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CCLitBox. A Wikidata Gadget to Classify World Literature

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Abstract

The Wikidata gadget, CCLitBox, for the automated classification of literary authors and works by faceted classification and using Linked Open Data (LOD) is presented. The tool reproduces the classification algorithm of Class O Literature of the Colon Classification and uses data freely available in Wikidata to generate Colon Classification class numbers. CCLitBox is completely free and allows any user to classify literary authors and their works. It is also easily accessible to everyone. It also uses LOD (Linked Open Data) from Wikidata where available, but if data on an author and/or their works are not available in Wikidata to be used by CCLitBox, it can be freely added, even using semi-automatic tools such as OpenRefine. Finally, CCLitBox is ready for any collaborative and networked project.

Keywords: Automated Classification, CCLitBox, Colon Classification, Linked Open Data (LOD), Wikidata

1. Introduction

The possibilities offered by the use of a faceted classification for the automatic classification of objects have been widely explored in recent years, and "we have also witnessed an increased interest in documentary faceted classification" (Slavic, 2008). According to Slavic, experience with classification automation can be used to speed up and facilitate the conversion of existing faceted classification schemes or the creation of management tools for new systems. She also suggests that it is possible to agree on a set of functional requirements for supporting faceted classifications and that classification schemes should be published and/or distributed in a format that is more appropriate to the way they are used and the functions they need to support (Slavic, 2008).

Linked Open Data (LOD) is an effective way of publishing data that makes it easier to share and connect data across different applications and organisations. Linked Open Data is a set of design principles for sharing machine-readable interlinked data on the web (Berners-Lee, 2006). LOD allows data to be freely used and distributed by anyone, subject only to the requirement of attribution and sharing-alike (Linked Data Community, 2012). LOD is based on open standards such as Resource Description Framework (RDF), Uniform Resource Identifier (URI), and Hypertext Transfer Protocol (HTTP). The main goal of LOD is to make data more accessible, reusable, and interoperable. By using LOD, organisations can make their data available to others in a way that is easy to understand and use (Guerrini *et al.*, 2015). This can help improve data quality, reduce duplication of effort, and enable new applications and services (Open Data e Linked Data, 2023). LOD provides a way to publish data that makes it easier to share and connect across different applications and organisations. It helps improve data quality, reduce duplication of effort, and enable new applications and services.

Examples of faceted classification using LOD are the Universal Decimal Classification (UDC), a complex multilingual classification that can be used in all fields of knowledge and the Integrative Levels Classification (ILC); there is also an example of a partially faceted classification, the DDC, as mentioned by Gnoli (Gnoli, 2021).

Nevertheless, only a few studies have examined the Colon Classification (CC) both from the point of view of

its relevance for the organisation of bibliographic objects and for the feasibility of an automatic process for the creation of CC class numbers for literature.

In particular, regarding the organisation of bibliographic objects, CC is characterised by its filiatory sequence (Ranganathan, 1967), which expresses a holistic vision of the catalogue, and creates a complex bibliographic organisation that exhaustively represents the semantic content, literary relationships, and formal characteristics of the resources (Bianchini, 2011). Furthermore, by analysing similarities and differences between entities defined by Functional Requirements for Bibliographic Records (FRBR) (IFLA Study Group on the Functional Requirements for Bibliographic Records, 1998, IFLA Study Group on the Functional Requirements for Bibliographic Records, 2009) and later by the IFLA LRM (IFLA, 2017) and their representation in the Colon Classification call numbers, studies have shown the possibility of organising bibliographic resources by FRBR entities using the model of the facet formula provided by the Colon Classification (Varghese, 2010) and using relevant, ready, and useable existing linked open data.

The main results of this analysis are that correspondences can be found between FRBR entities and categories expressed in Ranganathan's bibliographic system; a solid but not fully FRBRised bibliographic arrangement can be achieved through call numbers even in catalogues that are not structurally able to satisfy the FRBR model (Bianchini, 2012). Moreover, CC accordance with the logical model of FRBR, its basic entities (such as Work, Expression, Manifestation and Item) and also with related works (such as commentaries and translations) is highlighted. The inclusion of related works is a very interesting feature of Ranganathan's CC because of the relevant presence of the phenomenon of families of works in the Indian literature.

Finally, some authors discussed S.R. Ranganathan's structural model called APUPA (Alien-Penumbral-Umbral-Penumbral-Alien), which can be visualised in the form of a bell curve, stressing that APUPA is commonly cited as an ideal shape resulting from the arrangement of works according to the principles of faceted classification, but also that this is only an application of a more general model of thought that recurs throughout Ranganathan's works: the order of the main classes of the Colon Classification (CC), and the anteriorising common isolates are two other features in which the bell-curve model can be observed (Bianchini, 2017).

As a faceted classification, CC is particularly biased towards the feasibility of an automatic process for creating class numbers. An extensive applicability of this approach was demonstrated for the Main class *O Literature*. A first case study on the automatic generation of faceted class numbers for special topics starting from data available on the semantic web was developed in 2019 (Bianchini, 2019). The aim was to investigate two questions: whether it is possible to automatically, quick, cost-effectively, and on a large-scale create class numbers for literary classics were possible, and, more generally, what are the requirements for the automatic generation of class numbers of a faceted classification scheme. The case study focused on data extracted from *data.bnf.fr* – the SPARQL endpoint of the National Library of France – and its reuse to obtain correct and complete Colon Classification class numbers for a sample of Italian literary authors born between 1800 and 1900. The process was applied to about thirty Italian authors and about one hundred works. Also, in 2019, Licul tested the same process both for the creation of Class numbers for three authors and their works and for the creation of book numbers too (i.e. of Manifestations and Items according to the IFLA LRM model) (Licul, 2019). Finally, the process of creating class numbers was described, starting from the identification and extraction of data, through their cleaning, transformation and translation into classified notation using OpenRefine[1] (Bianchini, 2020).

To summarise the results of previous studies, it can be assessed that CC is able to organise documents based on FRBR entities such as Works, Expressions, Manifestations, and Items. Furthermore, as described by Ranganathan, the resources are organised in a bell curve (APUPA) reflecting that the most relevant documents are in the middle, and the less relevant ones are arranged on the sides. Finally, an algorithm to generate CC Literature class numbers from freely available LOD is feasible.

2. The Facet Formula of Main Class *O Literature*

It might be useful to briefly recall the basics of classifying literature in the Colon Classification. The facet formula of main class *O Literature* is as follows:

[1] https://openrefine.org/

O [P] , [P2] [P3] , [P4]

where, facet [P] is the language of the work, facet [P2] is the literary form, facet [P3] is the Author (represented by the year of birth), and facet [P4] is the Work facet, which usually represents works in chronological order, if possible (Ranganathan, 1963).

Overall, the facet formula means that, in Main Class *O Literature*, concepts and punctuation must respect the following order:

O + Language + , + Form + Author + , + Work number and each facet must be used when it is applicable.

The Main class *O Literature* is probably unique in CC, as its Schedules for classification consist of a list of less than 10 isolates (voices); it is also interesting because two of the four facets (P Language and P3 Time) can be obtained from common isolate Schedules.

Let's look at an example. A drama by Shakespeare could be a good choice, as the author is very famous.

First of all, the following facets need to be considered:

Literature O, English 111, and Drama 2.

In the facet [P3], the author of the literary work that the book contains, or is about, is represented by his or her year of birth. The years are determined through the Time isolate schedule, where each century is represented by a capital letter (for example, the letter J represents all the years from 1500 to 1599). Each year of any century can be obtained by adding its last two digits to the letter representing its century, so that 1564=J64, and so on. Since Shakespeare was born in 1564, the facet will be:

1564 = J64

The last part is the Work number facet; for simplicity's sake, let us assume that *Romeo and Juliet* was Shakespeare's first play. So its Work number is 1. Putting all these numbers together, using the Facet Formula, we get the class number we want:

O111,2J54,1

If we were to take *Hamlet* as Shakespeare's second play, we would get the following class number and so on. According to Ranganathan's instructions, the "works should be arranged in chronological sequence or, if it is impossible, in any arbitrary sequence" (Ranganathan, 1963). This means that the date of the work is necessary, and that it is useful to have a chronological order of the works of a given Author – for example *Romeo and Juliet* (1599) would precede *Hamlet* (1604); for this reason, the date of creation of a work is a relevant piece of information in this process.

3. Wikidata as a LOD Platform

Wikidata was created and acts as central storage for the structured data of its Wikimedia sister projects, including Wikipedia, Wikivoyage, Wiktionary, Wikisource, and others. Like the other Wikimedia projects, it is free and open to everyone, and collaborative. It is also programmable and modular.

Wikidata is an invaluable asset for libraries and cultural institutions because it is "a freely available hosted platform that anyone — including libraries — can use to create, publish, and use LOD" (Allison-Cassin *et al.*, 2018).

Wikidata is made up of items, i.e., a set (called a *cluster*) of data (called *triples*) about "entities", such as people, and works, but also places, animals, plants, colours, personal qualities, abstract concepts and so on. Wikidata is open to any kind of data, so it can include data relevant to libraries, among others. "Wikidata is a dataset independent of, but highly relevant to, the library world; moreover, due to its openness, it can be used by anyone to create, publish, use, and reuse data, in an automated and programmable way, in a collaborative environment, and with a bottom-up approach. For these reasons, Wikidata proved to be the most suitable platform for the development of an automated classification process using LOD and faceted classification" (Bianchini *et al.*, 2021).

Figure 1 shows an example of an element (called *item*) representing Premchand in Wikidata (https://www.wikidata.org/wiki/Q174152). Cataloguers can easily see the availability of the most important data, usually included in an authority record. Firstly, labels which

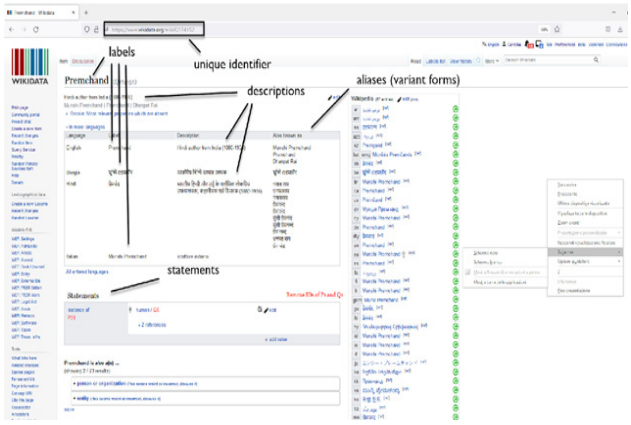

Figure 1. Labels, aliases, descriptions, unique identifier, and statements of Premchand's item.

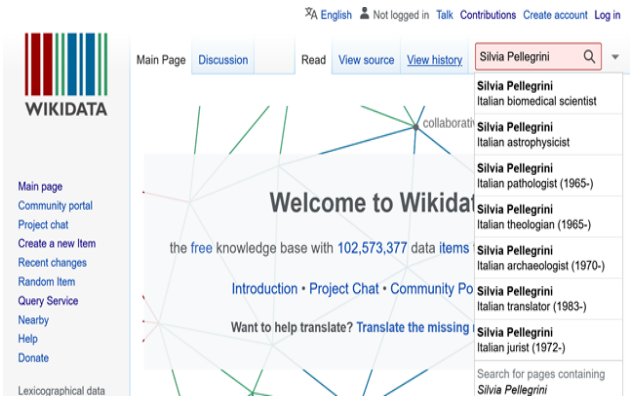

Figure 2. Descriptions help to disambiguate homonyms items.

Figure 3. Premchand's date of birth.

represent the preferred access point of for the item. Labels can be expressed in any world language (the figure shows English, Bangla, Hindi and Italian). Aliases are a way of recording and expressing any variant access point for the item. Since aliases are usually associated with a language, many aliases can be expressed for each different language.

Descriptions correspond to very short biographical notes, which are essential to disambiguate homonyms very easily and quickly. An example is shown in Figure 2. Each item is given a unique identifier, in the form of the Wikidata URI (e.g., https://www.wikidata.org/wiki/Q174152). This is an absolute identifier, which is unique within and outside Wikidata.

Finally, items are enriched with further data, expressed as "statements"[2]. Data relevant to the automated classification process is expressed as statements. In Figures 3 and 4, Premchand's date of birth, languages, and occupations are shown in red boxes.

[2]In fact, statements within are RDF triples, which have a common subject (the URI of the item) and attributes expressed by Wikidata properties and their specific values.

[2]https://www.wikidata.org/wiki/Property:P8248.

Figure 4. Premchand's languages and occupations.

Many properties in Wikidata that are used to express the attributes of the items. Any user can publicly propose a property if it does not already exist; if other users agree with the proposal, a Wikidata manager ensures that the property is created. The P8248 property, which expresses the Colon Classification class number for Wikidata items, was created in May 2020.[3]

Since the success of the automated class number creation process "requires the availability of semantic data with specific characteristics" and the availability of complete and coherent semantic data is a mandatory requirement for the process itself, Wikidata is a very useful solution because all the data needed for the CC author and work class numbers are either available in a Wikidata item or can be added.

What data is available on Wikidata? All the data needed to build the class number according to the facet formula, i.e. for literary authors:

- Language
- Literary Form
- Year of birth of the author

If an author writes or has written in more than one language, the main or preferred language of an author must be identified for the purposes of the automated classification. As to literary form, it should be the one most associated with the author; for example, if we are

looking at a writer who was, for instance, both a poet and a novelist, we must take into account the form most associated with him.

In addition, some data are usually available also for the work:

- Title of the work
- Date of creation/publication of the Work

The title is needed to identify the works of an author more easily, while the date is useful to order the works chronologically.

In Wikidata, Ranganathan's principle of Work Inequality – i.e., "Work is not equal to Book" (Ranganathan, 1963) – also applies, as items are created separately for works and for manifestations; thus, dates of creation of the works, which may be different from dates of publication of their manifestations, can be searched for, and retrieved – or created ex novo – and reused.

4. The Wikidata Gadget: CCLitBox

The user experience in Wikidata can be enhanced through *preferences* and *gadgets*. A gadget is a program consisting of JavaScripts snippets that reside in the MediaWiki namespace (*preferences*) or in the user's namespace (the user's *common.js* file).

Gadgets can perform a large variety of tasks, such as: searching and retrieving data within items, adding data to the items, moving data within the item page, sorting lists of property values, adding data from other Wikidata items or external resources, linking external identifiers, and *pre-compiling the object values* of Wikidata properties (also called *statements* or *triples*). For example, a gadget can be used to search for the value of a particular property

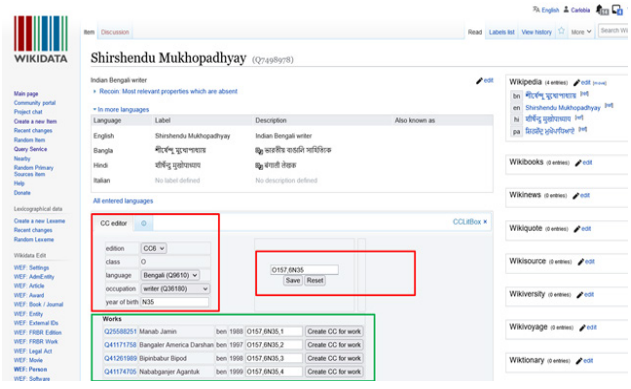

Figure 5. The CCLitBox in operation in the Shirshendu Mukhopadhyay' item.

of an item (e.g., a person's year of birth, a work's title), retrieve the value and reuse it in many useful ways.

CCLitBox is a Wikidata gadget designed by the author and written entirely by Stefano Bargioni. The *CCLitBox* gadget has been created for the analysis, synthesis, and production of the values of the Wikidata property for Colon Classification (P8248). To be available and used, the CCLitBox must be pre-installed by a registered user.

Figure 5 shows the Shirshendu Mukhopadhyay'item in Wikidata. If we are registered users of Wikidata and have included the CCLitBox in our own common.js file, the gadget is loaded by our browser on the item page. The gadget searches for and identifies the data required by the Facet Formula within the author item (language, occupation, year of birth), then collects the data and displays it on the left (in the red square on the left). Finally, on the right (in the red square on the right), the gadget suggests the calculated value for the P8248 property (i.e., a CC class number), which will become the CC identifier for this Author within Wikidata.

There are two buttons available to interact with the gadget (red square on the right): the SAVE button, which accepts the value and records it in the item of the Author, or the RESET button, which allows the browser to reload the page.

As we will see in a moment, in the second part of the box (green square), the gadget identifies all the works linked to the author whose data are present in Wikidata, extracts the data and calculates the corresponding values for the CC work class numbers.

In addition, CCLitBox is interactive and allows the user to choose the correct value to use when generating the author's class number. In this case, Wikidata records that Mukhopadhyay was both a writer and a novelist; the gadget chooses the first relevant value, the "writer". In fact, in Figure 5, the suggested number for the Author class contains the number "6" after the first comma, which means "writer" (as we read on the left).

But it seems correct to identify Mukhopadhyay as a novelist. So, we can interact with the gadget and open the drop-down menu, which shows all the values recorded in the WD author item (Figure 6a). The drop-down menu is available whenever more than one value recorded in Wikidata, either for occupation or language properties. Human interaction is required here.

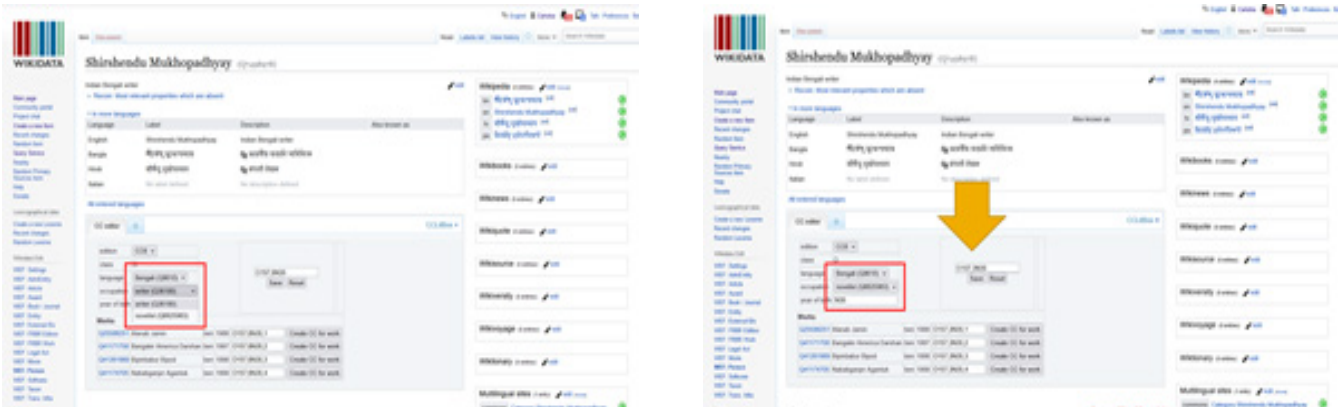

Figure 6 (a&b). Interaction with the drop-down menu of the CCLitBox.

When "novelist" is selected, the value of the CC property will be updated accordingly. Below the arrow (Figure 6b), the proposed value for the CC Author class number has changed to include the number "3", which means "novelist".

Another feature of the gadget is worth highlighting. So far, all the data and metadata shown in the figures have been in English; but thanks to the Wikidata platform, it is only a matter of setting user preferences to obtain a more user-friendly language. In fact, by setting the preferences to Bengali (Figure 7), the metadata and buttons are translated in Bengali. The metadata – i.e., the name of the properties – are translated by Wikidata, while the buttons have to be translated instead within the gadget, which is open source and therefore allows anyone to make the appropriate changes.

As the CC property is intended to act as an identifier (URI) in Wikidata, the gadget performs some consistency checks; examples of the following checks will be examined:

- The author item may already have the property P8248 (CC);
- More than one author of the same type (e.g., two or more poets, etc.) could be born in the same year;
- The work item may already have the property P8248 (CC);
- Work items may lack some of the properties needed to create the CC number.

For example, in Figure 8, the warning message is highlighted in Premchand item, because he already has the CC number recorded in Wikidata.

Another problem is to avoid assigning the same classification number to two different authors. For

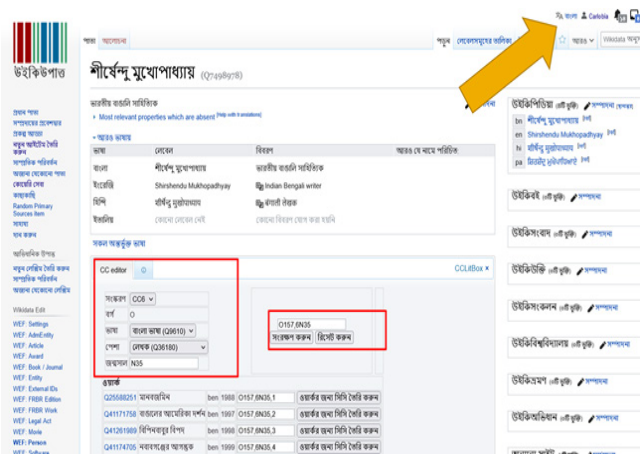

Figure 7. Translation of CCLitBox in Bengali.

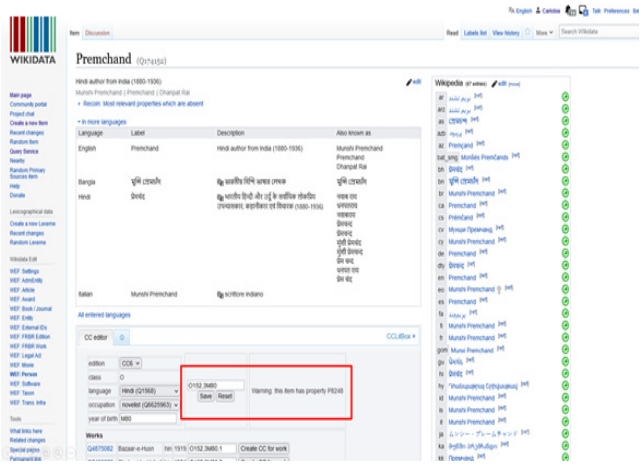

Figure 8. Warning message about the existence of a value for CC property.

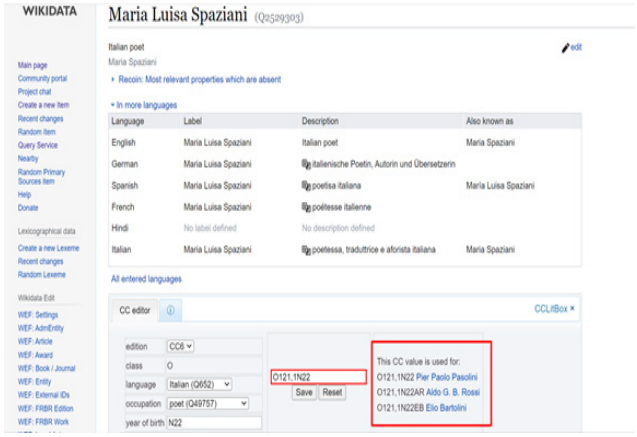

Figure 9. Warning message about other authors with a similar CC number.

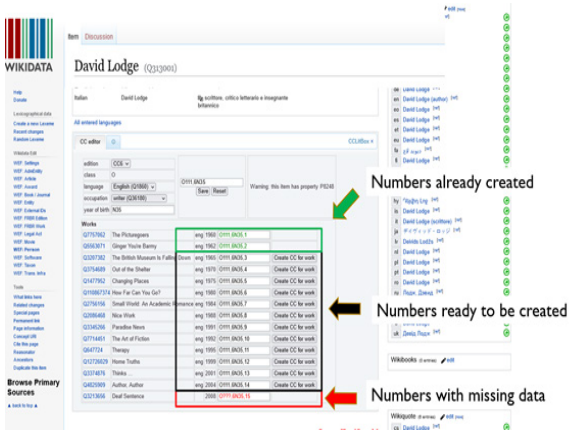

Figure 10. Warning message about other authors with a similar CC number.

example, (Figure 9), the item of the poetess Maria Luisa Spaziani is accompanied by a warning about the existence of authors of the same type, i.e. Italian poets born in the same year. CC numbers must be disambiguated. The Alphabetical Device (AD) provided by the colon classification rules could be extended and applied to such cases (Ranganathan, 1963). In these cases, the first letters of the given name and surname were added to the second and third-class numbers. For the poetess, Maria Luisa Spaziani, the letters M and S are added.

The second lower part of the CCLitBox is dedicated to the automatic classification of an author's works. The example (Figure 10) shows the Wikidata entry for the English novelist David Lodge. CCLitBox shows that it already has his class number, so we can go on to see how CCLitBox can be used to create the CC class numbers for his works.

The first two works already have CC numbers (green square and arrow). No user action is required for these first two works.

A second group of works does not have CC class numbers (black square and arrow). However, if all the necessary data is available in the works' Wikidata items, CC class numbers can be created for the works. A black button is available for each work, ready to be used.

Finally, the last work is recorded in Wikidata and represented by the CCLitBox (red square and arrow), but it lacks some data necessary to create its CC class number. Therefore, it is displayed in red and no button is available to avoid mistakes by the user.

5. Discussion

The CCLitBox is useful because it shows that it is possible to create a tool that can generate the class numbers of a faceted classification using Wikidata data. Although the CCLitBox already works, some issues – both on the Wikidata side and on the gadget side – that need to be resolved for it to be fully functional.

On the Wikidata side, the main problem is that some required properties for authors may be missing (e.g., date of birth or language or occupation), and related work items may be poorly described (e.g., no creation date or language). In fact, such cases are quite common in Wikidata.

Sometimes, only a few works have completed and correct data. Nevertheless, to preserve the chronological organisation of the works, an author's entire literary production should be recorded and described in WD before proceeding to create CC work class numbers. Only then can a user return to the Author item page, reload it (please note that WD requires a delay, which can be up to a few minutes), and create the CC numbers for the author and works using the now black buttons.

The problem of poor description of authors and works in Wikidata could be better addressed by using tools for massive upload of the author and work data into Wikidata, previously exported from high-quality bibliographic tools, such as online catalogues or SPARQL endpoints of national or large libraries.

Another possible problem is that of missing languages: a language may be missing from the gadget or

CC schedules. For example, Basque, a language spoken in Spain, and Venetian, a regional language in the Venice area of northern Italy are missing from the CC schedules. Of course, they are missing from the CCLitBox too.

Indian languages were also missing in the CCLitBox. However, as CCLitBox is a Wikidata gadget, and Wikidata is a free, collaborative and modular environment, the 22 constitutionally recognised languages of India were provided by Prof. Parthasarathi Mukhopadhyay and included in the official version of CCLitBox.

The main advantages of the CCLitBox gadget are:

- It is a completely free tool that allows any user to classify literary authors and their works according to the Colon Classification (even without knowing the CC).
- The tool is easily accessible to everyone.
- It can be used to create and generate class numbers and to classify a library collection of literature (virtually) from anywhere in the world.
- The tool is available through Wikidata, which allows users to add missing data if needed, both manually and through automated tools[4].
- Because the tool is based on the Wikidata environment, it is ready for any collaborative and networked effort[5].

Finally, there are some drawbacks to this gadget. It works, but it needs further improvements, for new or not well-known languages and improve consistency. An improved version for the production of *call numbers*, to be applied to the manifestations of the works could also be useful.

A major improvement would be to take it out from Wikidata and allow it to reuse data from more sources than just WikiData (such as LOD datasets from the world's major national libraries).

We also need to consider the disadvantages of CC:

The CC facet formula is not designed to be a complete identifier for authors and works (e.g. poems and novels by the same author are distributed in different class numbers when CC is strictly applied). This means that CC assigns a different class number to an author if he/she writes poems, dramas or novels.

This approach is more user friendly on the shelf, but prevents from the identification of an author (which is a basic requirement of the Semantic Web, including Wikidata).

CC language schedules are mainly devoted to Indo-European, Semitic, and Dravidian languages (currently 54 ready-made class numbers), so that other languages require (much) longer notations to be represented. Thus, CC would probably benefit from an update of its language isolates schedule. This could help to correct the bias towards the three currently favoured language families (Indo-European, Semitic and Dravidian) and add many missing languages to the tables. Since the CC most often reserves three Arabic numerals for the representation of languages, the Language Isolate table could be replaced by the list of ISO 639-2 codes, which is based on three digits.[6] The ISO list would ensure that a more complete, less culturally biased list of languages would be available in the form of an internationally distributed standard.

In summary, as you can see, the Colon classification should be subject to the application of the fifth law of Library Science.

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[4]For example, *QuickStatements* (https://quickstatements.toolforge.org/#/), *Mix'n'Match* (https://mix-n-match.toolforge.org/) or *OpenRefine* (see note 1). For more information about importing bulk data into Wikidata, see, for instance, https://www.wikidata.org/wiki/Wikidata:Tools/OpenRefine/Editing/Tutorials/Basic_editing or (Processing and importing data onto Wikidata, 2020).

[5]In fact, it was easy to work together with Prof. Parthasarathi Mukhopadhyay to improve the functionality of the CCLitBox by solving some problems that arose during the first application of the gadget to Indian literature.

[6] https://en.wikipedia.org/wiki/List_of_ISO_639-2_codes.

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