdom, which could be passed to the IHTSDO to prevent past errors from being made again?

**R5→ we added concrete recommendations at the end of the conclusion**

The authors should also discuss whether simple approaches could be used (e.g., simple analysis of transitions for changes in semantic tags over time) or explain why they cannot. FCA over history profiles seems like heavy artillery in some cases.

**R6→ FCA is a relative simple approach for which several open source programs are available, including plug-ins for Microsoft Excel and Protégé. We feel the technique is unknown, rather than complex, and hope that this paper draws more attention to the possibilities. Re other simple approaches, we hope this reviewer understands that we cannot report on research we didn't conduct.**

### **Review 2**

The data preparation and analysis from this well known informatics team is difficult to follow and I suspect it will be confusing to the most readers.

**R7→ we have provided extra explanations and examples where concretely requested by reviewers. See R11 and R13**

Speaking as a member of the SNOMED CT editorial community, I note that they discover a number of editorial forays in the historical development of SNOMED CT that ended in revisions and that are not common knowledge throughout the informatics world.

**R8→ We are not sure about what this reviewer tries to convey here. The reviewer – in contradistinction to the authors of this paper – being a member of the SNOMED CT editorial community, we assume that she/he confesses that at some point in SNOMED CT’s history editorial and modeling policies have been introduced that had major impact on large parts of the terminology and perhaps were not well enough thought through or difficult to adhere to consistently (hence the ‘forays’?) so that therefor some of them were revised a few times afterwards. Changes of this sort have been reported in SNOMED CT’s documentation over time and could have been found by ‘the informatics world’ but indeed not without the considerable effort of digging through tons of documents. The methodology applied here turned out to be able – not to our surprise as it was designed to make such discoveries – to detect these changes and the impact thereof.**

Conclusions will be difficult for most to formulate but presentation of the techniques may well stimulate thoughts in the community involved in formal logic towards the development of methods for constraining and guiding editorial policy in management of large ontologies.

**R9→ We agree. We added some recommendations to the conclusion**

I would further recommend to the authors that they consider for their presentation identification of axioms employing their analytical methods that would be candidate metrics for SNOMED CT quality assurance.

**R10→ Identification of axioms is the next step in our endeavor. This paper describes observations and explores possible explanation for phenomena observed. For the presentation in November, examples of such axioms can be provided.**

### Review 3

Very good solid work. I found the analysis of semantic tag history both easier to follow and more interesting than the more general history table analysis.

Generally very well written. As I am rusty on FCA, an example of attribute implication off the bat on page 5 would have been helpful.

**R11→ We did so. We added the sentence: For example, if ‘being mammal’ and ‘being vertebrate’ would be attributes used to correctly describe animals, then ‘*being mammal* → *being vertebrate*’ would be computable as being a valid implication.**

For the Duquenne-Guigues base and the Luxemburger base I would have definitely appreciated more explanations ...

**R12→ There is unfortunately no space to do that in the methodology and it would increase the technicality of the paper considerably, while reviewer 1 requests us to do exactly the opposite.**

... and an early example.

**R13→ we added one building further on the mammal – vertebrate example. We added the sentence: *'for example, for a particular zoo it could be found that 85% of the vertebrates on display are mammals'*.**

:) There is a period missing at the bottom of page 5, end of sentence. :)

**R14→ This was corrected.**

Figure 1 should be in a bigger font and with more explanation, specifically concerning the numbers on the links. Figure captions can be written in a more self-contained manner.

**R15→ All this has been done**

Personally I would have preferred the writing to be just a little more prescriptive than descriptive. What is the lesson for the IHTSDO staff? What can and should be done most urgently.

**R16→ We added concrete recommendations to the conclusion**

#### **Review 4:**

This paper provides a detailed analysis of the data structures IHTSDO used for tracking SNOMED CT change history. The motivation is to learn about SNOMED CT's mistakes committed in the past to detect still existing mistakes and prevent new ones. However, instead of focusing on this interesting and more significant question, the paper attempted to "identify pitfalls and possibilities that should be taken into account for an endeavor to that end," using January 2016 version of SNOMED CT as a specific case.

**R17→ The title of the paper was (and still is) *"Analyzing SNOMED CT's Historical Data: Pitfalls and Possibilities"*. It should thus not be a surprise that it is on exactly this topic that the paper focusses. However, we do understand the disappointment of this reviewer that we didn't make the ultimate goal we are striving for, i.e. *'to learn about SNOMED CT's mistakes committed in the past to detect still existing mistakes and prevent new ones'*, the main topic. This is because the work reported on here covers the exploratory phase of this endeavor. We pointed this out in the resubmission.**

**Original text (last sentence of the introduction): *'In this paper we report on how we explored thus far the history information included in the RF2 distribution of the January 2016 version of SNOMED CT not with the goal to answer this question, but to identify pitfalls and possibilities that should be taken into account for an endeavor to that end.'***

**Replacement: *"This sort of quality improvement being the ultimate goal of our efforts, the work described in this paper is the first phase of this endeavor during which we explored the history information included in the RF2 distribution of the January 2016 version of SNOMED CT to identify pitfalls and possibilities that should be taken into account for the development of novel error detection methods."***

The paper presented a wealth of information about the intricacies of SNOMED CT formats. However, the results seem mostly preparatory, and no specific examples are given of exactly what mistakes we can learn from such change histories.

**R18→ Results are preparatory indeed. This was stated in the original submission, and now even more so highlighted in the resubmission, already in response to this reviewer's previous remark. We disagree strongly with the claim that no specific examples are given of exactly what mistakes we can learn from such change histories. The results and discussion section contains ample examples of idiosyncrasies discovered and what questions re root causes result there from.**

Because of these, the enthusiasm of this reviewer is dampened. I encourage the authors to discover specific quality improvement examples that can take advantage of the change history, ...

**R19→ that is indeed part of our ongoing effort and will be reported in later publications**

and to leverage the visualizing power of FCA concept lattice diagrams for this purpose.

**R20→ given the size of our context, visualization of the computed graph did not turn out to be useful. Including it in the paper would be a waste of space. However, we will show the graphs during our presentation to highlight this. For the paper, we added in the data analysis section the sentence “While FCA concept lattice diagrams have visualizing power when applied to domains with a small number of concepts and attributes governed by a simple organizational structure, they are rather useless in case of more complex situations as the one explored here.” The sentence before which this addition was introduced, i.e. “An important notion in FCA is that of *attribute implication* where an implication asserts a certain relationship between two attribute sets which are respectively called *premise* and *conclusion*” was changed into “More useful here is the notion of *attribute implication* where an implication asserts a certain relationship between two attribute sets which are respectively called *premise* and *conclusion*”.**