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## **Leveraging the Dewey Decimal Classification for online subject access: Three use cases of *WebDewey Search***

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### **Abstract:**

*The national libraries of Germany, Norway and Sweden each offer an openly accessible end-user tool with which to leverage data from their respective translations of the Dewey Decimal Classification (DDC) for use in search and navigation of selected catalogs: WebDewey Search Deutsch, Norsk WebDewey Search and Svenska WebDewey Search. The tool allows users to search for DDC classified documents by either browsing the hierarchical relationships displayed with the class captions of the system or by searching with natural language for Relative Index terms leading to DDC classes. This paper addresses the strengths and weaknesses of the tool while highlighting the differences between the three versions. We conclude with suggestions for areas of further development.*

**Keywords:** Dewey Decimal Classification, WebDewey Search, search, navigation, end-user tools

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## **1. Introduction**

Over the past decade, there has been increasing interest in the exploitation of underlying metadata of the Dewey Decimal Classification (DDC) for end-user search and navigation of DDC-classified resources. Underlying metadata includes language-based elements such as captions and Relative Index terms and system-based elements like hierarchical relationships between notations. The recent accessibility of these elements in machine-readable form has

spurred the recognition that they may be used to facilitate subject access for end-users without any prerequisite knowledge of the DDC. This has been particularly evident in several of the European national libraries providing DDC translations.

In early 2012, the national libraries of Germany, Norway and Sweden each contracted the German IT company Pansoft<sup>1</sup> to develop and maintain three separate, openly accessible end-user tools with which to leverage data from their respective translations. The result was the creation of *WebDewey Search Deutsch*<sup>2</sup>, *Norsk WebDewey Search*<sup>3</sup>, and *Svenska WebDewey Search*<sup>4</sup>. All three versions offer users two distinct ways to access documents through DDC data: through the navigation of DDC hierarchies and through word-based queries.

In this paper, we will demonstrate how WebDewey Search works and examine shortcomings in the available data. Next, we will explore the historical context for the use of DDC in Germany, Norway, and Sweden and the subsequent different approaches chosen for the WebDewey Searches in the three languages. Finally, we will suggest areas for further development and improvement.

## 2. WebDewey Search

### 2.1. History

WebDewey Search is based on MelvilSearch, a search service launched by the German National Library in 2006. Although MelvilSearch provided much of the same functionality as will be described in sections 2.2 and 2.3, the system was customized for German use cases, and captions were displayed without Dewey numbers until 2010, when the following two rights were negotiated with OCLC<sup>5</sup>: Each institution officially in charge of a DDC translation may 1) display Dewey numbers within their hierarchical context along with their translated captions and any see references, and 2) use Relative Index terms in search services providing they are not displayed with their associated notation or caption. Both rights must be practiced in accordance with the Creative Commons License<sup>6</sup> under which DDC is licensed.

By the year 2012, other countries had begun translating the newest DDC full edition with translation software developed by Pansoft, and more and more common uses in the DDC-applying community were being developed. Hence, the German National Library made a decision in favor of the cooperative international further development of DDC applications and replaced MelvilSearch with *WebDewey Search Deutsch*, for which basic functionalities were defined in collaboration with the national libraries of Norway and Sweden. Each library retained the possibility to adjust and add features if needed.

### 2.2. Navigation of DDC hierarchies

On the WebDewey Search main page, end-users are presented with the top levels of DDC classes represented by their notations and associated captions, both of which are hyperlinked to subclasses (see Figure 1). Subclasses consist of standard numbers and any built numbers

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<sup>1</sup> Pansoft is the developer and provider of DDC translation software and of WebDewey.

<sup>2</sup> *WebDewey Search Deutsch*, <http://deweysearchde.pansoft.de/webdeweysearch/index.html>

<sup>3</sup> *Norsk WebDewey Search*, <http://deweysearchno.pansoft.de/webdeweysearch/index.html>

<sup>4</sup> *Svenska WebDewey Search*, <http://deweysearchsv.pansoft.de/webdeweysearch/index.html>

<sup>5</sup> OCLC is the owner and maintainer of the DDC since 1988.

<sup>6</sup> CC-BY-NC-ND 3.0

stored in each translation's repertory. Displayed next to each class are two columns; the first column contains hits representing results from searches for the exact Dewey number in a connected catalog; the second contains results in the same catalog from searches for the exact number plus numbers of all subclasses.

The screenshot shows the 'WebDewey Search' interface. At the top is a search bar with the text 'Searchterm or DDC-notation:' and a 'SEARCH' button. Below this is a table titled 'Main classes'. The table has four columns: 'DDC-notation', 'Caption', 'Results in this class', and 'Results in this class and subclasses'. The data is as follows:

DDC-notation	Caption	Results in this class	Results in this class and subclasses
000	<a href="#">Datavetenskap, information &amp; allmänna verk</a>	0	<a href="#">230804</a>
100	<a href="#">Filosofi &amp; psykologi</a>	0	<a href="#">135060</a>
200	<a href="#">Religion</a>	0	<a href="#">235626</a>
300	<a href="#">Samhällsvetenskaper</a>	0	<a href="#">1027036</a>
400	<a href="#">Språk</a>	0	<a href="#">176875</a>
500	<a href="#">Naturvetenskaper</a>	0	<a href="#">286621</a>
600	<a href="#">Teknik</a>	0	<a href="#">525879</a>
700	<a href="#">Konsterna &amp; fritid</a>	2	<a href="#">586444</a>
800	<a href="#">Litteratur</a>	0	<a href="#">834090</a>
900	<a href="#">Historia &amp; geografi</a>	0	<a href="#">558936</a>

Below the table is a 'Main classes' section with links to each DDC number (000, 100, 200, 300, 400, 500, 600, 700, 800, 900). At the bottom is a 'Creative Commons License' section with the CC BY-NC-ND logo and text.

Figure 1: DDC top levels in a test version of WebDewey Search with English labels and Swedish data

Clicking on either a caption or a notation opens a display of the next level of subclasses for each DDC number with corresponding results in the catalogs (see Figure 2). In this way, the user is continuously provided with an overview of both the subjects and the amount of documents on each subject in each catalog. Clicking on the number of hits in either column opens the results list in the connected catalog.

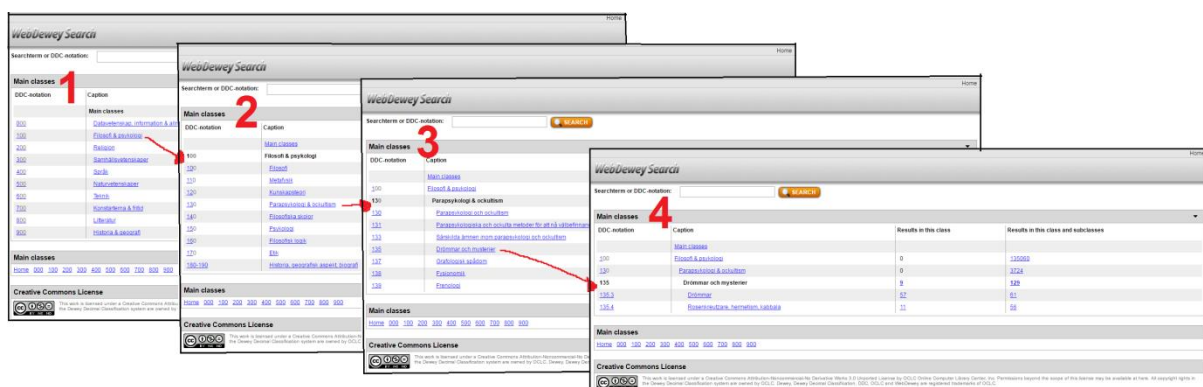


Figure 2: Navigation<sup>7</sup> from [1] DDC top levels to [2] 1 *Philosophy & psychology* to [3] 13 *Parapsychology & occultism* to [4] 135 *Dreams and mysteries*

<sup>7</sup> It is also possible to search directly using a DDC number in the search box at the top of the screen. For example, a search for "135" leads the user directly to the hierarchical display of notations and captions for 135 *Dreams and mysteries*.

## 2.3. Word-based queries

Word-based queries in WebDewey Search yield results based on matches to terms from the DDC Relative Index (see Figure 3). The DDC Relative Index is a list of topics found in DDC classes, with subterms for the various disciplinary, geographical or periodical contexts in which they appear.

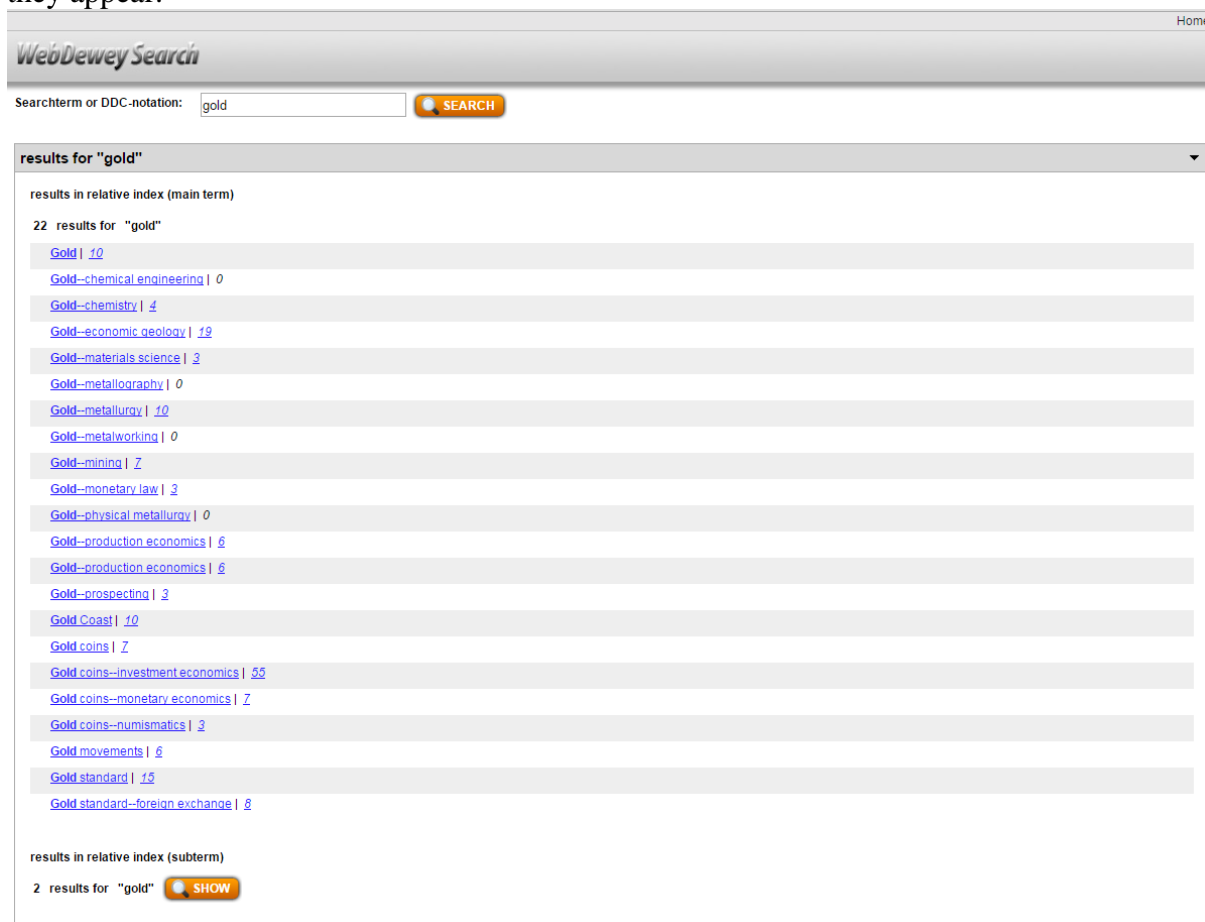


Figure 3: Results list from query for “gold”

Clicking on a Relative Index term leads the user to the class to which the term is associated, displayed within its hierarchy as described in section 2.2. Clicking on the hits next to each term opens the catalog’s results list.

There are two major issues regarding the use of Relative Index terms for the retrieval of DDC-classified resources. The first concerns the registration of equivalence relationships between synonymous index terms. As of March 2016, the index to the standard English-language WebDewey<sup>8</sup> consisted of over 103,000 terms, including synonyms. Until recently, complex see references between non-preferred and preferred terms were only registered in specific cases, meaning that the preferred term for many synonyms remains implicit. There is, for example, no see reference between the terms “Criminals” and “Offenders” in 364.3, even though they are treated synonymously, with “Offenders” the implicitly preferred term. Thus, end-users searching for “Criminals” in WebDewey Search will only get one result, while a search for “Offenders” yields eight results for the topic treated in various disciplinary contexts.

<sup>8</sup> “Dewey by the Numbers (2016-03-01),” *025.431: The Dewey blog*, March 01, 2016. <http://ddc.typepad.com/025431/2016/03/dewey-by-the-numbers.html>.

The second issue concerns the relationship between Relative Index terms and DDC classes. Relative Index terms represent topics either explicitly or implicitly belonging to a class, but the exact nature of the relationship is not registered. It is therefore not possible to know whether a term is equivalent to a class, as is the case for the term “Gold” which indexes to class 669.22 *Gold*, or if it is much narrower in scope, for example “Gold movements” which indexes to 332.0424 *Capital movements*.

### 3. WebDewey Search Deutsch

#### 3.1. History of DDC in Germany

Germany’s DDC history<sup>9</sup> only goes back to the early 00s of the 21<sup>st</sup> century. While there had been a consistent and cooperative subject cataloging routine for decades using the RSWK (Headword Cataloguing Rules for Subject Cataloguing)<sup>10</sup> and the SWD (Subject Headings Authority File, today part of the Integrated Authority File [GND<sup>11</sup>]), various classification systems had been established, among them both modified ones and systems invented to meet institution-specific or regional requirements, e.g., the RVK (Regensburger Verbundklassifikation)<sup>12</sup>. In 1998, an expert group for classification issues published a report wherein the DDC was considered appropriate and a translation of the English 22<sup>nd</sup> edition was recommended. The specifications included the creation of a classification tool for professionals and a research tool for end-users, which was to take into account the fact that German on-site and online library users were not used to searching for literature with Dewey numbers. DDC Deutsch<sup>13</sup> came out in 2005 as a printed edition of DDC22, and in 2006 as the first electronic version of a DDC translation in the form of MelvilClass<sup>14</sup>.

#### 3.2. Special functionalities

##### 3.2.1. Search and navigation of number components

In the German National Library, the components of any built number (the base number and any number of the Schedules or Auxiliary Tables [Tables 1-6] needed to construct a specific number according to DDC add instructions) are stored together with the complete number in the bibliographic record.

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<sup>9</sup> Since most instruments for verbal subject cataloging and classification with DDC are jointly used in Austria, Germany, and Switzerland, good parts of the DDC history are shared by all German-speaking countries.

<sup>10</sup> “Rules for the Headword Catalogue (RSWK)”, Deutsche National Bibliothek, <http://www.dnb.de/EN/Erwerbung/Inhalterschliessung/rswk.html>.

<sup>11</sup> “Integrated Authority File (GND)”, Deutsche National Bibliothek, <http://www.dnb.de/EN/gnd>.

<sup>12</sup> “Regensburger Verbundklassifikation Online”, <http://rvk.uni-regensburg.de/> (in German).

<sup>13</sup> “Dewey-Dezimalklassifikation”, Deutsche National Bibliothek, <http://www.ddc-deutsch.de/> (in German).

<sup>14</sup> “Melvil – Der Deutsche Webservice zur Dewey-Dezimalklassifikation (DDC)”, [http://www.ddc-deutsch.de/Subsites/ddcdeutsch/DE/DDCprodukte/Melvil/melvil\\_node.html](http://www.ddc-deutsch.de/Subsites/ddcdeutsch/DE/DDCprodukte/Melvil/melvil_node.html) (in German)

<p>Example 1:</p> <p>082 04\$81\x\$a<b>914.9235204</b>\$qDE-101\$222/ger</p> <p>085 \$81\x\$b914</p> <p>085 \$81\x\$z<b>2\$492352</b></p>	<p>Example 2:</p> <p>082 04\$81\x\$a<b>338.76102504</b>\$qDE-101\$222/ger</p> <p>085 \$81\x\$b338.761</p> <p>085 \$81\x\$s<b>025.04</b></p>
<p>Example 3:</p> <p>082 04\$81\x\$a<b>230.0207</b>\$qDE-101\$222/ger</p> <p>085 \$81\x\$b230</p> <p>085 \$81\x\$z<b>1\$s0207</b></p>	<p>Example 4:</p> <p>082 04\$81\x\$a<b>779.974692</b>\$qDE-101\$222/ger</p> <p>085 \$81\x\$b779</p> <p>085 \$81\x\$s<b>704.949</b></p> <p>085 \$81\x\$s<b>746.92</b></p>

Figure 4: Examples showing built numbers and their number components, stored in title record

WebDewey Search Deutsch makes use of number components in two ways: through the search and navigation of Auxiliary Tables and with an additional results column showing title hits yielded by number components.

The navigation of the Auxiliary Tables is accessed by opening the lower portlet of the main page and performed in the same manner as the navigation of Schedules described in section 2.2. Parallel browsing of Schedules and Tables is provided, representing a good option for searches in conjunct areas like *Languages* in the 400s and Table 6.

Browsing the Tables can be considered as “aspect browsing”, since the topic is being approached by other attributes than given by the base number, like T1—0207 *Humorous treatment* (see Figure 4: Example 3). The biggest gain from this feature is the access to titles that have been assigned a built number that is not part of the standard edition repertory held in WebDewey Deutsch. For example, 914.9235204 (travel in Amsterdam) is not included in WebDewey Deutsch, but access to titles classified by the number is provided by browsing to T2—492352 *Amsterdam* (see Figure 5, see also Figure 4: Example 3).

WebDewey Search
Suche mit der Dewey-Dezimalklassifikation

Suchbegriff oder Notation:

Suche in:
☒ DNB
☐ GBV
☐ HeBIS
☐ SUB
☒ SWB
☐ FUB

Haupttafeln ▶

Hilfstafeln ▼

Notation	Thema	Titel in dieser Klasse	Titel in dieser Klasse und Unterklassen
	<a href="#">Hilfstafeln</a>		
<a href="#">T2-0</a>	<a href="#">Hilfstafel 2. Geografische Gebiete, Zeitabschnitte, Biografien</a>	0 (DNB) 0 (SWB)	<a href="#">25 (DNB)</a> <a href="#">178 (SWB)</a>
<a href="#">T2-3-T2-9</a>	<a href="#">Einzelne Kontinente, Länder, Ortschaften; außerirdische Welten</a>	<a href="#">17897 (DNB)</a> <a href="#">7875 (SWB)</a>	<a href="#">389219 (DNB)</a> <a href="#">127819 (SWB)</a>
<a href="#">T2-4-T2-9</a>	<a href="#">Heutige Welt; außerirdische Welten</a>	<a href="#">17799 (DNB)</a> <a href="#">7811 (SWB)</a>	<a href="#">386698 (DNB)</a> <a href="#">119188 (SWB)</a>
<a href="#">T2-4</a>	<a href="#">Europa Westeuropa</a>	<a href="#">15530 (DNB)</a> <a href="#">6947 (SWB)</a>	<a href="#">345834 (DNB)</a> <a href="#">108771 (SWB)</a>
<a href="#">T2-49</a>	<a href="#">Andere Teile Europas</a>	<a href="#">31 (DNB)</a> <a href="#">8 (SWB)</a>	<a href="#">36297 (DNB)</a> <a href="#">8780 (SWB)</a>
<a href="#">T2-492</a>	<a href="#">Niederlande</a>	<a href="#">810 (DNB)</a> <a href="#">348 (SWB)</a>	<a href="#">1547 (DNB)</a> <a href="#">444 (SWB)</a>
<a href="#">T2-4923</a>	<a href="#">Nordwestliche Provinzen der Niederlande</a>	<a href="#">3 (DNB)</a> <a href="#">1 (SWB)</a>	<a href="#">334 (DNB)</a> <a href="#">75 (SWB)</a>
<a href="#">T2-49235</a>	<a href="#">Nordholland (Noord-Holland)</a>	<a href="#">55 (DNB)</a> <a href="#">1 (SWB)</a>	<a href="#">210 (DNB)</a> <a href="#">58 (SWB)</a>
<a href="#">T2-492352</a>	<a href="#">Amsterdam</a>	<a href="#">155 (DNB)</a> <a href="#">57 (SWB)</a>	<a href="#">155 (DNB)</a> <a href="#">57 (SWB)</a>

Figure 5: Auxiliary Tables in WebDewey Search Deutsch (Schedules box folded).  
Example Amsterdam

It is also possible to perform word-based queries for terms that match Relative Index terms associated with Table numbers. For instance, searching for the German region of “Vogtland” leads to zero results in the Schedules, but there is one match for the Tables since “Vogtland” is part of and indexed to T2—432169 *Vogtlandkreis*.


Since Table numbers are number components themselves, the two existent columns for catalog hits are sufficient; however, for Schedule numbers (full or added digits) added to a base number within the Schedules, a third column is required (see Figure 6).



WebDewey Search

Suche mit der Dewey-Dezimalklassifikation

Suchbegriff oder Notation:

 SUCHE

Suche in:

☒ DNB ☒ GBV ☒ HeBIS ☒ SUB ☒ SWB ☒ FUB

Haupttafeln

Notation	Thema	Titel in dieser Klasse	Titel in dieser Klasse und Unterklassen	Weitere Titel
	<a href="#">Haupttafeln</a>			
<a href="#">000</a>	<a href="#">Informatik, Informationswissenschaft &amp; allgemeine Werke</a>	0 (DNB) <a href="#">15 (GBV)</a> 0 (HeBIS) <a href="#">2 (SUB)</a> <a href="#">14 (SWB)</a> <a href="#">1 (FUB)</a>	<a href="#">49473 (DNB)</a> <a href="#">429345 (GBV)</a> <a href="#">78939 (HeBIS)</a> <a href="#">88227 (SUB)</a> <a href="#">2588</a>	0 (DNB)
<a href="#">020</a>	<a href="#">Bibliotheks- und Informationswissenschaften</a>	0 (DNB) <a href="#">2 (GBV)</a> 0 (HeBIS) <a href="#">1 (SUB)</a> <a href="#">9 (SWB)</a> <a href="#">1 (FUB)</a>	<a href="#">3615</a> <a href="#">8282</a> <a href="#">1737</a>	
<a href="#">025</a>	<a href="#">Tätigkeiten und Betriebsabläufe in Bibliotheken, Archiven, Informationszentren</a>	<a href="#">30 (DNB)</a> <a href="#">535 (GBV)</a> <a href="#">73 (HeBIS)</a> <a href="#">215 (SUB)</a> <a href="#">320 (SWB)</a> <a href="#">32 (FUB)</a>	<a href="#">1982 (DNB)</a> <a href="#">12352 (GBV)</a> <a href="#">3864 (HeBIS)</a> <a href="#">5506 (SUB)</a> <a href="#">8023 (SWB)</a> <a href="#">1000 (FUB)</a>	<a href="#">3 (DNB)</a>
<a href="#">025.04</a>	<b>Informationsspeicherungs- und Information-Retrieval-Systeme</b> <ul style="list-style-type: none"><li>Für informatische Aspekte von Informationsspeicherungs- und Information-Retrieval-Systemen, von Datenbanken, siehe <a href="#">Datendateien und Datenbanken</a></li><li>Für Informationsspeicherungs- und Information-Retrieval-Systeme, bibliografische Verzeichnisse von Websites, digitale Bibliotheken für bestimmte Themen siehe <a href="#">Themenspezifische Informationsspeicherungs- und Information-Retrieval-Systeme</a></li><li>Für eine bestimmte Art von Informationsspeicherungs- und Information-Retrieval-System siehe die Art, z.B. Online-Kataloge <a href="#">Online-Kataloge</a></li></ul>	<a href="#">377 (DNB)</a> <a href="#">1927 (GBV)</a> <a href="#">567 (HeBIS)</a> <a href="#">676 (SUB)</a> <a href="#">1579 (SWB)</a> <a href="#">140 (FUB)</a>	<a href="#">684 (DNB)</a> <a href="#">2455 (GBV)</a> <a href="#">782 (HeBIS)</a> <a href="#">794 (SUB)</a> <a href="#">2009 (SWB)</a> <a href="#">186 (FUB)</a>	<a href="#">22 (DNB)</a>

338.7610250

338.76102504

Figure 6: Column “Weitere Titel” with example for Schedule number 025.04 added to base number 338.761, making 338.76102504 (not available in German standard edition)

Finding DDC-classified resources with Schedule numbers that have been added to a base number is a big deal: Often, a certain built number is the one and only place in the DDC to treat the topic (For 338.76102504, the most-used number for Google Inc., see Figure 6 and Example 2 in Figure 4; for 779.974692, the number for fashion photography, see Example 4, Figure 4).

### 3.2.2. One search – multiple catalogs

Due to the decentralized organization of the German library landscape, specialized collections are found in any of the federal states of Germany. Most research libraries belong to a library network system, operating own library catalogs. Besides the DNB catalog, five further catalogs of libraries or library networks are connected to and selectable in *WebDewey Search Deutsch*<sup>15</sup>. In order to cope with the continuous increase of incoming resources, a considerable amount of the material lacks sufficient verbal indexing data. Thus, Dewey numbers received from the Library of Congress, the British National Bibliography, or from the DNB give good reasons for a central access to DDC-classified resources located in catalogs of different physical places in order to provide access to resources that would otherwise be hard to find<sup>16</sup>.

<sup>15</sup> Catalogs connected: German National Library (DNB), Common Library Network (GBV), Hessisches BibliotheksInformationsSystem (HeBIS), Göttingen State and University Library (SUB), Library Service Centre Baden-Wuerttemberg (SWB), Library System of the Freie Universität Berlin (FUB)

<sup>16</sup> As a second measure to tackle this problem, the German National Library currently is in a testing phase of attaching the DDC’s Relative Index terms to title data, in order to provide the user with more verbal metadata as access points in the DNB catalog.



## 4. Norsk WebDewey Search

### 4.1. History of DDC in Norway

The DDC has a long history of use in Norwegian libraries. In 1898, the Oslo Public Library became the first library outside North America to use the system, and in 1914 a Norwegian translation of excerpts of DDC8 was published. A modified and abridged translation of newer editions has been published ca. every twenty years thereafter. By the turn of the 21<sup>st</sup> century, the system was in use in either modified translated form or in the newest English unabridged edition by all Norwegian public and school libraries and by ca. 40% of university and research libraries. Since Norway does not have national subject headings, the DDC serves as the only common means of subject access across these libraries. In order both to increase the interoperability of classification work amongst Norwegian and international libraries and to better take advantage of underlying DDC metadata, the National Library decided to translate DDC23 and publish it as the Norwegian WebDewey, which was launched in the fall of 2015.

### 4.2. Special functionalities

*Norsk WebDewey Search* was launched in February, 2016. Since the Norwegian WebDewey includes the number building tool, built numbers are included in the underlying data. The service is connected to a beta version of the Norwegian union catalog, Biblioteksøk<sup>17</sup> and contains a number of modifications and additions to the default WebDewey Search.

#### 4.2.1. Single-column results

The largest modification made to *Norsk WebDewey Search* was the removal of the column in the hierarchical view containing results from searches for the exact Dewey number (see Figure 7). For Norwegian users, it was reasoned that it would be misleading to distinguish between exact results and results in the exact class plus all subclasses with two separate columns, since the majority of DDC-classified resources dating from 2015 or earlier would have been classed with a modified and abridged translation. For example, books about ice cream making would be classed in respectively 641.86 and 641.862 before and after 2015. The single-column approach makes it easier for end-users to see where there are more results in broader classes than in their subclasses, a possible indication that an abridged number had previously been applied.

Deweys hovedklasser: Teknologi (600) > Husholdning og familieliv (640) > Mat og drikke (641) > Tilberedning av bestemte typer retter og tilberedning av drikkevarer (641.8) > Desserter (641.86)		
Deweynummer	Klassebetegnelse	Treff i denne klassen og dens underordnede klasser
	<a href="#">Deweys hovedklasser</a>	
600	<a href="#">Teknologi</a>	470135
640	<a href="#">Husholdning og familieliv</a>	40097
641	<a href="#">Mat og drikke</a>	23985
641.8	<a href="#">Tilberedning av bestemte typer retter og tilberedning av drikkevarer</a>	3658
641.86	<a href="#">Desserter</a>	443
641.862	<a href="#">Frosne desserter</a>	5
641.863	<a href="#">Sattis, sorbet</a>	3
641.864	<a href="#">Gelatindesserter, puddinger</a>	3
641.865	<a href="#">Søte bakverk</a>	579

Figure 7: Single-column approach in Norsk WebDewey Search.

While the reasoning behind the modification was simple, its execution was complicated: In the two-column approach, a search for any given Dewey number would yield two results: one for

<sup>17</sup> “Biblioteksøk”, <http://www.nb.no/bibsok/start.jsf>.

the exact notation and one for the notation with a right-truncation. In the single-column approach, results for the exact class are shown when the class has no more subclasses to open. To accomplish this, algorithms were developed with rules stating when to make exact searches and when to make truncated searches.

#### 4.2.2. Relative Index directs to hierarchy

In word-based queries, the hyperlinked number of hits next to each term was eliminated (see Figures 9 and 10) because it was argued that results lists for terms that are narrower in scope than the classes to which they are associated would be misleading. By eliminating the direct link to the catalog, the end-user is forced back to the hierarchical display on the main page to see the class and hierarchical context to which the term belongs and with which the catalog's resources are classified.

#### 4.2.3. API

There is a link to *Norsk WebDewey Search* from the Norwegian WebDewey, making it readily available to librarians, but so far, no links have been made available from within catalogs. In an effort to make the tool more accessible to end-users, the National Library and Pansoft offer an API to non-commercial library developers containing the same metadata used in WebDewey Search. The hope is that search and navigation of DDC-classified resources may be integrated directly into catalogs in the future. At time of writing, two library developers are experimenting with the use of the API for integration of DDC-based search and navigation directly in their catalogs.

#### 4.2.4. Other modifications

Breadcrumbs were added in the hierarchical view to allow for easier navigation within the hierarchy (see Figure 8).

Deweys hovedklasser <a href="#">Samfunnsvitenskap (300)</a> > <a href="#">Utdanning og oppl�ring (370)</a> > <a href="#">Bestemte utdanningstrinn (372-374)</a> > <a href="#">[ ]</a> > <a href="#">Spr�kferdigheter (kommunikasjonsferdigheter) (372.6)</a> > <a href="#">Fremmedspr�k, offisielle spr�k, andrespr�k; tospr�klig undervisning (372.65)</a> ▼		
Deweynummer	Klassebetegnelse	Treff i denne klassen og dens underordnede klasser
	<a href="#">Deweys hovedklasser</a>	
<a href="#">300</a>	<a href="#">Samfunnsvitenskap</a>	<a href="#">900309</a>
<a href="#">370</a>	<a href="#">Utdanning og oppl�ring</a>	<a href="#">127783</a>
<a href="#">372-374</a>	<a href="#">Bestemte utdanningstrinn</a>	<a href="#">52753</a>
<a href="#">372</a>	<a href="#">F�rskoleoppl�ring og barneskoleoppl�ring</a>	<a href="#">41887</a>
<a href="#">372.3-372.8</a>	<a href="#">F�rskoleoppl�ring og barneskoleoppl�ring i bestemte f�g</a>	<a href="#">24968</a>
<a href="#">372.6</a>	<a href="#">Spr�kferdigheter (kommunikasjonsferdigheter)</a>	<a href="#">8108</a>
<a href="#">372.65</a>	<a href="#">Fremmedspr�k, offisielle spr�k, andrespr�k; tospr�klig undervisning</a>	<a href="#">1017</a>
<a href="#">372.651</a>	<a href="#">Tospr�klig undervisning</a>	<a href="#">152</a>
<a href="#">372.652-372.659</a>	<a href="#">Bestemte fremmedspr�k, offisielle spr�k, andrespr�k</a>	<a href="#">504</a>

Figure 8: Breadcrumbs in the Norwegian WebDewey Search, with ellipses replacing middle levels in more than six levels. These are displayed by clicking on the ellipses.

English Relative Index terms are retained in the underlying Norwegian translation metadata and thus searchable, yielding results for translations with the original English terms shown in angle brackets (see Figure 9). Complex see references between synonymous Relative Index terms are published when available (see Figure 10).



treff for "literacy"	
treff i registeret (der søketerm forekommer som emne i diverse fagområder)	
13 treff på "literacy"	
<a href="#">Skriftspråklig kompetanse</a>	<Literacy>
<a href="#">Skriftspråklig kompetanse--ferskoleoppl�ring og barneskoleoppl�ring</a>	<Literacy--primary education>
<a href="#">Skriftspr�klig kompetanse--lingvistikk</a>	<Literacy--linguistics>
<a href="#">Skriftspr�klig kompetanse--oppl�ring--personalf�rvaltning</a>	<Literacy--training--personnel management>
<a href="#">Skriftspr�klig kompetanse--sosiologi</a>	<Literacy--sociology>
<a href="#">Skriftspr�klig kompetanse--utdanningspolitikk</a>	<Literacy--educational policy>
<a href="#">Skriftspr�klig kompetanse--voksenoppl�ring</a>	<Literacy--adult education>
<a href="#">Tiltak for skriftspr�klig kompetanse</a>	<Literacy programs>
<a href="#">Tiltak for skriftspr�klig kompetanse--voksenoppl�ring</a>	<Literacy programs--adult education>
<a href="#">Datakunnskap</a>	<Computer literacy>
<a href="#">Datakunnskap--ferskoleoppl�ring og barneskoleoppl�ring</a>	<Computer literacy--primary education>
<a href="#">Digital kompetanse--ferskoleoppl�ring og barneskoleoppl�ring</a>	<Digital literacy--primary education>
<a href="#">Informasjonskompetanse--ferskoleoppl�ring og barneskoleoppl�ring</a>	<Information literacy--primary education>
treff i registeret (der s�keterm forekommer som faglig inndeling av andre emner)	
0 treff p� "literacy"	

Figure 9: Results list of word-query for English “literacy”

treff for "aves"	
treff i registeret (der s�keterm forekommer som emne i diverse fagom�der)	
1 treff p� "aves"	
<a href="#">Aves</a> <Aves>	
se ogs� <a href="#">Fugler</a>	
treff i registeret (der s�keterm forekommer som faglig inndeling av andre emner)	
0 treff p� "aves"	

treff for "Fugler"	
treff i registeret (der s�keterm forekommer som emne i diverse fagom�der)	
55 treff p� "Fugler"	
<a href="#">Fugler</a>	
<a href="#">Fugler--aff�r</a>	
<a href="#">Fugler--Australia</a>	
<a href="#">Fugler--bevi�mpelse av skadeorganismer--teknologi</a>	
<a href="#">Fugler--bevi�mpelse av skadeorganismer--teknologi--landbruk</a>	
<a href="#">Fugler--bildeverk</a>	
<a href="#">Fugler--embryologi</a>	
<a href="#">Fugler--evne</a>	

Figure 20: A word-based query for “Aves” yields one result. It also displays the see reference “se ogs  Fugler” (“see also Birds”), for which there are 55 results.

## 5. Svenska WebDewey Search

### 5.1. History of DDC in Sweden

Swedish libraries did not start using DDC until 2011. Most libraries had until then used the Swedish classification system SAB (since 1921). A national system for subject headings, the Swedish Subject Headings, only started being used in 2002. As a consequence, searching and browsing subjects using classification data was important. The SAB system was used for browsing by subject in Libris webbs k<sup>18</sup>, the web catalog of the Swedish national union catalog. In Libris one finds the national bibliography and the collections of university and research libraries, and a growing number of public libraries. With the transition to DDC in 2011, there was need for a search tool that could be based on the use of DDC and the development of a search tool using the DDC was part of the Swedish Dewey project<sup>19</sup>. In 2012, *Svenska WebDewey Search* was launched.

<sup>18</sup> “LIBRIS”, <http://libris.kb.se/>.

<sup>19</sup> The Swedish Dewey Project. 2009-2011, translated DDC into Swedish, updated the mappings between SAB and DDC and gave training courses to Swedish librarians in DDC. <http://www.kb.se/om/projekt/avslutade-projekt/dewey/Om-Deweyprojektet/> (in Swedish, viewed 2016-05-10).

## 5.2. Mixed translation

*Svenska WebDewey Search* uses the default interface of WebDewey Search with two columns, one for the exact class and one for subclasses to the exact class<sup>20</sup>. It is connected to Libris webbsök, where there are 4.6 million records with DDC or SAB. The mappings between SAB and DDC make it possible to search also for records with SAB classification.

A problem for Swedish users is that only about 40% of the Swedish WebDewey is translated into Swedish. Word-based queries are possible with either Swedish or English terms, but only the English index is complete. Several problems are due to not having a full translation:

- Difficulties in finding an appropriate English search term
- Searching in English leads the user to all numbers, also translated numbers with captions in Swedish. This may be confusing.
- No possibility to choose search language. This may cause problems when there are words in Swedish and English with the same spelling but with different meanings. An example is that a search for “glass” (Swedish for ice cream) will get the user translated numbers about “glas” (Swedish for glass) as the numbers are translated and the captions are in Swedish (see Figure 11).

The screenshot shows the search results for the term "glass". On the left, a list of 70 results is shown, each with a link to a specific Dewey class and its relative index. On the right, a table titled "DDK:s huvudklasser" (DDC's main classes) is displayed, showing the hierarchy of classes for "glass".

DDK-nummer	Rubrik	Resultat
	<a href="#">DDK:s huvudklasser</a>	
<a href="#">600</a>	<a href="#">Teknik</a>	0
<a href="#">660</a>	<a href="#">Kemiteknik</a>	0
<a href="#">666</a>	<a href="#">Keramiska och liknande tekniker</a>	348
<a href="#">666.1</a>	<a href="#">Glas</a>	544
<a href="#">666.104</a>	<a href="#">Special topics of glass</a>	0
<a href="#">666.12-666.14</a>	<a href="#">Allmänna ämnen gällande glas</a>	42
<a href="#">666.15</a>	<a href="#">Specific types of glass</a>	3
<a href="#">666.157</a>	<a href="#">Fiber glass and foam glass</a>	2
<a href="#">666.19</a>	<a href="#">Products</a>	4

Figure 11: Word-based query for “Glass” (Swedish “Ice cream”) in Svenska WebDewey Search

<sup>20</sup> See Figure 1.

Library users do not want to search; they want to find without effort (Bates, 2010). *Svenska WebDewey Search* is unfortunately not easy to find in Libris webbsök. Integrating the search function with the API described in section 4.2.3 would help. This will be part of the development of a new generation of Libris webbsök.

### 5.3. Other search problems

The Swedish WebDewey has not yet been able to start using the WebDewey number building tool. Although it is possible to add built numbers directly in the translations software, it is easier to do so in WebDewey using the number building tool, since the tool automatically generates metadata for the underlying number components. Therefore, most built numbers published from the translation software come directly from the English edition. Finding information about a certain country can be difficult for end-users without knowledge of the DDC. An example is 274 *Christianity in Europe*: WebDewey Search cannot subdivide Europe into different countries, e.g., Sweden, as it is not subdivided in the DDC schema. To help end-users, the numbers would have to be built in the Swedish WebDewey. To an end-user it is strange not getting a more specific number and to get 7567 records to look through in the Libris catalogue. Other areas in the DDC with the same problem are 709 *Geographic treatment of fine arts*, 281-289 *Specific Christian denominations*, and 340 *Law*.

## 6. Conclusion and future work

WebDewey Search provides access to DDC-classified resources in ways that have not previously been possible. There are, however, several ways the service may be improved. First and foremost, better synonym control of Relative Index terms is needed. OCLC Senior Editor Rebecca Green has outlined methods to automatically identify equivalence relationships in DDC, which would be a necessary first step to rectify this problem (Green, 2015).

All three national libraries have one or more externally controlled vocabularies mapped to the DDC. German subject and geographical GND headings have been mapped to the German DDC since 2006; Svenska ämnesord (SAO) have been mapped to the Swedish DDC since 2010; and three Norwegian local subject headings systems<sup>21</sup> have been mapped to the Norwegian DDC since 2015. A logical next step for further developing WebDewey Search would be the integration of these external vocabularies for word-based queries.

Another latent potential of WebDewey Search is the ability to switch between the various languages of the DDC translations; countries with more than one official language would profit from multilingual display and search, not to mention the increased interoperability between the catalogs' resources.

The three versions of WebDewey Search are based on metadata from the three respective WebDeweys in Germany, Norway, and Sweden, but at time of writing, only the Norwegian WebDewey offers classifiers the ability to contribute built numbers through the number building tool and integrates these in its repertory after vetting. The problems the National Library of Sweden faces by the lack of the tool are described in section 5.3. The German National Library is compensating for the lack of built numbers by registering number components in bibliographic records and allowing users to search for these in WebDewey Search. This, as well as the German approach to enrich bibliographic data with Relative Index

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<sup>21</sup> BS-emner have been mapped since the launch of the Norwegian WebDewey in 2015, while Humord and Realfagstermer are in the process of being mapped since 2016.

terms to compensate insufficient verbal indexing data, represents local solutions that may not be realistic for other countries to adopt. To get the best out of topical aspects in built numbers, their parts and hyperlinked verbal content should be made usable in WebDewey Search directly from the underlying number component data (MARC 21 field 765). The Tables integrated in WebDewey Search Deutsch can be considered a good start, however, for the Schedules, there might be other functionalities necessary to achieve the same effect without losing user-friendliness.

Perhaps the biggest challenge regarding search and navigation in library collections in general is getting end-users to use the services available to them. WebDewey Search is an open service, but end-users do not easily find it. Furthermore, it may be unreasonable to expect them to use an external service to gain access to catalog resources. A short-term solution to this problem may be an expansion of the Norwegian API to include the metadata from other translations and links to more catalogs, thus enabling more library developers to incorporate WebDewey Search functionality directly into their catalogs. In the long run, however, the Dewey data itself should be offered in a more universal and open format, such as Linked Data<sup>22</sup>. The easier it is to develop end-user services for subject access that better take advantage of the underlying metadata of the DDC, the stronger the DDC will be as a knowledge organization system.

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DDC, Dewey, Dewey Decimal Classification and WebDewey are registered trademarks of OCLC Online Computer Library Center, Inc.

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<sup>22</sup> Parts of the necessary metadata were previously available through dewey.info, which was taken down in 2014. Statements from several European national libraries describe the loss of dewey.info at the EDUG webpage (European Dewey User Group) <http://edug.pansoft.de/tiki-index.php?page=DDC+in+Europe> (viewed 20160509)