Modifiable digital identification keys

Edwin van Spronsen, Stefano Martellos, Dennis Seijts,
Peter Schalk, Pier Luigi Nimis

Abstract — The Open Key Editor (OKE) is a tool for editing and enriching existing identification keys and to produce localized 'minikeys' that apply to local flora and fauna, such as in parks, nature reserves and school gardens, or keys that apply to a particular season. The minikeys are easier to use than their originals, simply because of the fact that they deal with less species, their language can be adapted to a particular audience (e.g. pupils), and because they always point to species that are known to be present. OKE also allows the inclusion of user-generated content in any minikey (new text, images, hyperlinks etc.). The output of minikeys can be automatically tailored for display on computers, smartphones or PDA's.

Index Terms — biodiversity Informatics, field guides, identification tools, identification software, flora, fauna.

◆

1 INTRODUCTION

Identification keys are often written by experts and aim at an 'academic' audience. Once they are published, they are more or less carved in stone and leave little room for adaptation to a specific audience, a particular region or season. In the case of plants, such a key can - for instance - encompass 1900 species for the Netherlands or more than 6000 species for e.g. Spain or Italy. Long keys are complicated and have redundant information when used in a region with fewer species, such as a park or nature reserve, or even a school garden. An increasing number of identifications tools is being published on the internet [1], [2], [3] offering an opportunity for tailoring them to particular audiences and situations. The Open Key Editor [4] is a software package developed within the *KeyToNature* European project, that allows users to 'crop' a master key and customize it for a given set of species. The 'cropped' key can then be edited for language and illustrations (e.g. to suit a particular user level, or platform such as the mobile phone).

E. van Spronsen, D. Seijts and P. Schalk are with ETI BioInformatics, Amsterdam. E-mail: edwin@eti.uva.nl, dennis@eti.uva.nl, peter@eti.uva.nl.
S. Martellos and P. L. Nimis are with the Dept. of Life Sciences, Univ. of Trieste, via Giorgieri 10, I 34127 Trieste, Italy. E-mail: martelst@units.it, nimis@units.it.

2 THE OPEN KEY EDITOR

The *KeyToNature* Open Key Editor is an easy-to-use Open-Source tool for editing and enriching a key with user-generated content. It was developed since June 2009, is written in the PHP 5.2 language, and runs on a MySQL 5.0 database. The code is Open Source and available under the Creative Commons Attribution Non-Commercial (CC-BY-NC) license. The program can import *dichotomous* and *polytomous* keys with a compatible structure. It is downloadable since December 2009 from the Web Portal of project *KeyToNature* (http://www.keytonature.eu), together with sample keys. The current version is 1.1.

With the Open Key Editor the user can browse existing master keys and edit them. The first step in making a customized 'mini-key' is to create a filter: this is a list containing a subset of the species of the main key. Such a list can be made by selecting species from the original key, or by importing a text file with species names from an external source. The filters can be stored for later editing, so many mini-keys can be tailored from the same basic dataset. In the Open Key Editor new couplets can be added to the key for identifying species that are absent in the original key.

The unprocessed mini-key will contain three kinds of questions from the original key:

1.   valid ones that still separate (groups of) species.
2.   questions that used to be like type 1, but now have only a single remaining branch.
3.   questions that no longer lead to any species at all.

Questions of type 2 and 3 will have to be removed. Once a filter is defined, the programme starts with the species that were removed and traces them back until in encounters a question that is still relevant. All questions downstream are 'dead wood' (type 3) and will be removed. The application repeats this process with the remaining species in order to find questions of type 2. When it encounters a question that no longer separates at least two species, the question is removed from the decision tree, but its parent and child questions are connected in a new branching pattern. Because there is a chance that this new branching pattern will also contain questions of type 2, the whole process is reiterated until no more changes have to be made. The result is a key in which only questions of type 1 remain.

Special problems are reticulated keys. These are keys in which a question branches to another part of the key that is not 'downstream' of the present node. This problem is solved by controlling the creation of loops and unravelling them during the processing of the key.

2.1 KEY VIEWER

The *Editor* is provided with a simple single-access query interface (Fig. 1), which displays, for each step of the identification process, one question and all its possible answers, enriched by images when available. Users can retrieve a list of the remaining species at each step of the identification process.

Furthermore, they can produce a printable, illustrated, identification key to the remaining species.
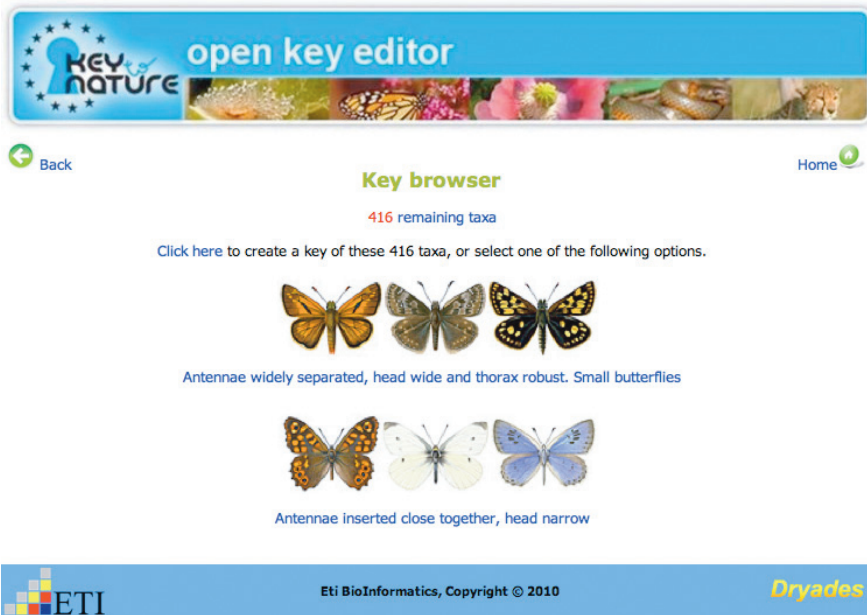

Fig. 1 – A key as displayed by the Open Key Editor. At any time a minikey, based on the remaining species, can be generated.

2.2 Editing interface

The main functions of the Editor are devoted to the integration of user-generated content in the keys. Users can modify, or add user-generated content, to:
- the text of the key
- the pictures
- the names of the species, their images and descriptions, and links to external pages of interest

The editing process involves one line of a key at each time. The available options are displayed in a simple graphic interface (Fig. 2).

Apart from editing keys at the level of lists of species, a second level of editing is available: all texts of a key and its species descriptions can be changed. Jargon can be removed for pupils or added for specialists. Photographs or drawings can be uploaded by the user. They can be added to the original illustrations or even replace them. Changes in texts or illustrations of a minikey will not interfere with the original masterkey.
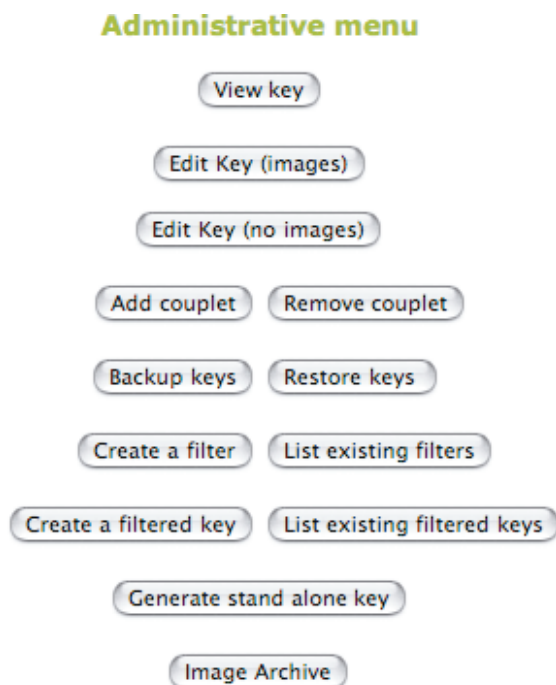
Administrative menu

View key

Edit Key (images)

Edit Key (no images)

Add couplet   Remove couplet

Backup keys   Restore keys

Create a filter   List existing filters

Create a filtered key   List existing filtered keys

Generate stand alone key

Image Archive

Fig. 2 – The administrative menu of the Open Key Editor.

2.3 GENERATION OF 'FILTERED' KEYS

The Editor can generate ex-novo a virtually unlimited number of "filtered" keys from a single "master" key. After filtering, the "cropped" key becomes a separate entity, which can be edited independently from its "master" counterpart. A filtered key can be made available on the web, or given to a user for further editing. Any changes in texts or illustrations of a filtered key will not interfere with the original master key.

2.4 EXPORT OF *STAND-ALONE* KEYS

Identification keys can be used at home or in a laboratory, but they can also be used in the field, while exploring the biodiversity of an area. The Editor can export the master key, or any of the filtered keys, in the form of stand-alone packages (Fig. 3). The stand-alone versions can be published on CD- or DVD-ROMs, or used on mobile devices, such as PDA's and smartphones. These devices, when equipped with a camera, can also be used to enrich the key with original pictures.

Fig. 3 – A single masterkey can produce different stand-alone minikeys, based on scientific or arbitrary criteria.

3 Conclusion

With the Open Key Editor, existing identification tools can be modified and their use can be made much easier by removing species that are absent from a particular region or season. Text of keys and species descriptions can be edited or translated so as to adapt them to user groups like pupils. Modified keys can be turned into stand-alone applications for computers, websites, smartphones or PDA's.

References

[1] H. H. Visser and H. Veldhuijzen van Zanten, "European Limnofauna" http://ip30.eti.uva.nl/bis/limno.php?menuentry=sleutel, 2010.

[2] ETI Bioinformatics, "World Biodiversity Database" http://ip30.eti.uva.nl/bis/projects.php, 2010.

[3] S. Martellos and P. L. Nimis, "*KeyToNature*: Teaching and Learning Biodiversity: Dryades, the Italian Experience" In: M. Muñoz, I. Jelinek and F. Ferreira (eds.), *Proceedings of the International Association for the Scientific Knowledge (IASK) International Conference "Teaching and Learning",* Aveiro, Portugal pp. 863-868. (http://www.dryades.eu), 2008.

[4] S. Martellos, E. van Spronsen, D. Seijts, N. Torrescasana Aloy, P. Schalk and P. L. Nimis: "User-generated content in the digital identification of organisms: the *KeyToNature* approach". *International Journal of Information and Operations Management Education* (IJIOME), vol. 3, 3, pp. 272 -283, 2010.