Revision and Stability in Dewey 21: 
The Life Sciences Catch Up

Abstract: The Dewey Decimal Classification (DDC) has faced the problem of innovation in knowledge organization since it first appeared 120 years ago. During its first 75 years, the DDC took two different approaches that in retrospect proved to be wrong ones. In the last 45 years, however, the system has developed an approach to innovation that can serve as a model of how knowledge organization should be revised. This approach is illustrated by a review of the three major revisions appearing this year in Edition 21. The specific problems found in revising the life sciences in 560-590 are reviewed in detail.

1. General Issues of Innovation versus Stability

When it comes to facing the issues of innovation versus stability in knowledge organization, the Dewey Decimal Classification has been on three sides of the question. That is, Dewey has blindly pursued stability at the sacrifice of all innovation other than straightforward expansion, Dewey has tried innovation in a manner that got it all wrong, and, judging by its present viability as the most widely used universal system for classifying knowledge, Dewey finally found the right approach to innovation.

Managing innovation of knowledge organization involves two simple principles. First we must organize according to enduring principles, then we must keep the general outlines and most of the landmarks of the system recognizable over time. If we do not change at all, we fail in the competition for new customers, and eventually lose our old ones. If we change too fast, we risk losing old customers in an effort to win new ones, and we may fail to win new ones if we look too reckless in our innovations.

Comaromi (1976) provides historical perspective on change in the DDC. When the first edition of Melvil Dewey's classification appeared in 1876, it proved to be an instant success. It was widely adopted by libraries because it introduced two powerful enduring principles: shelf arrangement determined by simple numeric symbols representing subjects, and subjects arranged according to disciplines. That is, ordinary gardening is found in 635 under agriculture, but landscape gardening is found in 711 under fine arts. The original disciplines have endured, even if their contents have changed radically.

The second edition of the DDC published in 1885 was considerably revised as well as enlarged, and was adopted by an increasing number of libraries. Soon thereafter, however, Dewey became opposed to further changes in the meaning of numbers. His opposition was canonized under the principle of "integrity of numbers." Expansion was allowed, but not adjustment in the meaning of numbers. Use of the system grew rapidly for decades, but it became increasingly dated and it started losing ground to other classifications. The anti-innovation policy continued through 1942 when Edition 14 appeared.

During the 1940s the pressure for innovation became overwhelming. But when Edition 15 appeared in 1951, it simply changed too much. There was a major loss of old friends to the more stable Library of Congress classification. In reaction, however, people learned to handle...
innovation better. Under the able leadership of editor Benjamin Custer, the DDC was soon back on track.

Provisions of editions 14 and 15 were carefully reviewed. Changes that met the approval of the library profession were retained; the ones that required excessive reclassification or eliminated needed specificity were reversed in Edition 16, which appeared in 1958. Thereafter, particular attention was given to disciplines that were obsolete or unsatisfactory. One or two disciplines were selected for complete revision in each edition: psychology in Edition 17 (1965), law and mathematics in Edition 18 (1971), sociology in Edition 19 (1979), and computer science and music in Edition 20 (1989).

2. Lessons from the First 75 Years

Three important lessons may be drawn from the Dewey experience. First, no universal system for classifying knowledge can last even a generation without regular adjustments to accommodate the growing and changing body of knowledge produced by modern civilization.

Second, as soon as the classification becomes established in the hearts, minds, and institutions of people not controlled by its creators, the creators inevitably find themselves sharing control with the users. The first thing shared is the burden of innovation, because the system that is widely adopted has a dual manifestation: the body of the canon, and the body of materials classified under the system. The more the system gratifies the hopes of its developers by being widely adopted, the more chilling the effect of success upon innovation. Fortunately, Dewey has survived the chill, and has learned to innovate.

Third, successful innovation must address the problem of reclassification required in major collections of knowledge using the system. The problem remains even though many Dewey libraries avoid the worst of it. For example, well over half of these libraries have small collections that are in constant flux. New material is constantly added, old material is gradually worn out or is discarded when it becomes dated. Current national bibliographies and publishers catalogs arranged by the DDC also benefit without paying a price; they can immediately use the revised schedules in forthcoming issues. The material in the old numbers remains harmlessly in back issues. Electronic resources like the Internet and the World Wide Web, are also in constant flux; the sources tagged with Dewey numbers will probably change faster than the numbers do.

Nevertheless, the problem will not go away. Consider the large academic and research libraries that cannot avoid the problem created by old numbers with new meanings. These libraries keep the old material for research and archival purposes, but the bulk is so large in proportion to use that they do not even consider reclassifying it. Their needs and practices must be respected, even if we cannot stop the process of innovation out of deference to their needs.

Therefore, innovation must be measured and focused. A certain amount of pruning and spot adjustments to eliminate minor mistakes in development or obsolescence of distinctions among classes can be done on a continuous basis. Any drastic revision, however, should target the most obsolete or poorly developed disciplines, and must limit the change at any given time to what large and busy institutions using the system can accommodate at a reasonable pace. Then, even institutions that cannot reclassify will be able to understand both the immediate benefits of the occasional major revision for many users now, and the ultimate need of the knowledge professions for a classification that remains current. Over time, they may find some way to accommodate the innovation.
3. How Things Go Wrong

We speak glibly about obsolescence of knowledge, but more often the problem is that knowledge was not yet being explored at the time the system was developed. The literature available then often does not represent what appears later. Just a little bit of incautious development to fit the then current works creates a distorted frame of reference for future literature. Expansion built upon the faulty foundation compounds the problem instead of relieving it.

The three disciplines revised in Edition 21 of the DDC illustrate three different degrees of distortion compounded over time. In none has there been a real obsolescence of the material for which the original scheme was designed. Yet bad guesses by the original developers about how the literature should be organized have become increasingly apparent over time. The situation was worst in public administration, and most bearable (but still difficult) in education. It was intermediate in the life sciences.

The DDC devised three quite different remedies for the three situations. Let us review the first two briefly, because what we did is straightforward. Then let us explore the interesting juggling done for the life sciences.

4. The Revision of Education (370)

In the early 80s we considered a complete revision of the education schedule in 370. But there was neither consensus for any single principle of reorganization nor a willingness to accept wholesale changes if the principle was not changed. We dropped the idea of radical change.

Now, over a decade later, we bring out a revision that leaves the main outlines of the schedule basically the same, but reworks numerous subdivisions where the terminology was confusing. We also removed many irregularities that had crept in over time, especially ones involving our standard notation for concepts like educating teachers or using apparatus and equipment. Both the terminology problems and the irregularities invited errors in applying the schedule, and made the overall structure difficult to grasp.

In addition, we relocated several important topics to more predictable locations. For example, education of women and ethnic minorities now joins education of other kinds of students, religious schools are now next to other kinds of schools, and educational sociology joins sociology of other disciplines in 306.

All the changes taken together are not drastic. We list education as one of three major revisions of Edition 21, but we have mainly pruned the twigs rather than cut the branches. In fact, only six numbers are reused, and these are for minor topics. We warn users to expect big changes, but the changes will not require a dismaying burden of reclassification.

5. Revision of Public Administration (350-354)

In contrast to the old education schedule, the old public administration schedule in 350-354 had fundamental problems that could not be removed by small adjustments or half measures. The problems were a veritable catalog of what can go wrong when development is not based on an informed understanding of the needs of the profession using the discipline:

The old schedule required a meaningless distinction between works on central government administration of any given topic (classed in subdivisions of 351) and comprehensive works on public administration of the same topics (classed in corresponding subdivisions of 350). For administration of these same topics in specific jurisdictions, one had to start with different numbers, and follow number-building instructions that involved use of single, double, and triple zeros for different kinds of topics. The instructions, however, required a change in the number
of zeros in each case. The number building for central administration gave preference to country over topic, while most libraries wanted emphasis on topic. For local government, there was an arrangement of the topics in 352 quite different from the one used for central governments. In 352 preference was reversed to topic over jurisdiction. The number fell between the ones used for works on central governments in general (351) and works on specific central governments (353-354). Development overall was very unbalanced; many important topics required long numbers, while many minor ones had short numbers.

The whole schedule was maddening in its complexity and irregularity. One could hardly have a better case for a complete revision. Such a revision is offered under 351-354 in Edition 21. Not a single number in the new 351-354 has the same meaning that it had in Edition 20.

6. Innovation With Caution in the Life Sciences

The problems in the life sciences suggested a more cautious approach to innovation. These sciences were (and are) spread over four units:

- 560 Paleontology
- 570 Life sciences (the comprehensive number)
- 580 Botany
- 590 Zoology

There were two central problems: First, too much emphasis was given to specific kinds of organisms, and too little was given to biological processes that are the focus of most current research. Second, there was a terrible imbalance in the use of notation, typified by the fact that 80 percent of the material in 570 was classed in two subdivisions, much of it in numbers six or more digits long, while most three and four digit numbers were used for minor topics or were unused.

Even in the other three units there was little material in many subdivisions, especially in paleontology and botany. Other numbers were inordinately long without giving the necessary specificity, e.g., for popular mammals with heavy literature in 599. The scheme for dicotyledons in 583 was a mishmash of two obsolete classification systems. Microorganisms were scattered in three different places, and usually badly developed, while the fish schedule was very inadequate. There were many irregularities in the notation used to specify complex topics like behavior of birds, or ecology of insects.

The problems define the case for a measured and focused revision: Provide a complete revision only in 570, where biological processes can then be given preference over kind of organism, and in 583 where dicotyledons need a new arrangement under a currently recognized system. Bring microorganisms together somewhere with an up-to-date taxonomy, give mammals and fish the kind of revision that will provide greater specificity and shorter numbers, and clear out the irregularities in building numbers for complex subjects. Wherever possible, place new developments in numbers that either were vacant or were used for minor subjects, and avoid reusing old numbers that contain large bodies of material.

Edition 21 offers such a measured and focused revision of the life sciences. The story is a long one, but it shows the importance we attach to wide-ranging consultations, even when they extend over decades.
7. The First Round of Proposed Revision of 560-590

The story began with a series of memoranda from Benjamin Custer to the Decimal Classification Editorial Policy Committee (EPC) in 1972 (the year after Edition 18 appeared) concerning revision in the last of his four editions. In "Extent of revision in Edition 19" (EPC Exhibit 67-34, 23 August 1972), he evaluated nine possible major revisions, including three that were parts of the life sciences. Each proposal received one of four priorities, in descending order: urgent, important, desirable, and "not given priority." A phoenix of taxonomic botany and paleobotany (582-589 and 561) was important, an extensive revision of taxonomic zoology and paleozoology was desirable, and a substantial revision of general biology (570) was not given priority.

At that time, Mr. Custer was both editor of the DDC and chief of the Decimal Classification Division (the Division) which applies the Classification to bibliographic records produced by the Library of Congress. I had been a science and technology classifier for five years, and received a copy. I responded immediately, because I had become quite exasperated trying to apply the preference order of organism over process. Scientists publishing research in the biological processes always played up the processes, and gave so little emphasis to the research organisms that it was often difficult to determine what kinds of organisms they had been working with. In fact, I had become convinced that the emphasis on organism over biological processes was all wrong.

Mr. Custer was very open-minded when he received a memorandum the next day urging that, contrary to his recommendation, priority for complete revision should be given to 570, including a reversal of preference between organism and biological process, while taxonomic revision was much less important. He asked me to write a think piece elaborating upon my views, and extracted the substance of them in EPC Exhibit 67-37 on 24 September. EPC responded favorably, and by November 1972 I was drafting a revision for biological processes under the supervision of Margaret Warren, the assistant editor. The result of our work was submitted as EPC Exhibit 70-21 on 4 April 1974.

That draft was rejected largely on the advice of consultants from the United Kingdom led by Marjorie Jelinek, and work on biology revision stopped for Edition 19, yielding to a new sociology schedule. I was not sorry to see my first major editorial project adjourned until another day, because I had been overruled on one vital point. Mr. Custer and Ms. Warren had accepted the reversal of preference only to the kingdom level. In the 1974 draft, zoological processes were in 591, and botanical processes in 581.

8. The Second Round Fails to Make Edition 20

Work was resumed for the Edition 20 cycle. In 1981 Forest Press contracted with a group led by Marjorie Jelinek based in what became Lancashire Polytechnic to produce a draft representing the views of consultants in the U.K. It was submitted in May 1984. Meanwhile, I had gone back to work on the Division's draft. The new editor, John Comaromi, allowed me to bring biological processes of plants and animals into 570, and to develop several new ideas. The Division draft of April 1983 thus differed substantially from the 1974 draft.

There was a meeting in Washington, D.C., in July 1984 of most members of the Lancashire group with Division staff to attempt a reconciliation of the two drafts. The differences were too fundamental to be compromised. Two new drafts were produced, but two other major revisions were already moving smoothly toward inclusion in Edition 20, and the life sciences were held over for Edition 21.

The two issues that separated the drafts are ones that inevitably come up in any revision process. The first is extent of revision: does every subject need a new home, or only some
subjects? The second is preference order, e.g., should physiology of mammals be classed under physiology or under mammals? The second usually leads to side issues concerning exceptions to the order proposed because of the nature of the subject. For example, may we class physiology of mammals under physiology, but behavior of mammals under mammals? Biology abounds in issues that tempt different people to propose different exceptions.

9. Comparison of the Rival 1985 Drafts

Let us compare the drafts on the points just covered, the Lancashire draft of July 1985 and the Division draft of September 1985:

The Lancashire draft was a complete revision. Its most striking feature was that it relocated plants and animals from 580 and 590 to a single sequence in 570. This relocation enabled the draft to achieve a sequence of numbers fully consistent with its preference order. The relocation was simultaneously the draft's greatest strength because it allowed complete intellectual consistency, and its greatest weakness because it required reclassification even in sections where the current arrangement could hardly be faulted.

The draft provided that the digits following 57 for a specific group of organisms could be appended to notation 1 under any topic for works on that topic in relation to the group of organisms. For example, mammals were 579; therefore the notation for mammals in relation to a specific topic was 19. The number for ecology was 581. Combine the two numbers and we have 581.19 for ecology of mammals. This kind of number building was widely used in both drafts, and, in fact, is characteristic of the DDC. Its simplicity was particularly useful in the Lancashire draft because, with trivial exceptions, every topic in biology took preference over kind of organism.

In contrast, the Division draft proposed nothing in the taxonomic schedules beyond the scope of the measured and focused revision proposed above. It had a jerry-built substitute for notation 1 that could be added to specific topic to show that topic in relation to specific organisms. But more importantly, it had several exceptions to the reversal of preference order. For example, both ecology and behavior of mammals would stay under mammals.

The underlying principle was: if you can make a good case for the present location and development of a subject, do not relocate or redevelop it. For example, it does not make much sense to scatter the biochemistry of different organisms throughout the taxonomic schedule, but many biologists think that it does make good sense to scatter behavior of different kinds of animals among the kinds of animals. Therefore, the preference order was reversed for biochemistry and other internal processes, but not for behavior, ecology, and description of external features such as flowers, leaves, horns, etc.

The Lancashire draft had an exception of another kind to accommodate the differences among the kingdoms, that is, plants, animals, and microorganisms. It devoted 580 to subjects where the processes in the kingdoms were held to be essentially similar. These consisted of ecology, behavior, genetics, evolution, cell biology, biophysics and biochemistry. In these topics, notation 1 was used for the full range of organisms.

Lancashire devoted 590 to physiological processes and systems in which the kingdoms were regarded as essentially different. There were four pairs of subdivisions, one for general and comparative physiology (591-592), and one each for the three kingdoms, e.g., physiology of microorganisms 593-594. In the first of these, there was no need for the notation for specific kind of organism. In the last three, one went first to kingdom, then to topic, and under each topic one used notation 1 for specific members of the kingdom.
In the Division draft the kingdoms were handled quite differently, largely as a result of reconceiving the problem. The radical differences in the biological processes of the kingdoms are an important feature in biology, but the inescapable differences pertain only to organs and tissues and physiological systems composed of them, e.g., circulatory and reproductive systems. Microorganisms do not have such organs, tissues, and systems. Their biology is entirely explained in terms of basic biological processes common to all organisms.

While there are some important differences between what is true of the physiology of all organisms and what is true only of animals, authors of specific books seldom labor the point. Except when we get down to specific physiological systems (circulation, reproduction, etc.) the uniqueness of animals does not require an exception to the preference order of process first, then organism. The base number is used for general works on the process; then the process in animals is distinguished by notation like that described above. But since the physiological systems do differ from what is found in the other kingdoms, they need unique numbers. In the 1985 draft as in Edition 21, the development for animal systems immediately follows the numbers for processes common to all organisms.

There are two ways to handle the plant kingdom. What ultimately prevailed in Edition 21 is treating plants the same way as animals. For all general topics not unique to plants, including biophysics, cell biology, and anatomy, notation for plants is appended to the general number for the topic. For the specific parts and systems that are distinctive in plants, there is a special development following that for physiological systems in animals.

The literature for internal processes in plants, however, is more distinctive from works on general biology than is the literature for animals. Authors never blur the distinction between the general biology of a process and the process in plants. Furthermore, the tissues and cells of the higher plants are unique; therefore, the biophysics and pathology of plants is often distinctive. Botanists have a much better case for a separate schedule for their kingdom than zoologists and microbiologists. In any event, a separate development for plants was built into the 1985 Division draft.

10. The Differences Are Resolved for Edition 21

As mentioned above, the two drafts were carried over for consideration as part of Edition 21. The Subject Analysis Committee (SAC) of the Cataloging and Classification Section of the Association for Library Collections and Technical Services in the American Library Association was asked to appoint a review committee for the life sciences, as it has done for all our recent important or difficult revisions.

The SAC Subcommittee to Review the DDC Life Sciences Schedule was appointed in May 1992. It was sent a thick packet of material including both 1985 drafts with related commentary and supporting information, such as literary warrant counts showing where material had been classed in the old schedule. The counts were particularly useful in identifying topics that needed expansion or shorter numbers, and heavily used numbers that might best not be reused if there were a complete revision.

The first full meeting was at the ALA midwinter meeting in January 1993. There it decided to give preference to the intent of the author, that is, to the focus of the book. When in doubt about the primary focus, one should use the following order:

1) Physiology [in a broad sense defined later]
2) Organism
3) Other biological process or topic
General physiology and physiology of plants and animals should be brought together in a single block of numbers in 570. Works that focus on the physiological features peculiar to plants or animals, however, should be kept separate from general physiology. On the last point, it rejected the Division draft on plants: rather than a separate unit on physiology of plants, only the works focusing on physiological features peculiar to plants should be kept separate.

The committee decisively rejected the relocation of plants and animals to 570 as being disruptive in the extreme, and likely to result in the rejection of the new schedule in most, if not all, American libraries. It also accepted a suggestion from the Division that 574 not be reused because it contained over 70% of all material classed in 570. All other numbers in 570 except 575 (evolution and genetics which contained about nine percent of the material), however, should be reused for a new schedule.

There was unanimity on bringing microorganisms together, but the question of where was left to the following meeting. The final decision in January was to reject a recommendation embodied in both the Division and the Lancashire drafts to relocate human anatomy and physiology from 611-612 in the medical schedule to the new physiology development in 570.

At its June 1993 meeting the committee agreed upon a tentative arrangement of subdivisions of 570 that largely determined the pattern of Edition 21. The most significant decision was to use 579 for a completely new development of microorganisms. It also fleshed out the list of specific topics in which preference should be given to process: physiology, anatomy, biophysics, biochemistry, cytology, and pathology.

The corresponding committee in the U.K. (The Library Association's Dewey Decimal Classification Committee) would have preferred to keep more of the Lancashire draft, but understood and accepted the SAC subcommittee's recommendations.

In June the SAC subcommittee had reiterated the recommendation to keep evolution and genetics in 575, but the Division later decided that it had to use 575 for specific parts and physiological systems in plants. By doing so, it kept all topics in which preference was given to organism together in one block.

The final arrangement came out like this:

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>560</td>
<td>Paleontology</td>
</tr>
<tr>
<td>570</td>
<td>Life sciences</td>
</tr>
<tr>
<td>571-575</td>
<td>Internal biological processes and structures</td>
</tr>
<tr>
<td>576-578</td>
<td>General and external biological phenomena</td>
</tr>
<tr>
<td>579-590</td>
<td>Natural history of specific kinds of organisms</td>
</tr>
</tbody>
</table>

"Natural history" is taken as symbolic of the topics in which preference would remain with organism, that is, the topics found in 576-578, including evolution and ecology. The specific organisms were subarranged as follows:

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>579</td>
<td>Microorganisms, fungi, algae</td>
</tr>
<tr>
<td>580</td>
<td>Plants</td>
</tr>
<tr>
<td>580</td>
<td>Animals</td>
</tr>
</tbody>
</table>

These three numbers are used for comprehensive works on microbiology, botany, and zoology, respectively.

The committee also agreed to the regular use of notation 1 throughout the taxonomic schedule (579-590) for general topics relating to specific kinds of organisms, although notation 04 was most commonly used in Edition 20. As a result, notation 13 is the symbol for evolution
and genetics of any organism, e.g., evolution and genetics of microorganisms 579.13; 17 is the symbol for ecology, e.g., ecology of plants 581.7; and 15 is the symbol for behavior, e.g., behavior of animals 591.5.

For specific taxonomic groups, it agreed that a complete revision of dicotyledons in 583 was needed, that the schedule for mammals in 599 should be revised to provide shorter and more specific numbers for the kinds that had heavy literature. In addition it made a recommendation not broached by the Division, to revise numbers in 597 for fishes and amphibians. This recommendation involved reducing the development for amphibians from three subdivisions to one (597.6-8 down to 597.8), and enlarging the development of fishes from four subdivisions to six (597.2-.5 up to 597.2-.7).

The committee accepted the principle of keeping reuse of numbers to a minimum. Thus, even though adopting a revision without reclassifying material in old numbers leads to illogical arrangement, doing so will result in limited mixing of old and new material in the same subdivisions.

Two of the relocations mentioned above illustrate the point. Both the old comprehensive number for amphibians (597.6) and the number for evolution and genetics (575) were reused. They were reused, however, as hook numbers, that is, the numbers themselves were not used, only the subdivisions. The subdivisions of these numbers that had previously been used for more than a handful of books did not need to be reused. The number 597.6 was reused for three superorders of fishes that are never written about collectively; the literature is on the specific orders and their families. The only subdivision previously used (597.65 for newts) could be left vacant because it was not needed for these orders.

Analysis of previously used subdivisions of 575 is even more revealing, because they had previously contained about nine percent of the total material in 570, the largest block outside 574. But the material was almost all concentrated in 575-575.2, numbers that were not needed in the new development for specific parts of and physiological systems in plants. Thus, in spite of the nominal reuse of 575, over 80% of the 570 old material in most large research collections will probably be found in a single short span, 574-575.2 that has no meaning in the new schedule. Thus, even in completely revised 570, reclassification can be limited to numbers containing less than 20% of the old material.

11. Summary

Whether we consider the three major revisions in Edition 21 as a whole, or focus only on the life sciences revision, we have a model of how revision in a widely used universal classification system should be carried out. In some cases (e.g., public administration), the faults in the old structure are so basic that the entire schedule must change. In other cases (e.g., education), judicious relocations and expansions may address the problems. Finally, in extensive schedules such as the life sciences, we can combine both approaches. We must keep the value of the enduring features of the schedule in mind and focus our attention on the parts that really need to change. We must consult our users, and heed their advice.

References