

Research and Innovation Action

Social Sciences & Humanities Open Cloud

Project Number: 823782 Start Date of Project: 01/01/2019 Duration: 40 months

Deliverable 3.4

Multilingual ontologies for Occupation, Industry, Regions and cities, Food items, and Religion, with use case

Dissemination Level	PU
Due Date of Deliverable	28/02/2021 (M26)
Actual Submission Date	22/04/2021
Work Package	WP3 - Lifting Technologies and Services into the SSH Cloud
Task	T3.2 Selected SSH Ontologies and Vocabularies
Type	Report
Approval Status	Waiting EC approval
Version	V1.1
Number of Pages	p.1 – p.19

Abstract:

SSHOC Task 3.2 (Selected SSH Ontologies and Vocabularies) selected global ontologies regarding occupational titles, educational categories, sectors of industry, geographical regions, food items, and religions are further improved and optimized. The classified titles are stored and disseminated in the SurveyCodings.org web environment.

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History

Version	Date	Reason	Revised by
0.1	28/02/2021	Draft ready	Maurice Martens
	12/03/2021	Review	Daniela Ceccon
	22/03/2021	Review and update	Kea Tijdens
1.0	25/03/2021	Review and update	Daan Broeder
1.1	13/04/2021	Update	Maurice Martens
	17/04/2021	Review and minor editorial edits	Daan Broeder

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Executive Summary

In the SSHOC project Task 3.2 (Selected SSH Ontologies and Vocabularies) several efforts were taken to foster the use of selected global ontologies regarding occupational titles, educational categories, sectors of industry, geographical regions, food items, and religions. These ontologies allow classification of elements into standard global classifications, for example the ISCO classification of occupations (ILO 2012) and its derived social status (Meron M et al, 2014) or the NACE/ISIC classification of industries (EUROSTAT 2006). These ontologies service the usage of vocabularies for classifying text corpora and predefined response categories for survey questions.

The mentioned multilingual ontologies are further improved and optimised. This is by its nature an ongoing process, these ontologies are alive, they aim to describe response options in a world where new occupations, food items, religions, educations appear, and others will disappear. If one for example looks at the COVID crisis, the world and the way of working changed drastically, which created new specialisations and new job titles.

Centerdata structures, stores and disseminates the ontologies using the SurveyCodings.org platform. This platform also aims to connect the experts in this field.

In section 4 the SurveyCodings.org website and its underlying backend is introduced. The ontologies on Religion, Regions, Food items, Occupation titles and Industries that were developed so far will be discussed in section 5. In section 6, as a Use Case the implementation of the Occupation title database in the Survey of Health, Ageing and Retirement in Europe (SHARE) will be discussed. In section 7, a conclusion is presented.

Abbreviations and Acronyms

API	Application Programming Interface.
CAPI	Computer-assisted personal interviewing
EOSC	European Open Science Cloud
ESS	European Social Survey (https://www.europeansocialsurvey.org)
EVS	European Values Study (https://europeanvaluesstudy.eu)
GET request	A GET request is an HTTP (Hypertext Transfer Protocol) method, used to request data from a specified (internet) resource
ISCO	International Standard Classification of Occupations
JSON	JavaScript Object Notation, a data human-readable data exchange format.
NACE	Nomenclature des Activités Économiques dans la Communauté Européenne (Nomenclature of Economic Activities)
PHP	PHP: Hypertext Preprocessor. A general-purpose scripting language, mainly used in the development of web applications (https://www.php.net/).
SERISS	Synergies for Europe's Research Infrastructures in the Social Sciences
SHARE	Survey of Health, Ageing and Retirement in Europe (http://www.share-project.org)
SKOS	Simple Knowledge Organization System
TMT	Translation Management Tool, a former name of the TranslationCTRL tool.
XML	Extensible Markup Language

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1. Introduction

For many studies in the social sciences, surveys are used. To best understand respondents, one might need to know how much money they make, how healthy they are, what their values are or perhaps what their socio-economic status is. Obviously, it is not always easy to simply ask these questions. Respondents might not be willing to answer, or the concept one wants to measure might be too complex to be caught in a single question. If researchers want to compare respondents, they can try to ask questions that survey respondents can understand, like “What is your current job?”, “What study did you do?”, or “What did you eat yesterday?”. The responses to these open questions can help us determine the more complex concepts, but, while they are easier to respond to, they do pose problems. From just knowing one’s job title, name of their study, or what they ate the day before, it is not possible to do statistics. First, these responses need to be recoded into values that are useable.

A typical way of making sure a researcher can do statistics with the responses is to present the full potential answer domain into a limited set of possible answers. The responses are then presented as a closed answer set in the form of a tree or list. These lists only present an aggregated level on the domain, and, if not well defined, they might not completely cover the full domain. Moreover, to the survey holder assumes that the respondents know where to place themselves on this aggregated level. Many people know that feeling, when they need to pick a response to answer a question, and their situation is not precisely covered by the options. It is better to capture the response using an open answer: “Type in your response”.

But how to classify these open responses into a form of classification, to make them comparable? This typically used to be done by human coders. They would interpret the open answer and classify the response following a procedure often helped by software tools. These days artificial intelligence is often used to code these responses.

Regardless of who does the office coding, the survey holder is always dependent on the quality of the response; the open response might be too broad or too specific to be properly classified. The response might contain typos or maybe a whole sentence is used to describe the concept. In these cases, any guess the coder makes is uncertain and the researcher might want to revisit the respondents and ask them to clarify or adapt their responses.

To address the issues above, the authors would like to allow for open responses, but also to somehow analyse the response during the interview. In surveys we want to present a full domain, or at least a very broad representable subset of the domain, in such a manner that the respondents can find an answer which we already know how to classify.

The SurveyCodings.org website and repository is just that: it is a broad collection of classified and translated items that often occur in surveys. These sets are developed, collected, and archived by experts. If different studies would use the same sets, it would make it easier to compare them. The sets currently exist for Occupational titles, Industry, Educational attainment, Education, Religion, Food items, Regions and Cities. All items are translated and classified according to international standards and stored in an online database. In addition, tools to integrate these items in one's own survey, as well as best practice examples, are available in the environment.

Task 3.2 will make the extended and improved ontologies available via SSH Open Marketplace and a SSHOC vocabulary platform. Discussions are underway how this can be best achieved, also taking into account the more specific roles of Centerdata and UvT in the 3.1 workplan with regards to offering the ontologies in SKOS format.

2. SurveyCodings.org

In the previous project (SERISS¹) an online environment was implemented to structure, disseminate, and maintain several classified sets of translated items often used in surveys in the socio-economic domain. This environment, Surveycodings.org, consists of a frontend, the entry point for users, where they can download the sets, example questionnaires and example source code and review background information. The collection is maintained via a backend that allows registered expert users, to maintain and version the sets. Under the SSHOC project, a further improvement of the content has been implemented, several new ontologies were added, and several adjustments were made to allow the content to be integrated and updated. In this chapter, first the frontend is presented, whereupon later the backend will be discussed.

Frontend

SurveyCodings.org is a web-based tool developed by Centerdata, in the Netherlands. This platform helps to structure, store and disseminate the ontologies commonly used in surveys. The SurveyCodings.org platform has a straightforward interface. Several themes are displayed as menu items, and each of this background information on the subject can be found. Also, there is the option to do a database live search, to 'play around'. Some example questionnaires are integrated, and an explanation on how to call the API is presented there. The availability matrix is an alternative interface on the available items and version. A link to a coding-app is also available: the same functionality the website presents can be stored in an app that can be used on a mobile device. To do that, the sets with the language and domains the survey holder needs to target should be loaded, whereafter the functionality of the SurveyCodings.org on a tablet or mobile phone becomes available, without the need of an Internet connection.

¹ Synergies for Europe's Research Infrastructures in the Social Sciences - EU funded project (No 654221) website: <https://seriss.eu/> [accessed 16 Mar 2021]

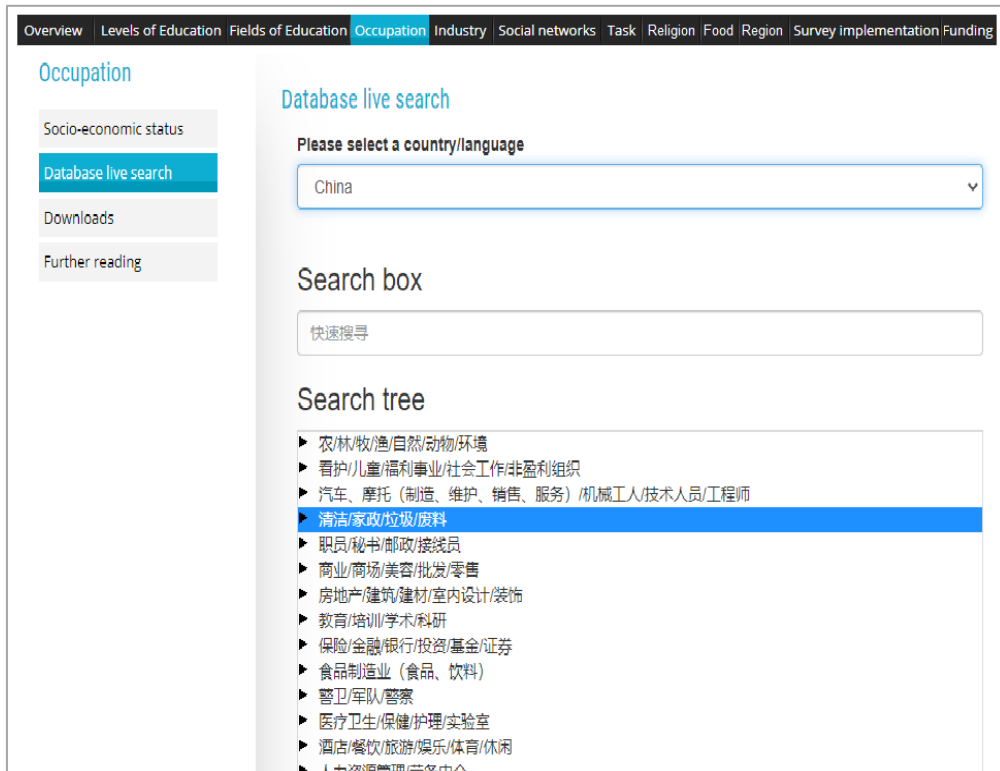


FIGURE 1: TREE INTERFACE ON OCCUPATION DATABASE

One can select for example the occupation tab, and, after selecting a language, immediately see a tree-interface.

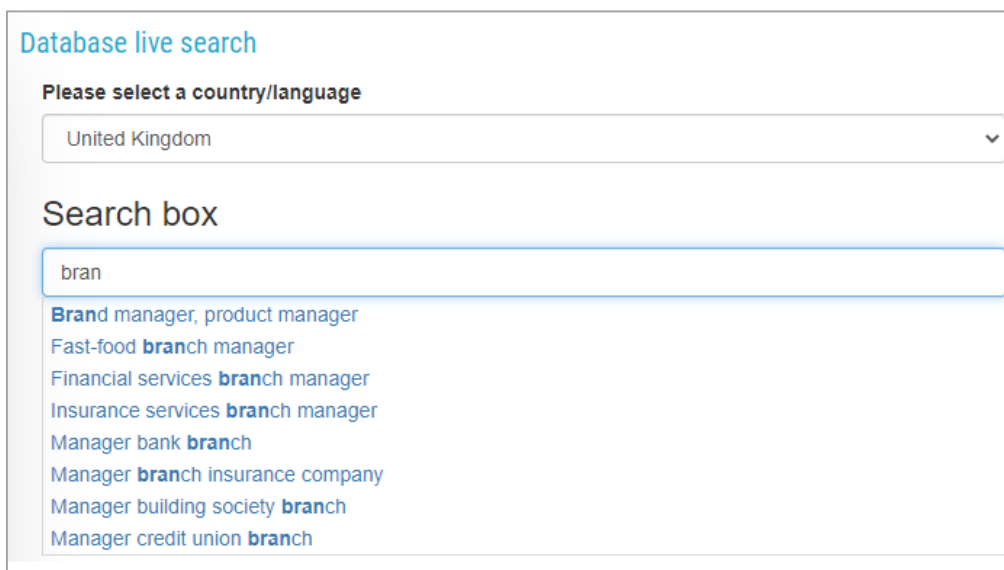


FIGURE 2: TEXT SEARCH ON DATABASE

Using the search box, survey holders and survey respondents can find matches to the items they might need to classify. When an item is selected, the background information on the item is displayed.

Backend

Behind this website, a database stores the ontology in a structured manner and defines the various relations between items, keeps track of versioning, stores various standard classifications and attaches the classifications to the items in the set. Per item, it is possible to store who added it, and where it came from.

name	description	searchable	active	Australia (en_AU) English	Belarus (ru_BY) Russian	Belgium (nl_BE) Dutch
110000200018	Air force marshal	<input checked="" type="checkbox"/>	1	Air force marshal	Маршал военно-воздушных сил	Marshaller luchtmacht
110000300018	Air force pilot	<input checked="" type="checkbox"/>	1	Air force pilot	Пилот военно-воздушных сил	Piloot luchtmacht
110000400018	Army captain	<input checked="" type="checkbox"/>	1	Army captain	Капитан армии	Kapitein strijdkrachten
110000500018	Army colonel	<input checked="" type="checkbox"/>	1	Army colonel	Полковник армии	Kolonel strijdkrachten
110000600018	Army major	<input checked="" type="checkbox"/>	1	Army major	Майор армии	Majoor strijdkrachten
110000700018	Army officer	<input checked="" type="checkbox"/>	1	Army officer	Офицер армии	Ritmeester
110000800018	Navy captain	<input checked="" type="checkbox"/>	1	Navy captain		Kapitein (marine)
110000900018	Navy lieutenant	<input checked="" type="checkbox"/>	1	Navy lieutenant	Лейтенант военно-морских сил	Luitenant ter zee (marine)
110010000000	Commissioned officer armed forces	<input checked="" type="checkbox"/>	1	Commissioned officer armed forces	Офицер вооруженных сил	Officier strijdkrachten
110020000000	Military operations leader	<input checked="" type="checkbox"/>	1	Military operations leader	Руководитель военных операций	Leider militaire operaties
210000100018	Army sergeant	<input checked="" type="checkbox"/>	1	Army sergeant	Менеджер кинотеатра	Sergeant strijdkrachten
210000200018	Flight sergeant	<input checked="" type="checkbox"/>	1	Flight sergeant	Менеджер развлекательного центра	Wachtmeester koninklijke marechaussee
210000300018	Sergeant major	<input checked="" type="checkbox"/>	1	Sergeant major		Sergeant-majoor strijdkrachten
210010000000	Non-commissioned officer armed forces	<input checked="" type="checkbox"/>	1	Non-commissioned officer armed forces	Менеджер школы верховой езды	Onderofficier strijdkrachten
310000100018	Air force airman	<input checked="" type="checkbox"/>	1	Air force airman	Читатель новостей / радио	Vlieger luchtstrijdkracht
310000200018	Air force corporal	<input checked="" type="checkbox"/>	1	Air force corporal	Радиоведущий	Korporaal luchtstrijdkracht
310000300018	Army commando	<input checked="" type="checkbox"/>	1	Army commando	Спортивный диктор	Bewaker krijgsmacht
310000400018	Army corporal	<input checked="" type="checkbox"/>	1	Army corporal	Ведущий ток-шоу	Korporaal operationele strijdkrachten
310000500018	Army gunner	<input checked="" type="checkbox"/>	1	Army gunner	Телевизионный диктор	Artillerist leger
310000600018	Army infantryman	<input checked="" type="checkbox"/>	1	Army infantryman	Репортер по ситуации на дорогах	Infanterist operationele strijdkrachten

Page 13 of 224, showing 20 records out of 4474 total, starting on record 241, ending on 260

← Previous 9 10 11 12 13 14 15 16 17 Next →

FIGURE 3: BACKEND PROVIDES TABLE INTERFACE ON TRANSLATIONS

Coding

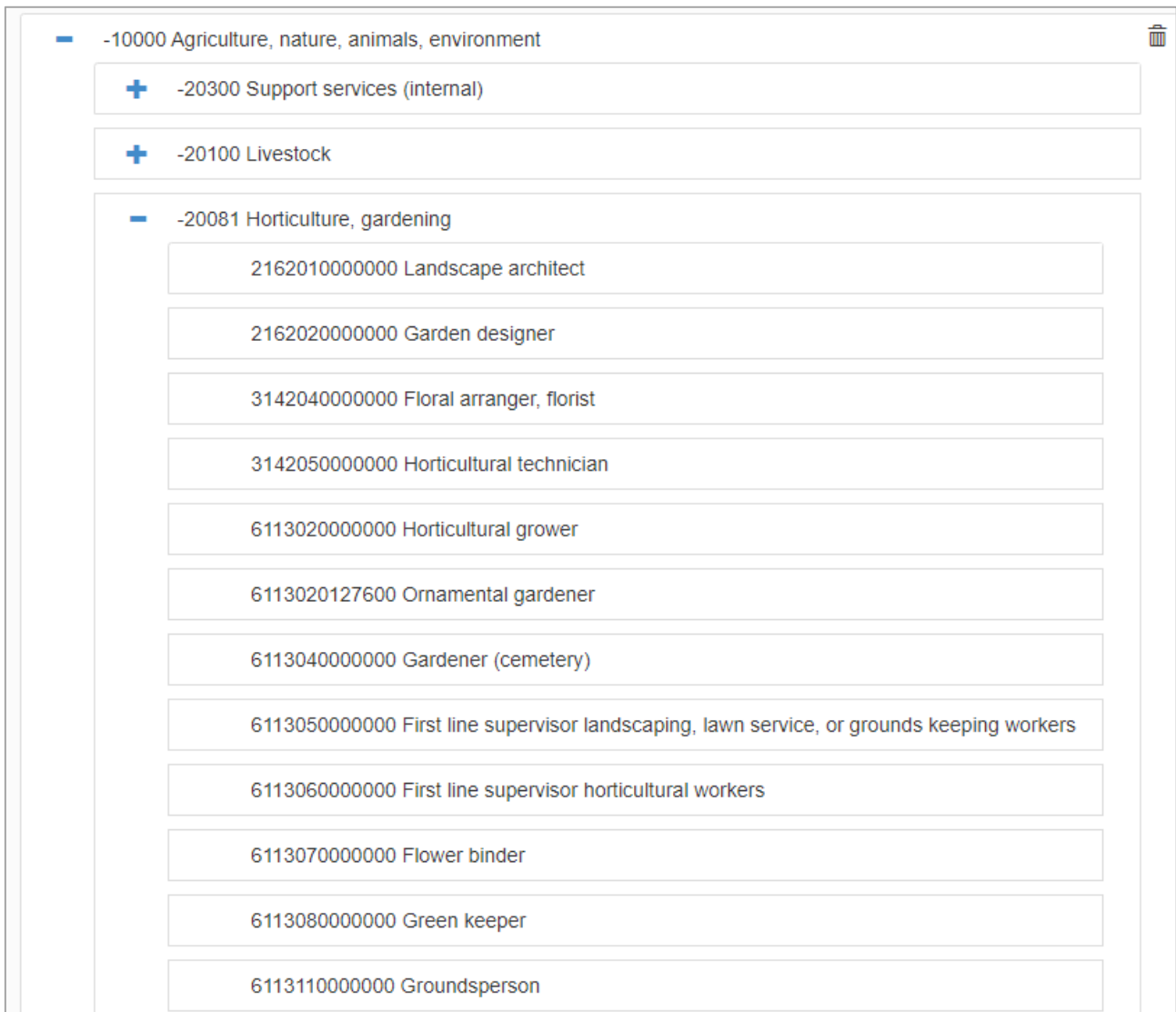
Actions ▾

Description	Manager riding school
Name	1431000600018
Searchable	1
Active	1

Classification Elements

Classification	Name	Description	Source	Deviation	Note	Action
ISCO08	1431	Sports, recreation and cultural centre managers				<input checked="" type="checkbox"/> ✕

FIGURE 4: MORE BACKGROUND INFORMATION PER CODED ITEM



The image shows a screenshot of a web-based interface for defining a subset of occupations. The interface is organized into a tree structure with expandable and collapsible nodes. The root node is '-10000 Agriculture, nature, animals, environment', which is currently collapsed. It has two child nodes: '-20300 Support services (internal)' and '-20100 Livestock', both of which are expanded. The '-20100 Livestock' node is further collapsed to show a single child node: '-20081 Horticulture, gardening', which is expanded. This node contains a list of 12 specific occupation codes and titles, each in its own row:

- 2162010000000 Landscape architect
- 2162020000000 Garden designer
- 3142040000000 Floral arranger, florist
- 3142050000000 Horticultural technician
- 6113020000000 Horticultural grower
- 6113020127600 Ornamental gardener
- 6113040000000 Gardener (cemetery)
- 6113050000000 First line supervisor landscaping, lawn service, or grounds keeping workers
- 6113060000000 First line supervisor horticultural workers
- 6113070000000 Flower binder
- 6113080000000 Green keeper
- 6113110000000 Groundsperson

FIGURE 5: DEFINE TREE ON SUBSET

3. Ontologies

The collection of vocabularies builds on work conducted in the SERISS project (2015-2019) and earlier projects has been extended under the SSHOC project. This includes a Religion ontology, and a Food Items ontology, whereas the existing vocabulary have been improved and extended to more countries and languages, such as the Occupation and the Education vocabulary. The list of items is extended with translated or localized versions. The translated classified sets of items present a structured interface on the data. These are stored in a relational database. The model to structure these ontologies was developed with a focus on making them available to multilingual surveys. Defined upon these sets are standard classifications and structures like a tree view. Domains like education are by their nature harder to compare with other countries and are often impossible to translate, but they can be classified, the link between the items in the set therefor only exist when a classification is added. Domains like occupations are almost unlimited in size, but most can be translated. Classifications can be applied to the complete set in one go. The datasets interact with each other. It is possible to link industries to occupations, occupations to education, religion to region. These statistical links can be used to verify responses or present a more relevant domain of response options in surveys.

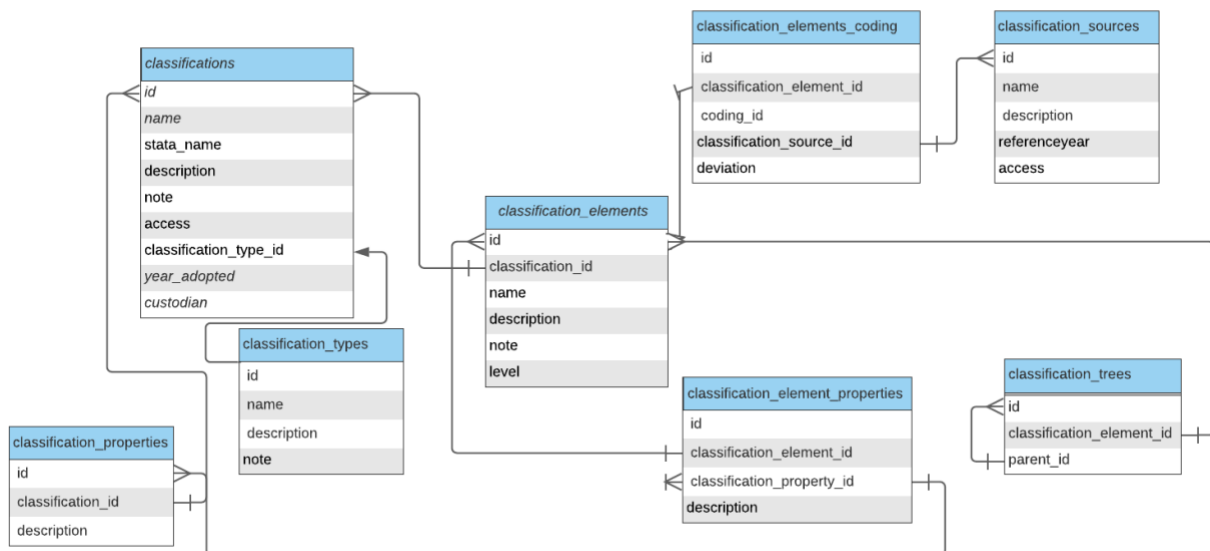


FIGURE 6: CLASSIFICATION MODEL

Religion

This ontology aims to map religious denominations across all countries in the world. By means of international long-standing social surveys and available national statistics, partner University of Tilburg

tracked down the known religious denominations in each country. In cooperation with the OnBound project², these denominations are classified in a taxonomic scheme that includes both major religious groups and smaller branches. As a last step, religious denominations are translated in every language spoken in the country where such religion is practiced. The resulting database is integrated in the SurveyCodings.org environment and can also be called via an API in the form of a predefined set of response categories. As of today, such a tool has never been prepared before, resulting in a plethora of different codings for religious denominations across different surveys. Hence, being aware of the ever-changing universe of religious denominations and of the multitude of research produced in this regard, with this project the ontology offers a manifold contribution:

- A comprehensive ready-to-use classification scheme that can be used by survey agencies to produce detailed and comparable data.
- A flexible tool for researchers valuable for all future research venues aiming both at comparing countries or deeply scrutinizing a specific case.

Regions and cities

In surveys, researchers often want to know where respondents live or lived, where their parents lived when they were young, where they worked. They often want to know “Where”. Usually in surveys this “Where” is asked on an aggregated level, like country, region, or city. Various sets of countries, regions and cities are collected. These sets have a hierarchical structure, and they do change; cities are sometimes renamed; regions within countries might split, or sometimes change country; countries might become regions and regions might become countries, and borders shift. This means that the relation between these elements, as well as the items themselves, have a temporal component attached. For a respondent to answer the “Where?” question, there is also the need to know the “When?”.

Within the SurveyCodings platform, a set of translated country names, regions within countries and municipalities, is defined. This work is ongoing, and translation is not always straightforward.

Food Items

A set of translated food items is integrated in the SurveyCodings platform. This is currently a set of basic food items, which could be used well in surveys on consumption behaviour. Further development might include more background information on the ingredients of food items, which would make it possible to assess overall intake of nutrients.

² See <https://www.gesis.org/en/services/processing-and-analyzing-data/data-harmonization/onbound>

Occupations

Already under the SERISS project³, a large database of classified occupation titles with their translations was collected. Under the SSHOC project these items have been reviewed and cleaned, allowing for a new version of sets of titles. In addition, the fostering of this collection has been extended to a larger group, with additional leverage within the international survey community, which will advocate further use of these items. This will further validate the sets.

Industries

The industry set is connected to the occupations: it is easier to detect unlikely combinations or to present a shortlist of most common industries for an occupation by using a threshold.

³ EU funded project (No 654221) website: <https://seriss.eu/> [accessed 16 Mar 2021]

4. Use Case

Many surveys, including the SHARE survey, ask for the occupation of a respondent. The interviewer typically types in the response the respondent gives. Afterwards, using office coding, these responses are classified against the ISCO08 classification. Alternatively, a short list of higher-level classification groups could be presented, where, using a show card, the respondent can self-select in which group their occupation should fall, which is not an easy task for the untrained respondent.

To better accommodate this process, to collect better data, and to avoid expensive and time-consuming office coding, the SurveyCodings occupation list was used in the SHARE questionnaire. The Survey of Health, Ageing and Retirement in Europe (SHARE) is a research infrastructure for studying the effects of health, social, economic, and environmental policies over the life-course of European citizens and beyond. From 2004 until today, 480,000 in-depth interviews with 140,000 people aged 50 or older from 28 European countries and Israel have been conducted. Thus, SHARE is the largest pan-European social science panel study providing internationally comparable longitudinal micro data which allow insights in the fields of public health and socio-economic living conditions of European individuals.

The SHARE survey is designed to be ex ante harmonized. This is largely accomplished by defining one generic source questionnaire, and not allow for major country specific deviations in this questionnaire. This source questionnaire only needs translations to be fielded in a SHARE country. Some countries have more than one language, to allow for localisation, up to 41 country-language versions are translated. The translations are managed in the Translation CTRL environment.

Arabic (Israel)	French (Switzerland)	Polish (Poland)
Bulgarian (Bulgaria)	German (Austria)	Portuguese (Luxembourg)
Catalan (Spain)	German (Germany)	Portuguese (Portugal)
Croatian (Croatia)	German (Luxembourg)	Romanian (Romania)
Czech (Czech Republic)	German (Switzerland)	Russian (Estonia)
Danish (Denmark)	Greek (Cyprus)	Russian (Israel)
Dutch (Belgium)	Greek (Greece)	Russian (Latvia)
Dutch (Netherlands)	Hebrew (Israel)	Russian (Lithuania)
English (Malta)	Hungarian (Hungary)	Slovak (Slovakia)
Estonian (Estonia)	Italian (Italy)	Slovenian (Slovenia)
Finland (Finnish)	Italian (Switzerland)	Spanish (Spain)
French (Belgium)	Latvian (Latvia)	Swedish (Finland)
French (France)	Lithuanian (Lithuania)	Swedish (Sweden)
French (Luxembourg)	Maltese (Malta)	

TABLE 1: LOCAL VERSIONS OF THE SHARE QUESTIONNAIRE

With this many translations and the need to have one central codebase, it is not straightforward to implement a tool that matches open responses. The collected data needs to be immediately harmonized,

and additionally a need for large sets of classified items to match these responses against. Occupational titles also have their localized versions, for example in Swiss German a hairdresser would be called ‘Coiffeur’ while in German ‘Frisör’ is used, implying a need also for localized versions of the occupations.

After several experiments in earlier waves with occupation sets provided by the country teams, the SurveyCodings set was used to follow the ex-ante harmonization concept more strictly. The rich sets provided by SurveyCodings could be used to setup a coding tool.

After setting up the tool, the coordinating teams in each country were asked to review their lists. This check was implemented to verify the quality and the usability of the list by native speakers who are familiar with the targeted respondents: senior citizens. Many of the newer occupations would probably not apply, while some occupations might no longer exist. After the review it was concluded, with some additions, the lists could be used. As a bonus in this process several new local translations of various occupations were found and added.

Interviewers are trained to stick as closely as possible to a scripted questionnaire when they conduct an interview. To use such a dynamic list and search tool, the interviewers needed to deviate from this practice. They were asked to look together with the respondent for an occupation title that matches the respondents’ occupation. If the occupation title the respondent provided has a direct match, the interviewer could quickly proceed. But if there was not such a match, the interviewer was asked to encourage the respondent to find alternative responses. The interviewers were trained to use instructions like “Could you be more specific?” or “Could you think of an alternative title for your job?”, if they felt that the set of presented job titles on their instrument was not matching well.

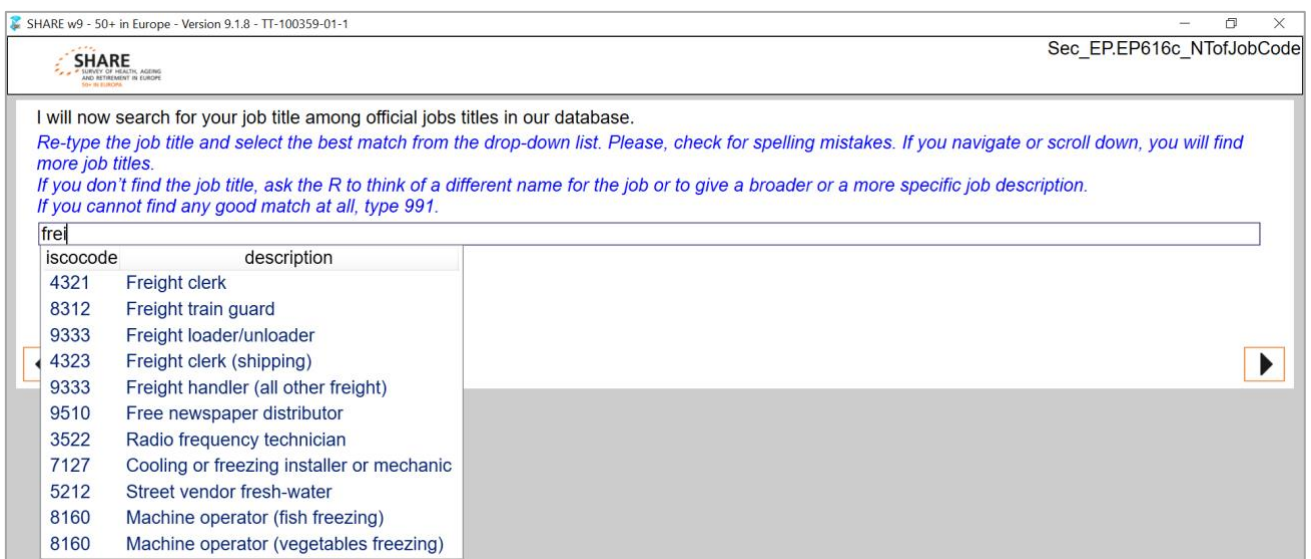


FIGURE 7: OCCUPATION TITLES LIST APPLIED IN SHARE

This concept is a very effective way to collect the interview data aimed at. In a similar manner, self- or interviewer-guided selection of education, industry, religion, birthplace, or food items could be applied.

To be able to navigate the large base of the translated ontologies with their attached classifications, during the interview, saves office coding and reduces the number of non-codable items.

For its Wave 6, SHARE aimed to increase coding quality and to reduce the costs and efforts related to ex-post coding of occupations and introduced a ‘coding-during-the-interview’ approach for the face-to-face interviews. SHARE uses Blaise CAPI software⁴, but it turned out that the full choice-set of the occupation database could not be implemented in Blaise. Therefore, Centerdata developed an external plug in, called ‘Job Coder’, that could be called from Blaise (Brugiavini et al, 2017). In the CAPI mode, the interviewer asks for the job title and fills the answer in open text format and a pop-up window appears, where Job Coder shows the matches and asks the interviewer to select the right match, or to skip when no match is found. The authors conclude that, except for Denmark where technical problems were encountered, the overall performance of the Job Coder was good: ‘Portugal and Sweden were the countries where the application worked better (it could code 90 percent of the answers in the EP module). Luxembourg was the country where the Job Coder was less effective still coding about 70 percent of the cases in the EP module.’ (Brugiavini et al, 2017, p 69).

⁴ Blaise website: <https://blaise.com/products/general-information/14-products/blaise> [accessed 22.03.2021]

5. Conclusion

Task 3.2 (Selected SSH Ontologies and Vocabularies) of the SSHOC project aims to foster the use of selected global ontologies in the social sciences and humanities, regarding occupational titles, educational categories, sectors of industry, geographical regions, food items, and religions. These ontologies service the usage of vocabularies for classifying text corpora and predefined response categories for survey questions.

The SHARE use case example shows the strength of using these comparable translated sets. There is no longer a need to ask respondents to find their occupations in a limited set of aggregated categories. By using the sets, the data can automatically be easier compared, and no office coding is needed to harmonize the data.

The newly introduced sets for Food Items will help respondents in surveys to easier identify how they spend their budget. The Religion database helps respondents to easier identify their actual religion. The datasets for industry and occupations are connected and a matrix is developed that describes how closely occupation title and industry are connected. This opens possibilities for data validation over larger sets over multiple questions. In addition, a set of tasks per classification are determined. In a similar manner, this could validate the responses, or suggest a subdomain of only relevant response options, lessening the respondent's burden. Up to now, the educational categories are not yet updated, since the relevant experts from GESIS were not connected to the SSHOC project. However, this team is now part of SSHOC, due to a transfer of resources from Centerdata to GESIS. Improvements on these specific ontologies are expected.

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